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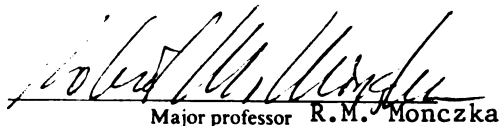
Supplier, Manufacturing, and Distribution Network Location
Changes Due to the Total Cost Effects of the United States-
Canada and North American Free Trade Agreements

presented by

Ernest Lindley Nichols, Jr.

has been accepted towards fulfillment
of the requirements for

Ph.D. degree in Operations Management



Major professor R.M. Monczka

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SUPPLIER, MANUFACTURING, AND DISTRIBUTION NETWORK LOCATION
CHANGES DUE TO THE TOTAL COST EFFECTS OF THE UNITED STATES-
CANADA AND NORTH AMERICAN FREE TRADE AGREEMENTS

Volume I

By

Ernest Lindley Nichols, Jr.

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ABSTRACT

SUPPLIER, MANUFACTURING, AND DISTRIBUTION NETWORK LOCATION CHANGES DUE TO THE TOTAL COST EFFECTS OF THE UNITED STATES- CANADA AND NORTH AMERICAN FREE TRADE AGREEMENTS

By

Ernest Lindley Nichols, Jr.

The United States-Canada Free Trade Agreement and the potential North American Free Trade Agreement have been the center of considerable debate covering a wide range of topics and interest groups. The purpose of this research is to examine the effects of the United States-Canada and North American Free Trade Agreements from the perspective of a hypothetical firm operating in the household appliance industry. The firm's supply chain configuration and total systems cost to manufacture and distribute its finished products are examined under different levels of economic integration. The research utilizes an existing network simulation model.

The hypothetical firm has potential suppliers, manufacturing and distribution center facilities in the United States, Canada and Mexico and sells its finished products in each of these countries. The research also addresses multiple purchased items used in the manufacture of the finished products.

The results of this study, while highly dependent on the data utilized, indicate that at full implementation the United States-Canada Free Trade Agreement is likely to have a relatively minor impact on the firm's supply chain configuration and total systems cost when compared to a separate country approach. However, at full implementation the North American Free Trade Agreement is likely to result in significant changes in both supply chain configuration and total systems cost when compared to a separate country approach.

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CHAPTER 1 - BACKGROUND

INTRODUCTION

The United States and Canada moved to integrate their economies through the United States-Canada Free Trade Agreement which became effective on January 1, 1989. On August 12, 1992 representatives from the United States, Mexico, and Canada announced the completion of a comprehensive North American Free Trade Agreement (NAFTA) (Bradisher 1992). Many changes in the tariff and non-tariff barriers between the United States and Canada are occurring and will continue to occur as a result of the United States-Canada Free Trade Agreement. (U.S. Department of Commerce 1988, 1989). Implementation of the North American Free Trade Agreement will bring similar changes to include Mexico (U.S. Department of Commerce 1991). These changes in the North American economic environment are affecting and will continue to affect the total cost associated with the purchase, manufacture, and distribution of products for firms conducting business in North America.

Free trade related changes in the North American economic environment have already had a significant effect on the supplier, manufacturing, and distribution center location decisions of several North American firms (Hawkins and Holstein 1989, Holstein and Borrus 1990, Wickens 1990, Chisolm, Wickens and Laver 1991, Lippert 1991, Wood 1991).

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The purpose of this research is to examine the effects of United States-Canada Free Trade Agreement and the proposed North American Free Trade Agreement on the supplier, manufacturing plant, and distribution center locations and the total cost to purchase, manufacture, and distribute finished products associated with a given network from the perspective of a hypothetical firm.

Research by Taylor (1991) examined the distribution center location implications in an integrated North American market from a logistics perspective. Taylor cited several areas where there were needs for additional research concerning North American economic integration. Purchasing and manufacturing issues were cited as key areas for future research. To date, no research has been conducted that specifically addresses the purchasing, manufacturing, and distribution center implications of an integrated North American economy. Bowersox and Closs (1989) have also indicated the need for logistics research that includes the supplier and manufacturing levels within the firm's logistical network. It is the intent of this research to make a contribution towards fulfilling these needs. Given the importance of the supplier, manufacturing plant, and distribution center location decisions on overall firm performance and the need for an integrated strategic approach to purchasing, manufacturing, and distribution functions, an examination of the effects of increased

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economic integration in North America resulting from the United States-Canada and North American Free Trade Agreements would appear to be a timely and worthwhile research endeavor.

The remainder of this chapter presents an overview of the United States, Canadian and Mexican economies, tariff and non-tariff barriers to trade, United States-Canada and North American Free Trade Agreements, research objectives, variables and questions, and research methodology utilized.

THE NORTH AMERICAN ECONOMIES

In 1991, the countries of the United States, Canada and Mexico had a combined population of nearly 371 million and a combined gross domestic product (GDP) of over \$6.5 trillion dollars. This represents a potential trading bloc with a population that is approximately 7.5 percent larger in terms of population and approximately five percent larger in terms of combined gross domestic product when compared to the European Community. Table 1 presents population and gross domestic product data for the combined North American countries and the combined total represented by the twelve European Community countries. This data illustrates the relative magnitude and potential of an integrated North American economy relative to the European Community.

Table 1

**Comparison Of North American And European Community
Populations And Gross Domestic Product - 1991**

	Population (<u>Millions</u>)	GDP (<u>US\$ Billions</u>)
North America	370.7	\$6,524.0
European Community	345.0	\$6,216.2

Sources: North American data: U.S. Department of Commerce as presented in Albert G. Holzinger, "Broader Horizons For Free Trade", Nations Business, December 1992, p. 24.

European Community data: "EC 1992 Presents Challenges For U.S. Businesses", Business America, February 22, 1993, p. 19.

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In 1991, the United States population was 255.6 million (69.0 percent of the combined North American total) while Canada's population was 27.4 million (7.4 percent of the combined North American total) and Mexico's population was 87.7 million (23.7 percent of the combined North American total). As for GDP, in 1991 the United States GDP was \$5.67 trillion (86.9 percent of the combined North American total) while Canada's GDP was \$570.0 billion (8.7 percent of the combined North American total) and Mexico's GDP was \$284.0 billion (4.4 percent of the combined North American total).

In 1991, the United States had the highest GDP per capita of the North American countries at \$22,123. Canadian and Mexican GDP per capita in 1991 was \$20,804 and \$3,283, respectively.

The United States had the highest 1991 legal minimum wages of the North American countries at \$4.25 per hour. The Canadian minimum wage level during this period was \$3.42 per hour. Mexican minimum wages in 1991 were \$4.28 per day (Holzinger 1992). Comparative economic statistics for the North American countries are summarized in Table 2.

Table 2

North American Economies 1991 Comparative Statistics

<u>FACTOR</u>	<u>UNITED STATES</u>	<u>CANADA</u>	<u>MEXICO</u>	<u>TOTAL</u>
Population (Millions)	255.6 (69.0)	27.4 (7.4)	87.7 (23.7)	370.7 (100.0)
GDP (US\$ Billions)	\$5,670.0 (86.9)	\$570.0 (8.7)	\$284.0 (4.4)	\$6,524.0 (100.0)
GDP Per Capita (US\$)	\$22,183	\$20,804	\$3,283	
Minimum Wage (US\$ Per Hour)	\$4.25	\$3.42	\$0.535	

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Note: Values in parentheses are the percentage of the North American total for the item represented by the individual country.

Source: U.S. Department of Commerce as presented in Albert G. Holzinger, "Broader Horizons For Free Trade", Nations Business, December 1992, p. 18.

Despite the magnitude of the United States' economy relative to the Canadian and Mexican economies, significant bilateral trade takes place between the United States and these countries. Canada and Mexico are the United States' largest and third largest trading partners. Bilateral trade between the United States and Canada represents the largest bilateral trading relationship in the world (Dick 1991). In 1991, the United States' bilateral merchandise trade with Canada and Mexico was \$178.0 billion and \$64.6 billion, respectively. United States' trade with both Canada and Mexico has increased steadily in recent years. United States-Canada merchandise trade increased at an average annual rate of 7.2 percent during the period 1987 through 1991. United States-Mexico merchandise trade increased at an average annual rate of 16.6 percent during the same period. The United States-Canada and United States-Mexico bilateral merchandise trade statistics for the years 1987 to 1991 are presented in Table 3.

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Table 3

**Bilateral Merchandise Trade Between the
United States and Other North American Countries
(Billions Of US Dollars)**

	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>
United States- Canada Trade	\$135.6	\$158.9	\$170.6	\$176.0	\$178.0
United States- Mexico Trade	\$35.1	\$43.9	\$51.8	\$58.6	\$64.6

Source: U.S. Department of Commerce as presented in Albert G. Holzinger, "Broader Horizons For Free Trade", Nations Business, December 1992, p. 24.

While of a much lower magnitude, Canada-Mexico merchandise trade is also increasing. In 1991 Canada-Mexico merchandise trade was \$3.0 billion dollars (Farnsworth 1992). This represents an increase of approximately twenty percent over the 1990 trade amount of \$2.5 billion (Business America 1991).

The high level of trade between the United States and other North American countries is generally explained by the complementary nature of the comparative advantages held by these countries. It is the complementary nature of the economies of the North American countries that free trade proponents cite as providing the basis for growth and efficiency gains through a North American Free Trade Agreement. Free trade supporters argue that the United States, Canada, and Mexico are not direct competitors in most economic arenas and that a North American Free Trade

Agreement will result in net growth for all countries involved (Wallace 1991).

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TARIFF AND NON-TARIFF BARRIERS TO TRADE**TARIFF BARRIERS**

Despite the significant level of bilateral trade that takes place between the United States and the other North American countries, trade is still restricted by a number of tariff and non-tariff barriers (U.S. Department of Commerce 1990). Tariffs are taxes levied on a commodity when it crosses a national boundary. The most common form of tariff is the import duty which is levied on the commodity upon entry into the importing country. Export duties are also found, but are not common practice. There are several types of import duties, but the most common types are ad valorem duty, specific duty, and compound duty. The ad valorem duty is based on a fixed percentage of the value of the imported commodity. The specific duty is a fixed dollar amount applied to a commodity. The combination duty includes both an ad valorem and specific component (Kreinin 1987).

Prior to the enactment of the United States-Canada Free Trade Agreement, tariffs on goods imported into the United States from Canada averaged four percent of the product value. Tariffs on United States goods imported into Canada averaged 9.5 percent (Lary 1989). However, seventy percent of this trade was duty-free due to the United States-Canada Auto Pact of 1965 (Taylor 1991).

Currently, tariffs on Mexico imports from the United States average ten percent. The average United States tariff on imports of Mexican goods is four percent. However, approximately forty-two percent of the United States imports from Mexico enter the country duty-free under the General System of Preferences (GSP). Under the GSP program specified products from developing countries can enter the United States duty-free in an effort to promote economic growth in those countries (U.S. Department of Commerce 1991).

The "Border Industrialization Program" or maquiladora program is a major facet of United States-Mexico trade that also receives special tariff treatment. Under the maquiladora program firms in the United States use firms in Mexico to perform a portion of their manufacturing activities. The Mexican firms are typically located along the United States border and use United States components to produce goods that are sold primarily in the United States. Maquiladora plants are typically involved in manufacturing activities that are highly labor intensive.

Maquiladora plants export to the United States finished or semi-finished products that enter the United States under Sections 806 and 807 of the United States Customs Code. These sections state that the duty on goods originally exported from the United States are paid only on the value

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which has been added by the maquiladora operation. Typically, the value added by the maquiladora operation is limited to the cost of the labor inputs. (McCray and Gonzalez 1989).

NON-TARIFF BARRIERS

A non-tariff barrier is "any law, regulation, or requirement that prevents or impedes the importation of goods without good cause" (Chopra 1991). Non-tariff barriers may not be as visible as tariffs, but can be extremely effective trade restraints. Common non-tariff barriers include, but are not limited to:

1. Government participation in trade (Discrimination in government procurement, state trading, subsidies, countervailing duties).
2. Customs and entry procedures (Regulations covering valuation methods, classification, documentation, health, and safety).
3. Standards (Standards for products, packaging, labeling, marking).
4. Specific limitations (Quotas, import restraints, licensing, exchange controls).
5. Import charges (Prior import deposits, credit restrictions for imports, special duties, variable levies) (Robock and Simmonds 1983, p. 139.).

Other important non-tariff barriers are restrictions on foreign direct investment and inadequate infrastructure to support trade between the countries involved. Restrictions on foreign direct investment alter investment and trade

patterns as well as provide unfair advantage to domestic investment. Inadequate infrastructure such as roads, bridges, and customs facilities also present obstacles to international trade. All of these non-tariff barriers effectively raise the cost associated with conducting business across international borders (U.S. Department of Commerce 1991).

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**UNITED STATES-CANADA AND NORTH AMERICAN
FREE TRADE AGREEMENTS**

In this section the free trade area is compared to other regional approaches to trade liberalization. Overviews of the United States-Canada and North American Free Trade Agreements are then presented. Various reactions to the United States-Canada and potential North American Free Trade Agreements are also discussed.

Free trade areas, customs unions, and common markets are common regional approaches to trade liberalization. Free trade areas, which are the product of free trade agreements, eliminate or reduce tariff and non-tariff barriers among the member countries. However, under a free trade agreement member countries can establish their own tariffs and other trade regulations that apply to trade with non-member countries. Customs unions are agreements between two or more countries that abolish all or the majority of trade restrictions among member countries and establish common tariffs and other regulations against countries that are not members of the customs union (Krein 1987). Common markets represent a still higher level of economic integration over that of a customs union. Common market member countries have eliminated trade restrictions among member countries, established common tariffs, and regulations that govern trade with non-member countries. A common market also

removes restrictions on the movement of capital and labor among member countries, and on the establishment and ownership of firms (Robock and Simmonds 1983).

The purpose of the United States-Canada Free Trade Agreement is to "increase economic growth, lower prices, expand employment and enhance competitiveness of both countries in the world marketplace" (U.S. Department of Commerce 1988). The stated objectives of the United States-Canada Free Trade Agreement are to:

1. Eliminate barriers to trade in goods and services between the two countries.
2. Facilitate conditions of fair competition.
3. Significantly liberalize conditions of investment.
4. Establish effective procedures to administer the agreement and resolve disputes.
5. Lay the foundation for further bilateral and multilateral cooperation (U.S. Department of Commerce 1988, p. 12).

These objectives will be accomplished through the United States-Canada Free Trade Agreement that will:

1. Eliminate all tariffs on bilateral goods by 1998.
2. Reduce non-tariff trade barriers.
3. Establish principles for the conduct of bilateral trade in services.
4. Establish rules for the conduct of bilateral investment.
5. Resolve many outstanding bilateral trade issues.

6. Enhance the energy and national security of the two countries.
7. Facilitate business travel.
8. Establish a timely bilateral dispute mechanism (U.S. Department of Commerce 1988 p. 7).

The timing for the removal of tariffs varies across the different goods traded. Three primary classifications are 1) immediate (1989) removal of tariffs, 2) twenty percent annual reduction over a five year period (1989-1993), and 3) ten percent annual reduction over a ten year period (1989-1998). The agreement also allows for firms in the United States and Canada to petition for accelerated tariff removal (U.S. Department Of Commerce 1988).

The proposed North American Free Trade Agreement is a comprehensive agreement similar to the United States-Canada Free Trade Agreement that will encompass the United States, Canada, and Mexico. This agreement must be ratified by the governments of each of the countries prior to implementation.

The North American Free Trade Agreement includes time-phased elimination of tariff and non-tariff barriers over a period of fifteen years. (Holzinger 1992). The primary objective of the North American Free Trade Agreement is to establish an economic environment where businesses from each country can compete on the basis of their competitive market

advantages rather than tariff and non-tariff barriers (Chopra 1991).

The North American Free Trade Agreement will not significantly alter trade between the United States and Canada. Changes in tariff and non-tariff barriers between the United States and Mexico will be significant. Approximately half of the Mexican tariffs currently imposed on imports from the United States will be eliminated when the agreement becomes effective. Major features of the agreement include:

1. Time-phased tariff reduction over a period of fifteen years.
2. Elimination of import limits or quotas.
3. Reductions in customs regulations including elimination of most import licensing requirements.
4. Implementation of trade dispute procedures that are expected to resolve most disputes within a ten month period.
5. Environmental protection regulations.
6. Equal opportunities for firms to compete for government contracts.
7. Protection of intellectual property rights.
8. Equal investment opportunities with the exception of the ownership of Mexican oil deposits.
9. Equal opportunities for service providing firms to operate throughout North America. This includes elimination of restrictions on trucking operations between countries.
10. Development of harmonized health, safety, and industrial standards on par with the highest standards in effect in any of the member countries (Holzinger 1992).

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Although the free trade agreement is the least restrictive on the constituent countries of the regional approaches to trade liberalization, the United States-Canada Free Trade Agreement and North American Free Trade Agreement are the subject of ongoing and significant debate. The debate is multifaceted and includes, but is not limited to, issues regarding, new market opportunities in neighboring countries, increased competition from foreign countries, plant closings, migration of jobs to lower-cost regions, environmental problems, safety standards, intellectual property rights, and national sovereignty (Baker, Weiner, and Borrus 1990, Holstein and Borrus 1990, Journal of Commerce 1990, Wu 1990, Baker, Lee and Coy 1991, Chisolm, Wickens and Laver 1991, Lippert 1991, Magnusson, Baker, Beach, DeGeorge and Symonds 1991, Moffet 1991, Wood 1991).

Despite the benefits cited by free trade proponents, many groups believe that they have suffered and will continue to do so in the future as a direct result of the free trade agreements. Canadian labor groups argue that the United States-Canada Free Trade Agreement has and will continue to result in the loss of Canadian manufacturing jobs to plants in the United States (Chisolm, Wickens and Laver 1991, Wood 1991). Canadian labor groups and their counterparts in the United States are both concerned about the migration of jobs to Mexico (Journal of Commerce 1990, Lippert 1991, Moffet 1991). However, several studies have concluded that a North

American Free Trade Agreement would result in an overall increase in manufacturing jobs in the United States (e.g. Almon 1990, Hufbauer and Schott 1990).

Firms that are relocating their manufacturing operations from their current home country to another North American country defend their actions on the basis of worldwide competitive pressures. A common theme presented is that despite the hardships caused by the relocation for the firm's current employees, the decision faced by many firms is one of relocation and survival versus maintaining the status quo and ceasing to exist (Chisolm 1991, Chisolm, Wickens and Laver 1991). These firms further argue that through the relocation of a portion of their manufacturing operations to lower-cost areas of North America, a greater number of manufacturing jobs are allowed to remain in the current home country (Wallace 1991).

METHODOLOGY OVERVIEW**RESEARCH OBJECTIVES**

The objective is to examine the supplier, manufacturing plant, and distribution center location changes due to the total cost effects of the United States-Canada and North American Free Trade Agreements. The research uses a modeling approach which is described in the following section.

RESEARCH APPROACH

The research approach utilized is one of modeling a hypothetical firm operating within the household appliance industry. The firm sells its finished products throughout North America and has potential supplier, manufacturing plant, and distribution center facility options in the United States, Canada, and Mexico. The firm purchases multiple items that are used in the manufacture of the finished products. Purchased items included in the research represent unique combinations of total cost, labor content, and transportation cost factors. The purchased items were selected on the basis of the percentage of finished product cost represented by the purchased item and for differences in total cost, labor content, and transportation cost.

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INDEPENDENT VARIABLES

The independent variables addressed in the research were developed on the basis of the literature review presented in Chapter 2. The specific independent variables examined in the research are the level of economic integration, tariffs, cross-border transaction costs, and increases in non-United States demand for finished products. A brief description of these variables follows.

The level of economic integration describes the firm's perspective regarding the degree to which it views its operations in the North American countries as an integrated supplier, manufacturing, and distribution system. This variable is defined in a manner similar to Taylor's (1991) study, but is extended to include the firm's suppliers. Three different levels of integration are considered, separate countries, United States-Canada, and United States-Canada-Mexico.

Tariffs are taxes associated with the cross-border movement of the purchased items and finished products. Tariffs are based on the actual tariffs applied to the purchased items and finished products examined in the research. Tariff levels addressed are full tariffs, fifty percent reduction in tariffs, and complete removal of tariffs.

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Cross-border transaction costs are defined in this research as the additional costs, other than tariffs, that are unique to an international transaction. Cross-border transaction costs are associated with both inbound and outbound transactions. Cross-border transaction costs addressed include an initial estimate, twenty-five and fifty percent reductions from the initial estimate.

The increase in non-United States demand is included in the research as this factor has been one of the major benefits that free trade proponents have argued will result from the United States-Canada and proposed North American Free Trade Agreements (U.S. Department of Commerce 1991, Wallace 1991). Increases in non-United States demand addressed include five and ten percent increases in Canadian demand and twenty-five and fifty percent increases in Mexican demand.

DEPENDENT VARIABLES

The primary dependent variables are "total systems cost" and "supplier, manufacturing, and distribution center locations utilized" as developed by the Netsim II model using the service\least cost solution approach. The other dependent variables are used to capture cost information at various points within the system. These "sub-system" level variables provide insights into what is causing the total systems costs to vary under different levels of the

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independent variables. The dependent variables examined are:

1. Purchases by manufacturing plant location
2. Purchases by supplier location
3. Total purchase expenditure for each purchased item and total purchases for firm
4. Finished products manufactured at each manufacturing plant location and total for firm
5. Source of finished products by distribution center location
6. Market areas serviced by distribution center location
7. Total cost for distribution center operations
8. Total transportation cost
9. Total systems cost

These variables capture the detailed cost and location information necessary to determine the effect of changes in the levels of the independent variables on the hypothetical firm's supplier, manufacturing plant, and distribution center system.

RESEARCH QUESTIONS

The research questions examine the changes in the supplier, manufacturing plant, and distribution center locations due to the total cost effects of the United States-Canada and North American Free Trade Agreement. Research questions are as follows:

1. What is the least total cost supplier, manufacturing plant, and distribution center system for an integrated United States-Canada (North American) system, given specified service constraints, and how does it differ from a separate United States-Canada (North American) design, assuming no changes in the other independent variables?
2. What is the least total cost supplier, manufacturing plant, and distribution center system for an integrated United States-Canada (North American) system, given specified service constraints, under the "most likely" levels of independent variables and how does it differ from the initial integrated United States-Canada (North American) system?
3. How do changes in the levels of the independent variables for tariffs, cross-border transaction costs, and non-United States finished product demand affect the supplier, manufacturing plant, and distribution center system in terms of locations utilized and total systems cost?
4. How do changes in the levels of the independent variables for tariffs and cross-border transaction costs affect the supplier locations utilized and the total systems cost when the United States and Canadian (North American) manufacturing plant and distribution center locations service only their respective domestic markets?
5. How do changes in the levels of the independent variables for tariffs and cross-border transaction costs affect purchased item groups which were established on the basis of purchased item price, labor content, and transportation cost characteristics?

METHODOLOGY

The research questions are examined through the use of an experimental methodology that utilizes an existing network simulation model. This approach permits the manipulation of one or a combination of the independent variables in order to determine the effect on the dependent variables. Various levels of the independent variables chosen to represent the economic environment faced by firms under the United States-Canada and North American Free Trade Agreements can be tested in a controlled manner thereby allowing the resulting effect on supplier, manufacturing plant, and distribution center locations utilized and costs associated with the system to be identified.

ANALYSIS

The results of the simulation runs conducted for the research are analyzed on a comparative basis to determine the location changes as well as absolute differences and the percentage change in cost factors between relevant simulations. Additional analyses are conducted which focus on the purchased items and their respective characteristics in an effort to identify which purchased items are likely to be sourced in other North American countries as a result of the free trade agreements and which are not. A chi square

goodness of fit test is used to determine if changes in sourcing patterns are statistically significant.

CHAPTER 2 - LITERATURE REVIEW

INTRODUCTION

Chapter 2 presents a review of the relevant literature. Literature is reviewed in the areas of location theory, logistics, international purchasing, the United States-Canada and North American Free Trade Agreements, and modeling.

LOCATION LITERATURE

LEAST-COST LOCATION LITERATURE

The work of Von Thunen (1826) lays the foundation of the location theory literature. Von Thunen's work centered on agricultural products. He examined the location of production for various agricultural products relative to the market location where the products were consumed. Von Thunen's analysis was conducted in reference to a self-sufficient isolated state. In the center of this isolated state was a single city where the agricultural products were consumed. The agricultural products were produced by identical suppliers that were distributed throughout the state. Transportation cost was viewed as a function of the products weight and the distance to market.

Von Thunen theorized that the origin price of the product would equal the city price of the product less the cost of transportation. Therefore, heavier weight products relative to their value would be produced closer to the city and lighter weight products relative to their value would be produced further from the city. Although, Von Thunen dealt with agricultural products, this approach was also applicable for manufacturing plants. The primary focus of Von Thunen's analysis related to the trade-off between transportation cost, which increased with increases in distance from the city, versus, land rent, which decreased with increases in distance from the city (Greenhut 1956).

Weber's (1929) approach to location theory differed from that of Von Thunen in that rather than attempting to determine the type of production that would be associated with a specific location, Weber examined the location of a specific type of production (Richards 1972). Weber's approach included consideration of transportation costs and labor costs which were described as "locational factors". Locational factors were defined as:

... an advantage which is gained when economic activities take place at a particular point or several such points rather than elsewhere. An advantage is a saving of cost, i.e., a possibility for the industry to produce at this point a certain product at less cost than elsewhere, to accomplish the entire productive and distributive process of a certain industrial product cheaper at one place than at another (Weber 1929, p. 18).

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Weber also presented the concepts of agglomerative and deglomerative factors. An agglomerative factor is defined as:

"...an advantage or cheapening of production or marketing that results from the fact that production is carried on to some considerable extent at one place, while a deglomerative factor is a cheapening of production that results from the decentralization of production..." (Weber 1929 p 126).

Weber theorized that products that experienced a low weight loss during the production process would be produced at locations near the using market. Products that lost considerable weight during the production process would be produced at locations near the raw material sources (Richards 1972).

Weber classified products according to a material index and a labor coefficient. The material index was a ratio of localized materials (i.e. raw materials) weight to the (finished) product weight. The labor coefficient was the ratio of the cost of labor per ton of product and the total weight of all goods transported.

Weber's analysis indicated that when labor costs were equal, production would take place at the point or points where transportation costs were at a minimum. If labor costs were allowed to vary, an industry would deviate from its transportation cost determined location only if the savings

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in the cost of labor are larger than the cost of additional transportation required.

Weber's theory represented a significance advance over the work of Von Thunen in its inclusion of labor and agglomerative / deglomerative factors. The work did not address industry specific or institutional factors. Interest, insurance and taxes were considered non-natural factors that did not belong in a general theory of location (Greenhut 1956).

Hoover's 1937 work represents an extension and refinement of Weber's theory. Hoover addresses two primary cost factors of location which are transportation factors and production factors. Hoover also discusses agglomerative forces and institutional factors. Greenhut states that Hoover's primary contribution is "...not in theoretical originality, but in the penetrating discussions of the influences of location factors" (Greenhut 1956, p.17).

PROFITS ORIENTED LOCATION LITERATURE

Losch (1954) presented a profits oriented approach to the location problem. In this work, Losch criticized the least cost theorists for having a "one-sided orientation" that viewed revenues as fixed, assuming fixed demand and price. Approaching the location problem from a total revenues

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perspective was also dismissed as an improper approach. According to Losch "the correct procedure" was based on total profit (Losch 1954, p.27).

Losch stated that when price and quantity are added to the spatial variables there is "no scientific and unequivocal solution for the location of the individual firm, but only a practical one: the test of trial and error. Hence Weber's and all other attempts at a systematic and valid location theory were doomed to failure" (Losch 1954, p.29).

Losch also presents a detailed discussion of the shape of the firm's market areas under conditions of monopolistic competition. Market areas start as circular shapes with firms separated from each other. As new firms enter the market the circles move closer together and eventually reshape into a hexagonal pattern.

Greenhut (1956) presented a profit oriented theory of plant location that included consideration of demand and costs. Greenhut also discussed "purely personal factors" that may influence the facility location decision. These factors are not specifically included in the mathematical formulation of the theory, but can be addressed by the individual decision maker on the basis of cost deductions or demand additions.

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Isard (1956) discussed the "Anglo-Saxon Bias" in the economic literature that was concerned with the issue of time, but generally assumed an "...economy in which all factors and producers, commodities and consumers are, in effect congregated at one point" (Isard 1956, p. 25). Isard cited the work of Chamberlin (1933) in the area of monopolistic competition as the primary exception to this condition. Isard (1956) reviewed the work of the earlier German location theorists and presented his location theory that was built upon the substitution approach of Predohl (1928). The works described to this point are of primarily a conceptual nature. Each of the authors have been concerned with the development of a theory of location. The early authors from the German school were concerned with the cost aspects of the location decision, specifically transportation and production costs. The latter authors expanded their analysis to include a total profits perspective through the inclusion of demand for the firm's finished products. The latter authors also indicated that the quantity demanded of the firm's products was a function of the price of the products, which in turn was a function of the cost of the product in the market. The cost of the product being determined by the location of the production facility.

The authors discussed in the preceding section were concerned with the location of manufacturing plant

locations. These authors did not specifically address the location of distribution facilities.

LOGISTICS LITERATURE

The early authors in the logistics arena built upon the work of the cost oriented location theorists and applied the least total cost principle to logistical activities. These authors identified numerous cost factors that should be considered in the development of the total logistics cost. Wassmansdorf (1960) emphasized that distribution related costs should not be addressed on an individual basis, but rather from a systems perspective. Smith (1966) presents a range of cost categories that need to be addressed in determination of the firm's distribution costs. Smith included packaging, materials, handling, storage, inventory, order processing, shipping, and transportation costs. Other contributors in this area included Flaks (1963) and LeKashman and Stolle (1965).

The early logistics authors were oriented toward application of their theories, rather than operating from a strictly conceptual standpoint. Taylor (1991) suggests that the reason for the application perspective is a result of the authors' association with the field of business administration, as either academics, practitioner, or consultants. Taylor also indicates that a key difference

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between the early location theorists and the logistics theorists is the specific incorporation of distribution center locations into their analysis.

Addressing the issue of distribution centers, Bowersox (1960) states that:

"...distribution centers enter a logistics system only when a degree of differential advantage results from their inclusion. This advantage may take the form of increased speed or decreased cost in inventory replenishment from manufacturers to retailers or consumers" (Bowersox 1960, p. 34).

Bowersox also discusses several different distribution center location strategies as they relate to economic principles. The distribution center location strategies discussed include situations where the firm sells non-differentiated products, differentiated products, and multiple products. Further, following Hoover's plant location classification, Bowersox discussed three distribution center locations. These locations were classified as market positioned, production positioned, and intermediately positioned (Bowersox 1960).

The work of the logistics authors included the consideration of inventory flows within the firm's operations. The inclusion of inventory costs provided a temporal factor to location decisions which were up to this point based primarily on spatial costs (Taylor 1991). Work by Lewis, Culliton, and Steel (1956), Forrester (1958), and Heskett (1966) all addressed both temporal and spatial issues.

According to Taylor (1991) this temporal/spatial integration represented a major theoretical contribution as it "... allowed for an analysis of both cost to cost and cost to service tradeoffs in making planning distribution center locations" (Taylor 1991, p. 50).

INTERNATIONAL LOGISTICS LITERATURE

The international logistics literature expands the scope of the traditional logistics perspective to include the support of the firm's international operations. Work by Dicer (1971), Anderson (1985, 1988), and Davies (1987) identified issues specific to international logistics. Articles by Bowersox and Sterling (1982), Kallock (1988), and Miller (1991) discussed the need for adopting an international view towards logistics.

Wood (1990) used the concept of channels to examine international logistics. The author presented three channels associated with international logistics which are the: 1) international transactions and payment channel, 2) international distribution channel through which the products move, and 3) documentations-communications channel. The author also discussed the role of third-party logistical services within the channel and their impact on channel operations. McCabe (1990) also addressed the use of third-party logistics firms as a viable option for firms that lack

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the resources or expertise internally to conduct logistics operations of an international scope. The third-party option is presented as a viable approach for firms that want to conduct business internationally.

Allen (1991) examined the role of logistics in the determination of foreign plant locations for United States-based multinational corporations. This study addressed key logistical factors that should be addressed in the foreign facility location decision as well as the decision making process.

Hurlbert (1987) presented a discussion of logistical operations and practices required to support maquiladora manufacturing facilities. Fawcett (1990) in his examination of Mexican maquiladora operations found that logistics costs increased and performance decreased with maquiladora manufacturing. However, the majority of the firms surveyed found their maquiladora operations to be highly successful from a total product cost perspective.

Murphy and Poist (1991) conducted a study to determine the critical skills and experiences that senior level logistical management should possess. The results of this study indicated that even though firms are becoming more involved in international operations, specific international skills

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and experiences were rated as relatively unimportant by senior level logistics managers.

Lancioni and Gattorna (1992) cited the importance of providing superior levels of customer service in international logistics activities. The authors also presented a six step process designed to improve customer service performance. Byrne (1992) summarized the results of an A.T. Kearney study of forces that will affect global logistics. These forces include: 1) achievement of customer satisfaction through quality, 2) globalization of markets, 3) a renewed quest for productivity, 4) increased marketplace demands, 5) the emergence of strategic alliances, 6) corporate restructuring, 7) the acceleration of cycle times, and 8) environmental concerns. These forces are expected to impact firms of all types in the upcoming decade and will place increased emphasis on the firm's logistical activities.

Several authors have addressed the impact of the United States-Canada and North American Free Trade Agreements on logistical areas. Garland and Chow (1990) addressed the reduction of non-tariff barriers and the United States-Canada trucking industry. The authors indicated that the United States-Canada Free Trade Agreement will result in a new structure in the trucking industry, caused by rationalized manufacturing and distribution patterns that

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will be a result of the free trade agreements. Muller (1992) discussed realignment in firms' logistics operations in response to the proposed North American Free Trade Agreement. The study indicated that various firms are altering their logistics operations in an effort to serve the entire North American market on an integrated basis with fewer facilities. Taylor's (1991) study examined the distribution center implications of the United States-Canada and North American Free Trade Agreements from a logistics perspective. Taylor used a network simulation model and examined distribution networks for three different industries under various degrees of economic integration.

Bowman (1992) addressed the use of rail transportation in the light of the North American Free Trade Agreement. The author cited the problems that currently exist with cross-border rail shipments between the North American countries. Specific problems cited include delays due to border-crossing procedures and lack of necessary infrastructure. White (1992) addressed the growth in intermodal transportation options resulting from the proposed North American Free Trade Agreement. Raia (1992) discusses the potential impact of the proposed North American Free Trade Agreement on Mississippi River ports. Ross (1992) discussed the strategies employed by a number of carriers to position their firms for anticipated increases in the demand for transportation services between the United States, Canada,

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and Mexico. Jacobs (1992) cited recent improvements in Mexican transportation infrastructure. The author noted, however, that transportation infrastructure in Mexico still requires significant improvement.

INTERNATIONAL PURCHASING LITERATURE

Purchasing from foreign suppliers by United States firms is a practice that has become more prevalent in the past decade. Foreign purchasing is expected to continue to increase in its importance as purchasing will need to focus on a global marketplace to meet the needs of the buying firm (Morgan 1991).

International purchasing represents a broadening of the scope of the firm's supplier selection process to include foreign as well as domestic suppliers. Reasons why firms use foreign sources include, but are not limited to, higher quality, superior delivery performance, lower cost, provide access to new technologies, provide materials not available domestically, and countertrade (Dobler, Burt, and Lee 1990).

When purchasing from foreign suppliers, firms may encounter higher levels of certain costs than would be associated with a domestic purchase. Examples of these costs include transportation costs, packaging, transit inventory cost,

communications costs, and costs associated with assessing the capabilities of foreign suppliers.

Firms are also likely to encounter several additional cost factors that are unique to foreign purchases. Monczka and Giunipero (1990) presented these costs which include customs duties, bank fees, as well as fees and/or commissions associated with inspection, documentation, wharfage, loading, warehousing, port terminal and handling charges, consular services, and customs brokers.

Monczka and Giunipero (1990) also discussed additional cost factors that impact the total cost of the foreign purchase, but may require some degree of estimation on the part of the buying firm. These cost factors are 1) additional inventory carrying costs, 2) extra communication and documentation costs, and 3) costs associated exchange rate costs. The additional costs associated with the use of a foreign supplier are the result of several factors including the increased distance between the supplier and the purchasing firm, additional administrative tasks unique to foreign purchases, tariffs, and non-tariff barriers.

Several authors have discussed problems associated with foreign sourcing that effectively increase the cost associated with purchasing from a foreign supplier. Ellram (1991) discussed barriers associated with international

sourcing activities. The most critical barrier cited in this work was lack of communication between the buying firm and the supplier. Frear, Metcalf, and Alguire (1992) in their study of offshore sourcing presented a summary of problems encountered with foreign suppliers by geographical region. Mexico was among the most frequently cited countries in terms of problem areas. Specific difficulties discussed include delivery, quality, geographical distance, technical capabilities, business customs and practices. Canadian suppliers were found to have problems in the areas of delivery, quality, and technical capabilities. Firms that participated in a study by Min and Galle (1991) indicated that the most frequently cited problem encountered in their international sourcing efforts were in the logistics arena.

Fawcett (1993) examined purchasing practices and supplier performance in Mexican maquiladora operations. The study indicated that the majority of the United States-owned maquiladora operations continue to use their United States supply base. Twenty-four percent of the firms that participated in this study indicated that they experienced higher costs to support their purchasing activities. The "primary cause of the increased costs were related to the firm's ability to effectively coordinate purchasing and purchasing related activities - communication, engineering coordination, and support activities were most affected by

the longer, international supply lines encountered in the maquiladora operations" (Fawcett 1993, p.29).

Monczka and Trent (1992) in their discussion of integrated worldwide sourcing requirements include the need for extensive worldwide information systems, coordination mechanisms, and personnel capabilities. These requirements and others must be in place in order to operate sourcing activities on a worldwide basis effectively.

UNITED STATES-CANADA AND NORTH AMERICAN FREE TRADE AGREEMENTS LITERATURE

There have been few topics during the period from the mid-1980's to the present that have drawn more attention than the United States-Canada and North American Free Trade Agreements. The vast majority of this literature has appeared within the popular business press. This literature has been largely of a descriptive nature. Various aspects of the free trade agreements that have been addressed include, but are not limited to: 1) areas addressed within the free trade agreements, 2) the negotiation process, 3) likely effects of the free trade agreements on the member countries, 4) likely effects on various industrial sectors within the member countries, 5) effects of the free trade agreements on non-member countries, 6) migration of jobs to lower wage regions, and 7) environmental issues. Examples

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of this material include Chisholm (1991), Chisholm, Wickens, and Laver (1991), Dick (1991), Chopra (1991), Gaugham (1991), Wallace (1991) and Holstein and Borrus (1990).

The majority of these works have not been the product of academic research, but rather present the perspectives of various academic, business, labor, and governmental authorities. In the following sections selected research that addresses the United States-Canada and North American Free Trade Agreements is reviewed.

UNITED STATES-CANADA FREE TRADE AGREEMENT LITERATURE

There have been several studies that have addressed the United State-Canada Free Trade Agreement in the economics literature. These studies have produced mixed results regarding both the magnitude and the direction of the benefit associated with the United States-Canada Free Trade Agreement (Trezise 1987).

Peters (1986) examined the effect of enhanced United States-Canada trade. Peters indicated that branch plants in operation strictly to avoid tariff and non-tariff barriers, were likely to be eliminated. Brown and Stern (1987) addressed the impact of bilateral tariff reduction and indicated that the United States-Canada Free Trade Agreement would slightly worsen Canadian conditions of trade and

welfare and slightly improve the United States condition (Trezise 1987). Burgess (1987) examined the United States-Canada Free Trade Agreement from the perspective of foreign direct investment and plant location. Burgess concluded that if both countries substantially reduce artificial barriers to trade the United States-Canada Free Trade Agreement would result in increased productivity, investment, and growth in both countries as resources are reallocated according to areas of comparative advantage (Burgess 1987). Biggs (1987) examined the effects of the United States-Canada Free Trade Agreement on third-party countries. Smith (1987) addressed the importance of including non-trade barriers in the United States-Canada Free Trade Agreement negotiations.

Harris (1991) conducted simulation research to address the effects of the United States-Canada Free Trade Agreement on the Canadian economy. This research addressed the removal of tariff and non-tariff barriers as well as the value of a dispute settlement mechanism included within the United States-Canada Free Trade Agreement. Harris' work showed that the United States-Canada Free Trade Agreement is beneficial to the Canadian economy, but the extent of the benefits are a function of benchmarks used as a point of comparison.

Dungan and Wilson (1991) used the University of Toronto's Focus macroeconomic model of the Canadian economy to address changes brought about by the United States-Canada Free Trade Agreement. The results of this study indicated that the agreement would have a favorable impact on the Canadian economy.

Koo, Uhm, and Golz (1991) examined the bilateral trade flows between the United States and Canada in light of the United States-Canada Free Trade Agreement. This study also examined the effects of the United States-Canada Free Trade Agreement on United States and Canadian trade with third-party countries. This study concluded that United States imports from Canada will increase as will Canadian imports from the United States. The study also concluded that there was little impact on United States or Canadian trade with third-party countries.

NORTH AMERICAN FREE TRADE AGREEMENT LITERATURE

Dornbush (1991) stated that a free trade agreement with Mexico will not have a negative effect on the United States due to the size of the Mexican economy, wage rates, productivity, and openness of the United States economy. The author also discussed the potential of a North American Free Trade Agreement which would provide a basis for broader integration of the entire Western Hemisphere as well as

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parallel the General Agreement on Tariffs and Trade (GATT) efforts toward open multilateral trade.

Masur (1991) also argued in support of the North American Free Trade Agreement. The author presented four reasons the North American Free Trade Agreement is important to United States business which include: 1) size of Mexican market for United States products, 2) that it provides an opportunity to make permanent the business reforms instituted within Mexico under Salinas, 3) importance of joint United States-Mexican manufacturing from an international competitiveness perspective, and 4) that it serves as a model for agreements with other Latin American countries. Baer (1991) also provided support for the North American Free Trade Agreement. The author states that the North American Free Trade Agreement will result in a North American economy "based on global competition".

An opposing view of the North American Free Trade Agreement was presented by Donahue (1991). The author stated that United States industrial workers will suffer as result of the North American Free Trade Agreement due to jobs being shifted to Mexico. Environmental concerns are also discussed. The author argued that the European Community's Social Charter approach should be used as the model for the North American Free Trade Agreement.

Krueger (1992) examined the potential economy of the United States-Canada and North American Free Trade Agreements. The author argued that bilateralism is not in the best interest of the United States when compared to free trade with all countries. The author offers an explanation as to why the bilateral approach has been taken despite the its inferiority to free trade with all countries. The reason given is that special interest groups have in recent years gained control of trade policy.

Cox and Harris (1992) examined the impact of the North American Free Trade Agreement on the Canadian economy using a general equilibrium model. The study indicated that from an aggregate perspective, Canada is not significantly effected by either a bilateral or the North American Free Trade Agreement, although the North American Free Trade Agreement is superior. Canada would not benefit from a North American trade bloc which raised tariff barriers to non-member countries. The greatest gains to Canada are the economic gains associated with rationalization of Canadian industry caused by price competition with Mexico.

Brown, Deardorff, and Stern (1992) used a general equilibrium model to identify the economic effects of the North American Free Trade Agreement. The results of the study included:

1. The United States, Canada, and Mexico will enjoy an increase in aggregate welfare.
2. The addition of Mexico will not remove Canada's benefits resulting from the United States-Canada Free Trade Agreement.
3. The wage differentials between the United States and Mexico will narrow, while real wages in the United States will rise due to trade liberalization.
4. All three countries will benefit from positive scale effects.
5. Capital formulation will be stimulated.
6. United States firms are not likely to relocate in Mexico.
7. North American Free Trade Agreement will have relatively minor negative effects on the rest of the world.

Sobarzo (1992) used a general equilibrium model to examine the potential effects of the North American Free Trade Agreement on the Mexican economy. The results of this study indicated that the North American Free Trade Agreement leads to gains from trade. Another result is that Mexican industries tend to concentrate and industrial sectors that present opportunities for economies of scale are most likely to prosper.

Several studies have been conducted that address the impact of the free trade agreements on specific industrial sectors within the member country economies. Representative examples include the auto industry (Hunter, Markusen, and Rutherford 1992), textiles and steel (Trella and Whalley 1992), and forest products and lumber (Boyd and Krutilla 1992).

The study by Hunter, Markusen, and Rutherford (1992) used an economic modeling methodology to examine the spatial pattern of production of finished automobiles. The results of this study indicated that a free trade agreement would significantly benefit Mexico, at little cost to the United States and Canada. Free trade is expected to result in greater plant specialization and a rationalization within the industry.

In the Trella and Whalley (1992) study a general equilibrium model is used to examine the effects of United States-Mexican trade on the textiles and steel industries. The results of this study indicated that trade liberalization in both industrial sectors would be advantageous for both countries. However, most of the gains associated with trade liberalization are likely to be found in Mexico. The study did indicate that a United States-Mexico bilateral agreement would have an adverse effect on third-party countries' trade with the United States and Mexico. It also found that the

benefits associated with a North American Free Trade Agreement that includes Canada, the United States, and Mexico do not significantly exceed those associated with a United States-Mexico bilateral agreement.

Boyd and Krutilla (1992) used a general equilibrium model of the United States economy to examine the effects of the United States-Canada Free Trade Agreement on the United States forest products and lumber industry. Overall results were seen as favorable for the United States forest products industry, but short-term losses were not examined.

MODELING LITERATURE

Accompanying the total cost approach to logistics has been efforts to arrive at solutions to increasingly complex logistical problems. Early attempts at the solution of facility location and logistics problems relied on both mathematical and non-mathematical approaches. Bowersox (1960) discusses four non-mathematical approaches, managerial preference, center of gravity, cluster method, and polar technique.

Bowersox (1960) presents mathematical techniques that were used for facility location problems. These approaches include Cartesian coordinates which could be employed with

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different variables of interest (i.e., weight, distance, weight and distance, or weight, distance, and time). The location results of this analysis would be in the form of a ton-center solution, mile-center solution, ton-mile center solution, or time-ton-mile center solution. The other mathematical solution referenced by Bowersox (1960) is linear programming.

The use of main frame and later, personal computers, have allowed logistics professionals to deal with increasingly more complex logistical issues. Quantitative approaches have frequently been applied to a wide range of logistics problems. These computerized approaches consist of models and techniques. "A model is an abstract mathematical system that is devised to represent reality. A technique, sometimes referred to as an algorithm, is used to optimize, or more generally analyze, a model" (Shapiro 1985 p. 374).

The problem addressed in this research is a facilities location problem, which is typically viewed from a longer-term planning horizon where the task is to design the configuration of the facilities network (suppliers, manufacturing plants, and distribution centers) and its capacities so as to minimize the sum of investment, production, transportation, and inventory carrying costs to meet anticipated demand or to maximize net profits if the product mix is allowed to vary. Customer service

constraints may also be included in the facilities location problem (Shapiro 1985). The questions that need to be simultaneously addressed in typical location problems are:

1. What facility sites should be used?
2. What size facility should be constructed at each site selected?
3. What markets are served by each distribution center?
4. What distribution centers are served by each factory?
5. What manufacturing plants are served by each supplier?
6. What products are produced at each plant and in what quantities?
7. What pattern of transportation flows between facilities?

Facility location problems have been previously addressed by three different computerized modeling approaches that include heuristics, optimization, and simulation. Each of these approaches are reviewed in the following section.

Heuristic approaches incorporate rules of thumb that direct the user toward the best solution, but do not provide any assurances that the best solution will in fact be found.

Heuristic is defined as follows:

"A heuristic is short cut process of reasoning...that searches for a satisfactory, rather than an optimal, solution. The heuristic, which reduces the time spent in search for the solution comprises a rule or a computational procedure which restricts the number of alternative solutions to a problem, based upon the analogous human trial and error process of

reaching acceptable solutions to problems for which optimizing algorithms are not available" (Hinkle and Keuhn 1967, p. 61).

Often times there is only a small difference between an optimal solution and a wide range of good solutions. This being the case, a heuristic approach may be an appropriate approach when faced with constraints such as time to find a solution or when computer resources are a consideration. Therefore, heuristics provide a viable approach to logistics decision making as they provide a means to quickly find satisfactory solutions to problems when simulation or optimization methods are either undesirable or impractical (Ballou 1989).

Examples of the use of heuristics for facility location problems include Kuehn and Hamburger (1963) and Feldman, Learer, and Ray (1966). Early modeling work by Baumol and Wolf (1958), Cooper (1963) and later by Khumawala (1973) incorporated the use of a heuristic procedure with analytical techniques. Examples of this approach of combining heuristic and analytic techniques in the facility location modeling literature continues to the present day (Klincewicz 1991, Wright and Haehling von Lanzenauer 1991).

Models which use analytical techniques identify an optimal solution to the problem under analysis. This means that no better solution exists than the one produced by the analytical model (Powers 1989). The fact that an analytical

model can develop the "best" solution to a given problem is the primary strength of this approach. Other benefits associated with analytical models are the ability to handle capacity constraints, efficiency of analysis, and the potential for cost savings compared to potentially sub-optimal results derived from non-analytical approaches (Geoffrion 1975, Powers 1989).

Analytic techniques that are frequently applied to logistics problems include network optimization and mixed-integer optimization (Bowersox, Closs, and Helfferich 1986). Mossman, Bankit, and Helfferich (1977) present a detailed examination of these approaches.

The mixed-integer approach that utilizes a decomposition technique is often used for facility location problems (Geoffrion and Graves 1974, Geoffrion 1975, Bender, Northup, and Shapiro 1981). Additional examples of analytical approaches to facility location problems include Efroymson and Ray (1966), Glover, Jones, Karney, Klingman, and Mote (1979), Bender, Brown, Isaac, and Shapiro (1985), Van Roy (1986, 1989), Robinson (1989), and Sharma (1991).

Simulation models represent a third option for addressing logistics problems. Simulation models include both static and dynamic approaches. Static simulation models attempt to describe a logistical system of interest. All aspects of

the system are replicated and cost and performance characteristics are developed through the use of numerical computation procedures. Static simulation models address logistical problems at a single point in time. Dynamic simulation models are capable of incorporating the temporal aspect of the system being modeled into the analysis. It is this temporal aspect that distinguishes static from dynamic simulation models (Bowersox, Closs, and Helferich 1986).

Simulation models differ from analytical approaches in that they do not provide an optimum answer to a specified problem, but rather provide the user with descriptive information about the modeled system's performance. Simulation models also have the ability to introduce stochastic factors into the problem analysis. Heuristic rules may also be incorporated into the simulation model in an effort to direct the model user to a "good" solution. Examples of simulation modeling approaches include Shycon and Maffei (1960), Bowersox (1972), Markland (1973), House and Jamie (1981), Bookbinder and Locke (1986), and Taylor (1991).

Facility location problems have been and are a popular topic within the operations research and management science literature. Articles in this area are numerous. The emphasis in a great number of these works appears to be on improvement of technique rather than on its application.

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Geoffrion (1975) noted that in the area of analytic approaches to large scale network problems, that the theory was advancing, but the link to application was limited. Shapiro (1985) presents a possible reason for this situation stating "...that the computer techniques for analysis are better understood and implemented than the computer systems for model description" (Shapiro 1985, p.374).

Modeling that has specifically addressed international facilities location problems is a relatively recent phenomenon (Canel and Khumawala 1992). Work by Hodder and Jucker (1985) and Hodder and Dincer (1986) are examples of key works that addressed international plant location problems.

Given the relative recency of the United States-Canada Free Trade Agreement and the fact that the North American Free Trade Agreement has not yet been implemented, there is very little in the modeling literature that addresses the impact of the free trade agreements on facility location and logistics issues. The author is aware of only one study that actually applies a facility location modeling technique in light of the United States-Canada and North American Free Trade Agreements, which is Taylor's 1991 study that was discussed in the international logistics section.

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SUMMARY

The scope of the current study calls on the literature in several different disciplines. The overall theoretical basis for the study can be traced to the total cost location theory literature.

This study addresses not only manufacturing plant location, but also the location of distribution center facilities and the flow of inventory through the hypothetical firm's network. Therefore, it also calls upon the logistics literature. The logistics literature provides the total systems cost perspective and the specific consideration of distribution center facility location, transportation cost, inventory cost, and customer service levels.

The location and logistics literatures have typically addressed the location of manufacturing plants and distribution center facilities within a given country. This study incorporates the location of these facilities across international boundaries and also examines the supplier location. Therefore the international logistics and international purchasing literature were addressed. The international logistics and purchasing literatures provided insights into factors unique to international operations. Factors addressed in this literature include internal capabilities and various requirements for successful

operation in the international arena and identification of additional costs associated with international transactions. This literature assisted in the development of the cross-border transaction cost independent variable.

The international facility location problem presented in this study is addressed in light of the United States-Canada and North American Free Trade Agreements. A review of the literature pertaining to these agreements was also conducted. This literature presented a description of the free trade agreements along with the potential benefits and costs associated with the agreements as viewed from a wide range of academic and business practitioner perspectives. This literature provided the basis for the independent variables for levels of economic integration, tariffs, cross-border transaction costs, and future non-United States demand for finished products.

Finally, a simulation modeling methodology is utilized in this study. A review of the modeling literature to identify appropriate modeling methods to address this facility location problem was also conducted.

This research required that the literature of several different disciplines be reviewed. The literature in each of these disciplines has specific limitations. The location literature is primarily of a conceptual nature with limited

applied works. The logistics literature is more oriented towards application, but has traditionally been concerned with domestic issues. The international logistics and international purchasing literatures are relatively recent additions and are primarily descriptive in nature. The modeling literature has numerous examples of techniques which address the facility location problem. However, a very small portion of this literature addresses international facility location and is much more oriented toward the development of modeling techniques than the application of them. The literature relating to the United States-Canada and North American Free Trade Agreements has been dominated by descriptive works appearing in the popular business press and aggregate level economic modeling.

The primary contribution of this research is that it is applications oriented. The research applies various aspects from each of the disciplines reviewed to address an important current business issue, namely, North American economic integration. With the exception of Taylor's 1991 study, which this research extends, there are no other works, to the best of the author's knowledge, that address the United States-Canada and North American Free Trade Agreements from an integrated supply chain perspective.

Taylor's 1991 research was first to address the United States-Canada and North American Free Trade Agreements from

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an integrated logistical perspective. The current study builds on Taylor's work to include the examination of the supplier echelon within the overall supply chain.

This study also makes a contribution to the international purchasing literature as it demonstrates the effects of tariff and non-tariff barriers on the supplier selection decision from a total cost perspective. It also makes a contribution to the literature associated with the economic effects of the United States-Canada and North American Free Trade Agreements. This study presents a microeconomic perspective on the impact of the free trade agreements on a specific industry and addresses logistical cost factors that are not addressed in the aggregate level economic modeling research.

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CHAPTER 3 - METHODOLOGY

INTRODUCTION

Chapter 3 presents the research methodology. This chapter includes the general approach, model justification, variable definitions, research questions, research design, and analysis approach used in this study.

GENERAL APPROACH

The research questions are examined through the use of an experimental methodology that utilizes an existing network simulation model, Netsim II. Experimental simulation has been used in a number of past studies in the logistics area (Taylor 1991, Powers 1985, Closs 1978, Sims 1974, and Speh 1974). This approach permits the manipulation of one or a combination of the independent variables in order to determine the effect on the dependent variables. Various levels of the independent variables chosen to represent the economic environment faced by firms under the United States-Canada and North American Free Trade Agreements can be tested in a controlled manner thereby allowing the resulting effect on the supplier, manufacturing plant, and distribution center locations utilized and costs associated with the system to be identified.

A hypothetical firm that is representative of all firms in the household appliance industry is modeled in this study. The modeled firm services total industry demand for the finished products examined in the study. An industry level approach is employed to gain insights into the effects of the United States-Canada and North American Free Trade Agreements on an entire industry and its supplier base, rather than on a specific firm within the industry.

The firm sells four finished products, which are 1) clothes washers, 2) clothes dryers, 3) ranges, and 4) refrigerators. The firm sells its finished products throughout North America and has potential supplier, manufacturing plant, and distribution center facility options in the United States, Canada, and Mexico.

The firm purchases twenty-five items that are used in the manufacture of its finished products. Purchased items included in the research represent different combinations of key factors that influence the buying firm's total cost associated with the use of a specific supplier. These factors include the supplier's price for the purchased item, labor content, and transportation cost.

A description of the firm and its operating environment is presented in this section. An overview of the echelons

included in the modeled firm's supplier, manufacturing, and distribution center network is presented in Figure 1.

There are twenty-five purchased items examined in the research. Each purchased item has a supplier option in the United States, Canada, and Mexico. There are three manufacturing plant locations, one in each of the North American countries. There are forty distribution center location options throughout North America. There are twenty distribution center locations within the United States, ten in Canada, and ten in Mexico. Materials crossing United States-Mexico borders pass through transfer points, which are located at key border crossings. There are two transfer points. The North American countries are divided into 292 geographic market areas.

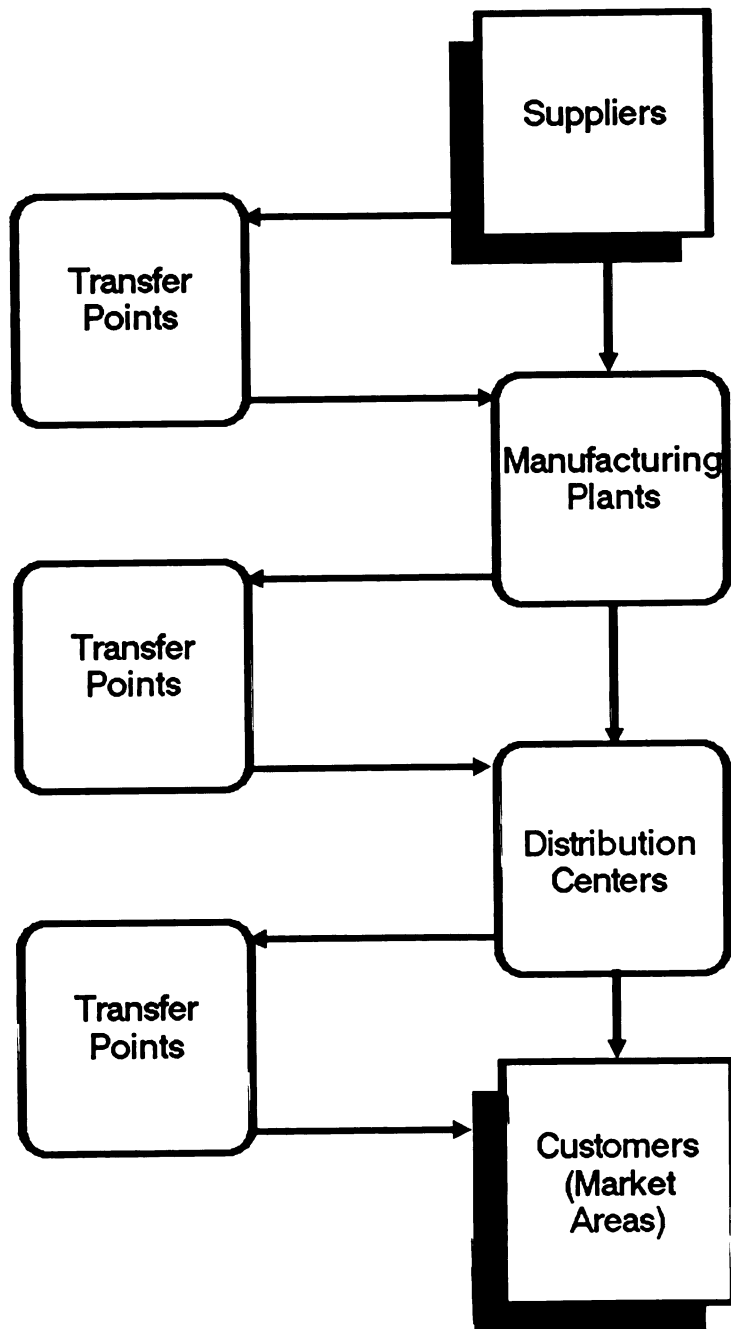


Figure 1
Echelons Included In Study

MODEL JUSTIFICATION

In the process of selecting an appropriate approach to test the relationship between the independent and dependent variables, both simulation and analytical models were evaluated. Both approaches have been applied to logistical network studies. Examples of analytical approaches include Geoffrion and Graves (1974), Glover, Jones, Karney, Klingman, and Mote (1979), Bender, Northup, and Shapiro (1981), Bender, Brown, Isaac, and Shapiro (1985), Van Roy (1986, 1989), Robinson (1989), Sharma (1991). Examples of simulation approaches include Shycon and Maffei (1960), Bowersox (1972), Bookbinder and Locke (1986), Powers and Closs (1987), and Taylor (1991).

Analytical models use mathematical methods to identify an optimal solution to the problem under analysis. This means that no better solution exists than the one produced by the analytical model (Powers 1989). The fact that an analytical model can develop the "best" solution to a given problem is the primary strength of this approach. Other benefits associated with analytical models are the ability to handle capacity constraints, efficiency of analysis, and the potential for cost savings compared to potentially sub-optimal results derived from non-analytical approaches (Geoffrion 1975, Powers 1989).

Analytical models are not without their limitations, however. Bowersox, Closs and Helferich (1986) discuss four problems faced by analytical approaches when applied to complex logistical networks. First, to format a comprehensive system design, it is necessary to develop the explicit functional relationships for the full range of design options. Second, the optimality feature of the technique is relative, being only as valid as the design problem definition. Too many simplifying assumptions can render the problem useless in terms of business practice. Third, the capability of existing linear programming procedures is typically limited to a system configuration with only three echelons. Thus, problems requiring the analysis of flows from manufacturing plants to warehouses and then to customers can be treated. However, it is difficult to perform a total channel analysis. A fourth weakness is the limitation regarding problem size. While optimization techniques are capable for solving moderately sized problems such as, 2 echelons, 15 plants, 45 distribution centers, 3 commodities, and 50 market areas, optimization techniques become less capable when the situation involves larger problem sizes (Bowersox, Closs and Helferich 1986, p. 412).

Given the drawbacks associated with analytical approaches simulation models are often used to study large-scale networks. Krajewski and Ritzman (1987) define simulation as

"...the act of reproducing the behavior of a system. A descriptive model of the system is developed, and certain variables are manipulated to measure their effects on the operating characteristics of interest." (Krajewski and Ritzman 1987, p. B23).

Simulation models differ from analytical approaches in that they do not provide an optimum answer to a specified problem, but rather provide the user with descriptive information about the modeled system. If heuristic rules are incorporated into the simulation model, then the model may direct the user to the "best" production/distribution network given the system described and heuristic applied.

While simulation models can not guarantee an optimum solution, they are a viable approach for the examination of large scale logistics network problems (Bowersox and Closs 1989). The primary advantages of static simulation are that it is simpler, less expensive to operate, more flexible than other comprehensive design techniques, does not require description of explicit functional relationships, and can incorporate a greater level of detail in terms of number of markets, products, facilities, and shipment sizes than analytical approaches (Bowersox, Closs and Helferich 1986).

The problem addressed in this study falls within the logistics planning category of structural analysis. As the

problem incorporates aspects of facility analysis (i.e. which manufacturing and distribution center facilities are utilized) as well as channel structure (i.e. what are the cost effects of different supplier options on the overall manufacturing / distribution system). Both types of problems can be addressed using a simulation methodology (Bowersox and Closs 1989).

The primary objectives of this research are to examine the relationships between changes in the economic environment related to the United States-Canada and North American Free Trade Agreements and their effects on a hypothetical firm's supplier, manufacturing and distribution center system and the costs associated with the system. Development of a sophisticated analytical model to study this phenomena is not an objective. Given these objectives, the simulation approach was chosen. The reasons for this decision follow.

In reviewing the literature where analytical models have been applied to large-scale logistical problems (Geoffrion and Graves (1974), Bender, Northup, and Shapiro (1981), Bender, Brown, Isaac, and Shapiro (1985), Sharma (1991) a common factor is that all have required the use of sophisticated optimization computer software which required multiple man-months of effort to formulate and implement. For example, a recent study by Sharma (1991) that addressed a moderately sized warehouse location problem within a

fertilizer distribution system required the development of approximately 20,000 lines of computer code. More than 1440 hours of CPU time was required in the development of this computer code. Once developed, this program required fifteen hours of CPU time on a VAX - 750 to solve a problem that contained 3,760 continuous variables, 51 integer variables, and 7078 constraints.

Another factor that makes the use of an analytical approach impractical is the computing time required once the model is formulated. Large-scale problems can be optimized, but require significant computing time to reach a solution. Robinson (1989) conducted tests to determine the computing time required to solve a series of network problems the largest of which contained 75 binary variables, 5,050 continuous variables, and 2,650 constraints. The test results indicated that the time required to solve these problems using a CDC Cyber 170/855 computer using the FTN5 compiler ranged from a low of 13.3 minutes to problems that were not solved in thirty minutes. Using the format presented in Robinson (1989) to determine the number of variables and constraints, the problem under consideration for this research would contain 100 binary variables, 55,800 continuous variables, and 28,200 constraints if addressed with an analytical model. The time required to solve a problem of this size could be significantly longer than those experienced by Robinson.

The final reason for the selection of the simulation model is that a proven simulation model was available to the author at no cost. Given that this research is being funded primarily by the author, this is not an insignificant factor.

The simulation model, Netsim II, was developed by a major logistics consulting firm and has been used successfully in over one-hundred network studies for a wide range of industries including food and beverage, chemicals, pharmaceuticals, consumer packaged goods, construction equipment, and sporting goods (A.T. Kearney, Inc., Dialog Systems Division 1991). Extensive use has demonstrated the model's internal reliability as well as its ability to effectively address a wide range of problem types and industries (Taylor 1991).

For a given set of independent variables and the hypothetical firm's logistical system which includes suppliers, manufacturing plants, distribution centers, and markets, the simulation model will determine the costs associated with the purchase, manufacture, and distribution of the finished products necessary to meet demand requirements for each customer market. The model has the ability to determine the cost associated with any specified network. The model is capable of addressing problems that incorporate multiple echelons and multiple products. The

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model also incorporates heuristics that will identify the "lowest cost" network of suppliers, manufacturing plants, and distribution centers.

The model identifies the level of demand in each customer market area, determines which customer market areas are serviced by individual distribution centers, determines which manufacturing plants will service distribution centers, and determines which suppliers will supply each manufacturing plant. The model output presents the detailed cost reports associated with a given network including purchase, manufacturing, distribution, transportation, and total systems costs.

METHODOLOGY

INTRODUCTION

The total cost associated with the operation of the firm's supplier, manufacturing, and distribution system is affected by a wide range of factors. Multinational firms whose supplier, manufacturing, and distribution systems transcend national borders are subject to additional costs as a result of tariff and non-tariff barriers. The independent variables examined in this research were selected because of the effects that they have on the firm's supplier, manufacturing, and distribution center location and utilization decisions. The variables were also selected based on their potential for change as a result of the United States-Canada and North American Free Trade Agreements.

INDEPENDENT VARIABLE DEFINITION

The independent variables examined in the research are the level of economic integration, tariffs, cross-border transaction costs, and increases in non-United States demand for the firm's finished products. The independent variables are discussed in the following sections.

Level Of Economic Integration

The level of economic integration describes the firm's perspective regarding the degree to which it views its operations in the North American countries as an integrated supplier, manufacturing, and distribution system. This variable is defined in a manner similar to Taylor's (1991) study, but is extended to include the firm's suppliers. Three levels of integration are considered, separate countries, United States-Canada, and United States-Canada-Mexico.

In the separate countries environment, the firm views each of the North American countries as a separate entity. In this environment the firm has parallel supplier, manufacturing, and distribution operations in each of the North American countries. Under the United States-Canada level of economic integration the firm views the United States and Canada as a single unit. The firm attempts to integrate supplier, manufacturing, and distribution operations on a lowest total systems cost basis, subject to specified service constraints. Under the United States-Canada-Mexico level of economic integration the firm views all three North American countries as a single entity and attempts to integrate supplier, manufacturing, and distribution operations on a lowest total systems cost basis, subject to specified service constraints.

Tariffs

Tariffs are taxes that are levied on a commodity when it crosses a national boundary. The tariff rates used in this study are based on the actual tariffs associated with the cross-border movement of the purchased items and finished products examined in the research. The tariff levels included in the analysis are the pre-free trade agreement levels, referred to as the "base level", a fifty percent reduction from the base level, and a one-hundred percent reduction from the base level (i.e., complete elimination of the tariffs).

The 1988 tariff rates are used as the base level for examination of trade under the United States-Canada research questions. The 1992 tariff rates are used as the base level for examination of trade under the North American Free Trade Agreement.

Cross-Border Transaction Costs

For the purposes of this research, cross-border transaction costs are defined as the additional costs, other than tariffs, that are incurred when conducting an international transaction which are not found in a domestic transaction. Cross-border transaction costs are associated with both inbound and outbound transactions (Anderson 1985, Davies

1987, McCray and Gonzalez 1989, Monczka and Giunipero 1990, Fawcett 1991). Individual cost elements that may be included in the cross-border transaction costs include, but are not limited to:

1. Additional internal administration costs
2. Increased costs of communication and coordination
3. Documentation and fees
4. Licensing requirements
5. Costs associated with managing currency exchange and risk
6. Increased travel requirements
7. Additional costs associated with cross-border transportation

Taylor (1991) addressed the cross-border transportation factor. This variable is included here along with other costs that may be encountered in cross-border transactions. Several of the cost factors included in the cross-border transaction costs variable are affected by non-tariff barriers, others are the result of organization practices or lack of capabilities within the focal firm that has limited experience with international operations. The cross-border transaction costs levels addressed include an initial estimate, a twenty-five percent reduction from the initial estimate, and a fifty percent reduction from the initial estimate.

**Increase In Non-United States Demand
For Finished Products**

The increase in non-United States demand is included in the research as this factor is one of the major benefits that free trade agreement proponents have argued will result from the United States-Canada and proposed North American Free Trade Agreements (U.S. Department of Commerce 1991, Wallace 1991). The amount and location of demand for the firm's finished products is also a key factor in the firm's manufacturing plant and distribution center location decisions (Losch 1954, Greenhut 1956, Shycon and Maffei 1960, Bowersox 1972).

Mexican demand is expected to increase significantly as this country is growing rapidly in terms of its population and gross domestic product. Mexico's population increased by 4.8 percent, from 82 to 86 million between 1987 and 1990. Mexico had an average annual growth in real gross domestic product of over two percent during the period from 1987 to 1990 (U.S. Department of Commerce 1991). The increase in Canadian demand for the firm's products is not expected to be as significant given its stable population.

The actual increase in non-United States demand is unknown. This variable can, however, be manipulated on a "what if" basis to determine its effect on the firm's supplier, manufacturing, and distribution system. For this research

the Mexican demand for the firm's finished products is examined for increases of twenty-five and fifty percent over current levels. Canadian demand is examined for five and ten percent increases over base levels. A summary of the independent variables and levels examined are presented in Table 4.

Table 4
Independent Variables And Levels Examined

<u>Independent Variables</u>	<u>Variable Levels</u>
Level Of Economic Integration	1. Separate Countries 2. United States-Canada 3. United States-Canada-Mexico
Tariff Levels	1. Base (Pre-Agreement) Levels 2. 50 Percent Reduction From Base Levels 3. 100 Percent Reduction From Base Levels
Cross-Border Transaction Costs	1. Current Estimate 2. 25 Percent Reduction From Current Estimate 3. 50 Percent Reduction From Current Estimate
Level Of Non-U.S. Demand For Finished Products	1. Current Demand 2. Canadian Increase 5 Percent Mexican Increase 25 Percent 3. Canadian Increase 10 Percent Mexican Increase 50 Percent

DEPENDENT VARIABLES DEFINITION

The dependent variables capture the detailed cost and location information necessary to determine the effect of changes in the levels of the independent variables on the hypothetical firm's supplier, manufacturing plant, and distribution center system. The primary dependent variables are "total systems cost" and "supplier, manufacturing, and distribution center locations utilized" as developed by the Netsim II model using the service\least cost heuristic (See Appendix A for a description of the heuristic). The other dependent variables are used to capture cost information at various points within the overall system. These "sub-system" level variables provide insights into what is causing the total systems costs to vary under different levels of the independent variables. The dependent variables are presented in the following section.

Purchases By Manufacturing Plant Location

This variable presents the suppliers used as sources of purchased items for each manufacturing plant location, quantities of purchased items used, purchased item unit price, the manufacturing plant's total purchase expenditure for each purchased item, and plant total for all purchased items. The cost to transport the purchased items from the supplier to the manufacturing location is also presented.

The transportation cost value includes the tariff and cross-border transaction costs associated with the purchased items for the given research question, if an international transaction is involved.

Purchases By Supplier Location

This variable presents a summary of the firm's purchases from each supplier location. The purchased item type, quantity purchased, and total purchase expenditure made by the firm from each supplier location utilized are included.

Total Purchase Expenditure For Each Purchased Item And Total Purchases For Firm

This variable presents the quantity purchased and total purchase expenditure for each purchased item, and the firm's total expenditure for all purchased items.

Finished Products Manufactured At Each Manufacturing Plant Location And Total For Firm

This variable presents the quantities manufactured and associated cost to manufacture each finished product at each manufacturing plant location utilized and totals for the firm. Manufacturing costs are defined as the fixed and variable costs associated with the operation of the

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manufacturing plant facility as well as the delivered cost of the purchased items used in the manufacturing process. The delivered cost of the purchased item is defined as the firm's expenditure for the purchased item and inbound transportation cost which includes tariffs and cross-border transaction costs, if an international transaction is required.

Source Of Finished Products By Distribution Center Location

This variable presents the manufacturing plant source of finished products for each distribution center location utilized. The finished product quantities shipped to each distribution center location are also presented.

Market Areas Serviced By Distribution Center Location

This variable presents the market areas serviced by each distribution center location.

Total Cost For Distribution Center Operations

This variable presents the costs associated with the operation of individual distribution centers and the firm's total cost for the operation of all distribution centers. Distribution center costs include the fixed cost, variable handling costs, and inventory carrying cost.

Total Transportation Cost

This variable presents the total cost associated with the transportation of purchased items and finished products. The total transportation cost is the sum of inbound freight cost (i.e., transportation between supplier facilities and manufacturing plant locations) and transfer freight (i.e., transportation between manufacturing plant and distribution center locations), and customer freight cost (i.e., transportation between distribution centers and market areas). Tariff and cross border transaction costs are also included in the transportation cost, if an international transaction is involved.

Total Systems Cost

This variable presents the total cost to manufacture and distribute the firm's finished products. The total system cost includes purchase expenditure and the cost to transport purchased items and finished products throughout the system.

The dependent variables address two fundamental areas, the locations utilized or supply chain structure and total systems cost. The dependent variables examined in the research are presented in Table 5. Figure 2 presents the relationship between the dependent variables and the key areas of interest. Figure 3 presents the flow of purchased

items and finished products through the system and associated costs addressed in this study.

Table 5
Dependent Variables Examined

Dependent Variable Number	Dependent Variable Description
1.	Purchases By Manufacturing Plant Location
2.	Purchases By Supplier Location
3.	Total Purchase Expenditure For Each Purchased Item And Total Purchases For Firm
4.	Finished Products Manufactured At Each Manufacturing Plant Location And Total For Firm
5.	Source Of Finished Products By Distribution Center Location
6.	Market Areas Serviced By Distribution Center Location
7.	Total Cost For Distribution Center Operations
8.	Total Transportation Cost
9.	Total Systems Cost

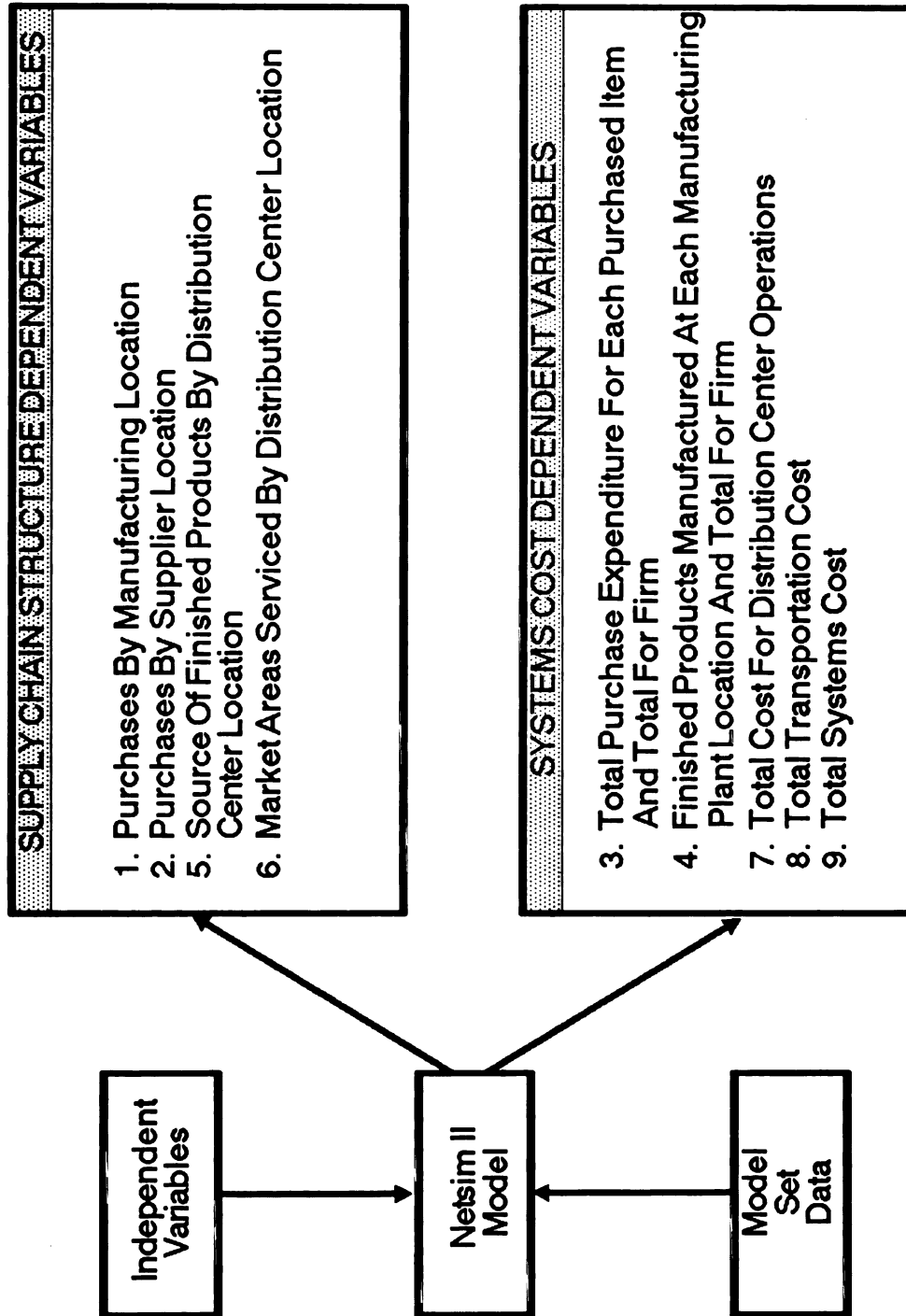


Figure 2

Dependent Variables Classified By Primary Areas of Interest

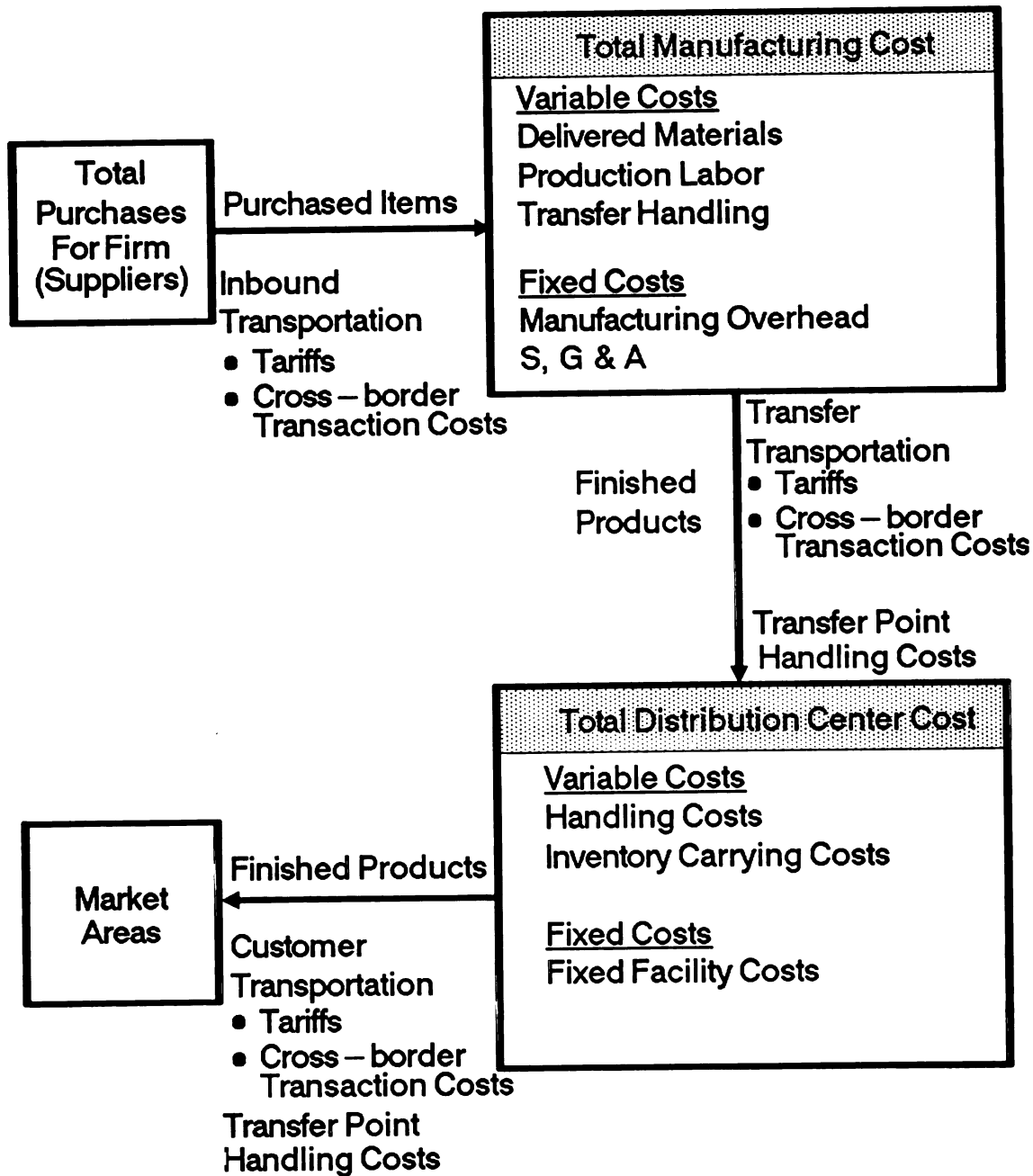


Figure 3

Material Flows And Associated Costs Addressed In This Study

RESEARCH QUESTIONS

The research questions addressed within this study are based on issues raised in the literature review, specifically the current literature that presents the questions and concerns of management and labor groups regarding the effects of the free trade agreements on their organizations. The research questions presented examine the changes in the supplier, manufacturing plant, and distribution center locations utilized due to the total cost effects of the United States-Canada and North American Free Trade Agreements.

United States-Canada Research Questions

The United States-Canada research questions address changes in supplier, manufacturing plant, and distribution center locations utilized that are the result of firms adopting an integrated perspective toward their United States-Canada operations. The research questions also examine the effect of changes in individual independent variables on the firm's supplier, manufacturing plant, and distribution center system that are related to changes in the economic environment that are a result of the United States-Canada Free Trade Agreement.

- RQA1. What is the least total cost supplier, manufacturing plant, and distribution center system, given specified service constraints, for an integrated United States-Canada system and how does it differ from a separate United States-Canada design, assuming no changes in the other independent variables?
- RQA2. What is the least total cost supplier, manufacturing plant, and distribution center system, given specified service constraints, for an integrated United States-Canada system under the "most likely" levels of independent variables and how does it differ from the initial integrated United States-Canada system developed in RQA1?
- RQA3. How do changes in the levels of the independent variables for tariffs, cross-border transaction costs, and non-United States finished product demand affect the supplier, manufacturing plant, and distribution center system in terms of locations utilized and total systems cost when compared to least cost system developed in RQA1?
- RQA4. How do changes in the levels of the independent variables for tariffs and cross-border transaction costs affect the supplier locations utilized and the total systems cost when the United States and Canadian manufacturing plant and distribution center locations service only their respective domestic markets?
- RQA5. How do changes in the levels of the independent variables for tariffs and cross-border transaction costs affect purchased item groups which were established on the basis of purchased item price, labor content, and transportation cost characteristics?

North American Research Questions

The North American research questions address changes in supplier, manufacturing plant, and distribution center locations utilized that are the result of firms adopting an integrated perspective toward their North American operations. The research questions also examine the effect

of changes in individual independent variables on the firm's supplier, manufacturing plant, and distribution center system that are related to changes in the economic environment that are a result of the North American Free Trade Agreement.

- RQB1. What is the least total cost supplier, manufacturing plant, and distribution center system, given specified service constraints, for an integrated United States-Canada-Mexico system and how does it differ from a separate United States-Canada-Mexico design, assuming no changes in the other independent variables?
- RQB2. What is the least total cost supplier, manufacturing plant, and distribution center system, given specified service constraints, for an integrated United States-Canada-Mexico system under the "most likely" levels of independent variables and how does it differ from the initial integrated United States-Canada-Mexico system developed in RQB1?
- RQB3. How do changes in the levels of the independent variables for tariffs, cross-border transaction costs, and non-United States finished product demand affect the supplier, manufacturing plant, and distribution center system in terms of locations utilized and total systems cost when compared to least cost system developed in RQB1?
- RQB4. How do changes in the levels of the independent variables for tariffs and cross-border transaction costs affect the supplier locations utilized and the total systems cost when the North American manufacturing plant and distribution center locations service only their respective domestic markets?
- RQB5. How do changes in the levels of the independent variables for tariffs and cross-border transaction costs affect purchased item groups which were established on the basis of purchased item price, labor content, and transportation cost characteristics?

Research Questions - Additional Information**Service Constraints**

The primary service constraint utilized in the simulations that were conducted for the United States-Canada research questions is that each market is to be serviced by a distribution center that is located within an eight hundred mile radius of the market location, if possible. It is assumed that trucks traveling from distribution center locations to market areas are capable of traveling four hundred miles per day. Therefore, if market areas are located within the eight hundred mile limit, then it is assumed the firm is providing two day service from the distribution center location. If a market area can not be serviced by a distribution center within the eight hundred mile limit, then it is serviced by the lowest cost facility regardless of distance.

The service constraint utilized in the simulations that were conducted for the North American research questions is identical to that used in the United States-Canada series with one exception. In the North American series, distance between distribution centers and market areas was limited to 1,200 miles or less. The objective here was to provide service to market areas within two days, if possible, but not more than three days in any case.

Another service constraint employed relates to the number of distribution facilities utilized within the firm's distribution system. A fixed number of distribution centers was established for each group of research questions. The firm uses of nine distribution centers for the United States-Canada research questions. Eleven distribution centers are used for the North American research questions.

Use of a fixed number of distribution facilities is a common industry practice. Reasons for using a specified number of facilities may be based on the firm's "traditional" operating practices or the perceived need to operate a certain number of facilities to provide a desired level of customer service (The Lyte Group 1992).

The service constraints are included in the research in an effort to make it representative of the competitive environment faced by firms within the household appliance industry. Both of the service constraints, days of service and number of facilities utilized, were considered reasonable by industry representatives and consultants familiar with the industry (A.T. Kearney 1992, The Lyte Group 1992, Whirlpool 1992).

Most Likely Case

The "most likely" level of economic integration discussed in research questions RQA2 and RQB2 is an estimate of the independent variable levels that represent the economic conditions firms are most likely to experience following implementation of the United States-Canada and North American Free Trade Agreements. The most likely variable levels for the United States-Canada series include an integrated United States-Canada network, no tariffs, a fifty percent reduction in cross-border transaction costs, and a five percent increase in Canadian demand for finished products. The most likely variable levels for the North American series include an integrated United States-Canada-Mexico network, no tariffs, a fifty percent reduction in cross-border transaction costs, and increases in demand for finished products of five percent in Canada and twenty-five percent in Mexico.

Mexican distribution center facilities are allowed to service United States market areas and vice versa, only under the most likely scenario for the North American series. This approach is taken in view of the fact that current border crossing procedure between the United States and Mexico may make the two day/eight hundred mile service constraint unattainable.

RESEARCH

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RESEARCH DESIGN

For each research question a research design incorporating a series of simulation runs has been developed to examine the relevant issues. The simulation runs are presented in Table 6 which includes the number of the research question that is being examined by the specified simulation run(s), the simulation run that is being used as point of comparison, and the values used for each of the independent variables for the specific simulation run.

Table 6
Simulation Runs

Research Question	Description	Level Of Economic Integration	Non-U.S. Demand	Tariff Levels	Cross Border Transactions Cost
	Validation	All	All	All	All
RQA1A	Base Case: U.S., Canada	Separate Countries: U.S., Canada	Current Demand	NA	NA
RQA1B (Compare with RQA1A)	Initial Integration	U.S.-Canada	Current Demand	Base Levels	Current Estimate
RQA2A (Compare with RQA1B)	Most Likely Case	U.S.-Canada	5% Increase in Canadian Demand	100% Reduction	50% Reduction
RQA3A	Change in Non-U.S. Demand	U.S.-Canada	5% Increase in Canadian Demand	Base Levels	Current Estimate
RQA3B (Compare with RQA1B)		U.S.-Canada	10% Increase in Canadian Demand	Base Levels	Current Estimate

Table 6 (cont'd.)

Research Question	Description	Level Of Economic Integration	Non-U.S. Demand	Tariff Levels	Cross Border Transactions Cost
RQA3C	Change in Tariffs	U.S.-Canada	Current Demand	50% Reduction	Current Estimate
RQA3D		U.S.-Canada	Current Demand	100% Reduction	Current Estimate
(Compare with RQA1B)					
RQA3E	Change in Cross Border Transaction Costs	U.S.-Canada	Current Demand	Base Levels	25% Reduction
RQA3F		U.S.-Canada	Current Demand	Base Levels	50% Reduction
(Compare with RQA1B)					

Table 6 (cont'd.)

Research Question	Description	Level Of Economic Integration	Non-U.S. Demand	Tariff Levels	Cross Border Transactions Cost
Note: RQA4A through RQA4H require that all manufacturing and distribution activities take place within the consuming country.					
RQA4A	Base Case: U.S., Canada	Separate Countries: U.S., Canada	Current Demand	None	None
RQA4B	Initial Integration	U.S.-Canada Sourcing	Current Demand	Base Levels	Current Estimate
(Compare with RQA4A)					
RQA4C	Change in Tariffs	U.S.-Canada Sourcing	Current Demand	50% Reduction	Current Estimate
RQA4D		U.S.-Canada Sourcing	Current Demand	100% Reduction	Current Estimate
(Compare with RQA4B)					

Table 6 (cont'd.)

Research Question	Description	Level Of Economic Integration	Non-U.S. Demand	Tariff Levels	Cross Border Transactions Cost
RQA4E	Change in Cross Border Transaction Costs	U.S.-Canada Sourcing	Current Demand	Base Levels	25% Reduction
RQA4F		U.S.-Canada Sourcing	Current Demand	Base Levels	50% Reduction
(Compare with RQA4B)					
RQA4G	FTA Partial Implementation	U.S.-Canada Sourcing	Current Demand	50% Reduction	25% Reduction
(Compare with RQA4A)					
RQA4H	Most Likely Case	U.S.-Canada Sourcing	5% Increase in Canadian Demand	100% Reduction	50% Reduction
(Compare with RQA4A)					

Table 6 (cont'd.)

Research Question	Description	Level Of Economic Integration	Non-U.S. Demand	Tariff Levels	Cross Border Transactions Cost
RQB1A	Base Case: U.S., Canada, Mexico	Separate Countries: U.S., Canada, Mexico	Current Demand	NA	NA
RQB1B	Initial Integration (Compare with RQB1A)	U.S.-Canada-Mexico	Current Demand	Base Levels	Current Estimate
RQB2A	Most Likely Case (Compare with RQB1B)	U.S.-Canada-Mexico	5% Increase in Canadian and 25% Increase in Mexican Demand	100% Reduction	50% Reduction

Table 6 (cont'd.)

Research Question	Description	Level Of Economic Integration	Non-U.S. Demand	Tariff Levels	Cross Border Transactions Cost
RQB3A	Change in Non-U.S. Demand	U.S.-Canada-Mexico	5% Increase in Canadian and 25% Increase in Mexican Demand	Base Levels	Current Estimate
RQB3B		U.S.-Canada-Mexico	10% Increase in Canadian and 50% Increase in Mexican Demand	Base Levels	Current Estimate
	(Compare with RQB1B)				
RQB3C	Change in Tariffs	U.S.-Canada-Mexico	Current Demand	50% Reduction	Current Estimate
RQB3D		U.S.-Canada-Mexico	Current Demand	100% Reduction	Current Estimate
	(Compare with RQB1B)				
RQB3E	Change in Cross Border Transaction Costs	U.S.-Canada-Mexico	Current Demand	Base Levels	25% Reduction
RQB3F		U.S.-Canada-Mexico	Current Demand	Base Levels	50% Reduction
	(Compare with RQB1B)				

Table 6 (cont'd.)

Research Question	Description	Level Of Economic Integration	Non-U.S. Demand	Tariff Levels	Cross Border Transactions Cost
	Note: RQB4A through RQB4H require that all manufacturing and distribution activities take place within the consuming country.				
RQB4A	Base Case: U.S., Canada, Mexico	Separate Countries: U.S., Canada, Mexico	Current Demand	NA	NA
RQB4B	Initial Integration	U.S.-Canada- Mexico Sourcing	Current Demand	Base Levels	Current Estimate
(Compare with RQB1A)					
RQB4C	Change in Tariffs	U.S.-Canada- Mexico Sourcing	Current Demand	50% Reduction	Current Estimate
RQB4D		U.S.-Canada- Mexico Sourcing	Current Demand	100% Reduction	Current Estimate
(Compare with RQB4B)					

Table 6 (cont'd.)

Research Question	Description	Level Of Economic Integration	Non-U.S. Demand	Tariff Levels	Cross Border Transactions Cost
RQB4E	Change in Cross Border Transaction Costs	U.S.-Canada-Mexico	Current Demand	Base Levels	25% Reduction
RQB4F		U.S.-Canada-Mexico	Current Demand	Base Levels	50% Reduction
(Compare with RQB4B)					
RQB4G	FTA Partial Implementation	U.S.-Canada-Mexico Sourcing	Current Demand	50% Reduction	25% Reduction
(Compare with RQA4B)					
RQB4H	Most Likely Case	U.S.-Canada-Mexico	5% Increase in Canadian and 25% Increase in Mexican Demand	100% Reduction	50% Reduction
(Compare with RQB4B)					

Note: The experimental design requires a total of thirty-four analysis runs plus validation runs. Research Question 5 is addressed with the same simulation runs as Research Question 4.

ANALYSIS

The results of the simulation runs conducted were analyzed on a comparative basis to determine the changes in supplier, manufacturing plant, and distribution center locations utilized. Absolute differences and the percentage change in total systems cost and other key cost factors between relevant simulation runs were also examined. The results are summarized by research question in Chapter Five.

An analysis of sourcing patterns and purchased item characteristics was also conducted. The objectives of this analysis are to identify changes in industry level sourcing patterns, to determine if these changes were statistically significant, and to identify the characteristics of purchased items affected by the free trade agreements.

Purchased items were classified and assigned to groups with other purchased items possessing similar characteristics. The characteristics examined were purchased item price, labor content, and transportation cost. The classification process is presented in the following section.

Purchased items with United States supplier unit prices of five dollars or greater are classified as "High" price items. Purchased items with United States supplier unit

prices less than five dollars per unit are classified as "Low" price items.

Purchased item labor content is based on the estimated labor content of the United States supplier option. Development of purchased item cost structure is discussed earlier in this chapter and in Appendix C. Purchased items with labor content values greater than ten percent of the price of the purchased item are classified as "High" labor content items. Purchased items with labor content less than ten percent are classified as "Low" labor content items.

The transportation cost classification is based on the relationship between the United States supplier price for the purchased item and the cost to transport the purchased item from the United States supplier location (Fort Wayne, IN) to the United States manufacturing plant (Indianapolis, IN). The cost associated with transporting one unit of the purchased item is divided by the United States purchased item price. Purchased items where the percentage of supplier price represented by transportation cost is greater than 0.50 are classified as "High" transportation cost items. Purchased items with values less than 0.50 are classified as "Low" transportation cost items. Table 7 presents the eight groups considered and the purchased items included in these groups.

Table 7

Purchase Item Classification Groups**High Price, High Labor Content, High Transportation Cost
(HHH):**

- 122 Washer Miscellaneous Parts
- 124 Range Miscellaneous Parts
- 125 Refrigerator Miscellaneous Parts

**High Price, High Labor Content, Low Transportation Cost
(HHL):**

- 115 Pumps
- 116 Relays
- 120 Wiring Harnesses
- 123 Dryer Miscellaneous Parts

**High Price, Low Labor Content, High Transportation Cost
(HLH):**

- 103 Compressors
- 110 1 Speed Motors
- 111 2 Speed Motors

**High Price, Low Labor Content, Low Transportation Cost
(HLL):**

- 108 Door Gaskets
- 119 Timers/Motors
- 121 Miscellaneous Electronics

**Low Price, High Labor Content, High Transportation Cost
(LHH):**

- 101 Aluminum Components
- 106 Corrugated Packaging
- 107 Fasteners
- 113 Plastic Components

**Low Price, High Labor Content, Low Transportation Cost
(LHL):**

- 102 Belts
- 105 Cord Sets

**Low Price, Low Labor Content, High Transportation Cost
(LLH):**

- 104 Copper Components
- 114 Polypropylene Resin
- 117 Steel

**Low Price, Low Labor Content, Low Transportation Cost
(LLL):**

- 109 Knobs
- 112 Paint (Powder)
- 118 Switches

In the separate country simulations (Simulations A1 and B1) manufacturing plants are restricted to the use of domestic suppliers. Therefore, the total number of purchased items sourced domestically by the manufacturing plants is twenty-five. These twenty-five purchased items are distributed across the purchased item groups in the manner presented in Table 7. The frequency distribution of purchased items within the groups is the same for all manufacturing plants (countries). When the use of foreign sources is permitted changes in the number of purchased items sourced domestically occur. This results in changes in the frequency distributions associated with the purchased item classification groups that continue to be sourced domestically. A chi square goodness of fit test was used to determine if the changes were statistically significant.

The chi square goodness of fit is an appropriate means to test for differences between frequency distributions (Kerlinger 1986). The application in this situation is appropriate if it assumed that the simulation results are random samples of actual sourcing pattern data found within the North American household appliance industry. This is purely an assumption and is not based on any empirical data.

Prior to applying the chi square test the purchased items were regrouped on the basis of labor content and transportation cost only. The reason for this approach is

that classification on the basis of the three characteristics discussed earlier results in cell sizes that fail to meet the chi-square test requirements (Weiss and Hassett 1987).

The first comparison is made between domestic sourcing (4A) and initial integration (4B) simulations. In this comparison the domestic sourcing pattern distribution serves as the expected frequency distribution for the chi square test. All other comparisons use that the initial integration (Simulation 4B) sourcing pattern frequency distribution as the expected values for the chi square test.

CHAPTER 4 - MODEL DATA DEVELOPMENT

INTRODUCTION

Chapter 4 presents the development of the data required to operationalize the simulation model. This chapter includes a discussion of model data requirements, data collection, data development procedures utilized, and verification / validation approach.

In addition to independent variable data, the simulation model requires data, referred to as model set variables, that define the parameters of the hypothetical firm's operations environment. Model set variable data includes the cost and physical characteristics of purchased items and finished products; the geographic location of suppliers, manufacturing plants, distribution centers, and market areas; transportation linkages and cost of transportation within the system; as well as the fixed and variable costs associated with the operation of the firm's manufacturing plants and distribution centers. Model set variables are held constant throughout all experimental simulation runs.

Identification of model set variables as well as a discussion of data collection and development for both independent variable and model set data are presented in this section.

MARKET AREAS

The simulation model requires that the countries included in the study be divided into markets on a geographic basis. This is accomplished through the use of three geocoding schemes, one for each of the countries included in the study.

The United States market areas are based on a three digit zip code sectional center georeference system. Under this format the United States is divided into markets based on the first three digits of the postal zip code. The geocoding approach used divides the United States into 200 separate market areas. Zip code-based options are available that divide the United States into a larger number of market areas, but research by House and Jamie (1981) indicated that two hundred is an appropriate number for an analysis of distribution center locations within the United States. The zip code georeference system used was developed by Dialog Systems Division of A.T. Kearney, Inc. (A.T. Kearney, Inc. 1991). It is based on a system of 204 market areas that was modified to exclude four markets that represented military personnel, Puerto Rico, Alaska, and Hawaii. The market areas produced under this system meet the key guidelines for an appropriate georeference system presented in Bowersox,

Closs, and Helferich (1986): they are relatively stable, mutually exclusive, and geographically contiguous.

From a modeling perspective the zip code approach is commonly used due to the availability of data at the market level, appropriateness of the data unit (market areas) coverage to the markets serviced by the firm, the ability to determine distance from facilities within the data unit, and the comparability of the data unit to the firm's management information system. The primary drawback associated with the zip code format is that the market areas may differ significantly in terms of their geographic size (Bowersox, Closs, and Helferich 1986).

Canadian market areas were developed through the use of a georeference system based on the first three digits of forward sortation areas for Canadian postal codes which divides the country into thirty market areas. This approach provides adequate coverage of the Canadian markets, resulting in an average of 860,000 people per market area which is approximately twenty-eight percent fewer people per market area than provided by the zip code system applied to the United States. This approach also meets the georeference guidelines presented in Bowersox, Closs, and Helferich (1986). The Canadian georeference system used was developed by the Lyte Group, Inc. (Lyte Group, Inc. 1992).

The approach used for Mexico was developed by Taylor (1991) and used in his research. This approach is based on the populations of major Mexican cities. Major cities were established as market areas and then states were further divided into additional market areas on the basis of population. A total of sixty-two market areas were created under this approach. This approach results in an average of approximately 1.3 million people per market area which is slightly larger than the average provided by the zip code system applied to the United States. This approach also meets the georeference guidelines presented in Bowersox, Closs, and Helferich (1986).

FINISHED PRODUCT DEMAND DATA

The simulation model requires finished product demand data by market area. Total 1991 demand data for each of the finished products (i.e. washers, dryers, ranges, and refrigerators) for each country were collected from secondary sources. Total country demand for the finished products, rather than a portion of the total country demand accounted for by a single firm, is used in this study. The reason for this approach is to determine the potential effect of free trade agreement related changes on the overall household appliance industry and its suppliers, rather than a single firm within the industry. Total finished product demand data is presented in Table 8.

Table 8

1991 Finished Product Demand

Finished Product	Demand In Thousands Of Units		
	<u>United States</u> ¹	<u>Canada</u> ²	<u>Mexico</u> ³
Clothes washers	6,113.0	522.0	20.6
Clothes dryers	4,294.0	437.0	8.2
Ranges	5,593.0	452.0	40.8
Refrigerators	7,086.0	543.0	35.7

Source: 1) "1992 3 Part Market Profile", Appliance Manufacturer, February 1992, pp. 41,42., 2) Canadian Appliance Manufacturers Association, telephone interview and fax, 3) Based on the author's extension of Miller, Robert W., "Report of Mexican Household Appliances and Parts," U.S. Department of Commerce, 1988.

Once the total demand for each of the finished products is established, the demand is then allocated to the individual market areas. The demand is allocated to market areas on the basis of the ratio of the population in each market area to the total country population. A sample calculation is presented below.

$$\frac{\text{Market Area Population}}{\text{Total Country Population}} = \frac{\text{Market Area}}{\text{Demand Percentage}}$$

The market area demand percentage value is then multiplied by the total country demand for each of the finished products to determine the individual market area's demand for finished products. Market areas and demand percentages are presented in Tables B-1 - B-3 in Appendix B.

Market area demand is then broken down by shipment sizes (i.e., what percentage of demand is accounted for by truckload versus various less-than-truckload (LTL) shipment sizes). In this research market area demand is divided equally between five shipment sizes which are presented in Table 9.

Table 9
Shipment Sizes

<u>Weight Group Code</u>	<u>Shipment Weight (pounds)</u>
W1	less than 2,000
W2	2,001-5,000
W3	5,001-10,000
W4	10,001-15,000
W9	over 15,000

PURCHASED ITEMS

The simulation model requires information regarding the characteristics of materials that are moved within the network. This information includes the purchased item price, weight, and freight rate classification. Purchased item information was gathered through telephone interviews with representatives of firms which are suppliers to the household appliance industry, and secondary sources.

Twenty-five purchased items are examined in this study. These purchased items were selected on the basis of the

percentage of finished product cost represented by the purchased item, and for differences in key characteristics including price, labor content, and transportation cost. The objective was to develop a sample of purchased items that included the major purchase areas for the appliances considered while providing purchased items with different combinations of the characteristics of interest. Purchased items examined in the study and quantities required to produce one unit of the finished products are presented in Table 10. The purchased item quantities required to produce a unit of finished product are based on 1992 industry component/material consumption amounts divided by total industry finished product shipment quantities (Appliance Manufacturer 1992).

Table 10
Purchased Items And Finished Product Assembly Data

Item No.	Description	SIC Code	Units	Quantity Required			Refrigerator	Item Weight (Pounds)
				Washer	Dryer	Range		
101	Aluminum Components	3354	Pounds	0.53	0	1	8	1.0000
102	Belts	3052	Each	2	1	0	0	0.3125
103	Compressors	3585	Each	0	0	0	1	25.0000
104	Copper Components	3351	Pounds	0	0	0.5	2.5	1.0000
105	Cord Sets	3643	Each	1	0	0	1	0.8000
106	Corrugated Packaging	2653	Each	1	1	1	1	10.0000
107	Fasteners	3496	Each	148	186	191	118	0.0065
108	Door Gaskets	3053	Each	0	0	0	1	2.0000
109	Knobs	3089	Each	3	2	9	2	0.0625
110	1 Speed Motors	3621	Each	0	1	0	0	15.0000
111	2 Speed Motors	3621	Each	1	0	0	0	20.0000
112	Paint (Powder)	2851	Pound	0.494	0.215	0	0.484	1.0000
113	Plastic Components	3089	Each	1	1	1	1	1.5000
114	Polypropylene Resin	2821	Pounds	22	1	0	34	1.0000
115	Pumps	3561	Each	1	0	0	0	1.0000
116	Relays	3625	Each	1	0	0	1	0.6250
117	Steel	3316	Pounds	84	103	93	58	1.0000
118	Switches	3825	Each	4	6	7	2	0.1000
119	Timers/Motors	3825	Each	1	2	1	3	0.1000
120	Wiring Harnesses	3643	Each	1	1	1	1	2.0000
121	Misc. Electronics	3825	Each	1	1	1	1	2.0000
122	Washer Misc. Parts	3633	Each	1	0	0	0	30.0000
123	Dryer Misc. Parts	3633	Each	0	1	0	0	1.0000
124	Range Misc. Parts	3631	Each	0	0	1	0	95.0000
125	Refrigerator Misc. Part	3632	Each	0	0	0	1	60.0000

Information regarding purchased item cost structure was also required to develop the price of the purchased items produced outside of the United States. Cost structure information is defined as the percentage of the purchased item's price represented by each of five product cost categories: materials; labor; manufacturing overhead; sales, general and administrative expense; and profit.

Suppliers interviewed were usually willing to provide approximate pricing and product weight data. Several also provided approximate cost structure information. Unfortunately, the majority of suppliers would not provide cost structure information. Therefore, it was necessary to develop an estimate of the purchased item cost structure using secondary source data. The main source used was the 1990 Annual Survey of Manufactures (U.S. Department of Commerce 1992). The procedures used to develop product cost structure data and purchased item prices for each supplier option are described in Appendix C. Table 11 presents purchased item prices by supplier location.

Table 11

Purchased Item Price By Supplier Location

Item No.	Description	Canadian Supplier Price (\$)	U.S. Supplier Price (\$)	Mexican Supplier Price (\$)
101	Aluminum Components	1.1630	1.1500	1.0073
102	Belts	2.4367	2.4000	1.9966
103	Compressors	50.4000	50.0000	45.6000
104	Copper Components	1.0574	1.0500	0.9687
105	Cord Sets	2.2799	2.2500	1.9213
106	Corrugated Packaging	2.2860	2.2500	1.8540
107	Fasteners	0.0101	0.0100	0.0085
108	Door Gaskets	8.0640	8.0000	7.2960
109	Knobs	0.2510	0.2500	0.2390
110	1 Speed Motors	18.4666	18.3200	16.7078
111	2 Speed Motors	24.9480	24.7500	22.5720
112	Paint (Powder)	3.2648	3.2500	3.0870
113	Plastic Components	3.5484	3.5000	2.9672
114	Polypropylene Resin	0.3624	0.3600	0.3337
115	Pumps	6.0667	6.0000	5.2661
116	Relays	7.0689	7.0000	6.2423
117	Steel	0.2829	0.2810	0.2600
118	Switches	0.7554	0.7500	0.6906
119	Timers/Motors	7.2964	7.2500	6.7396
120	Wiring Harnesses	6.0776	5.9800	4.9065
121	Misc. Electronics	6.4461	6.4000	5.8931
122	Washer Misc. Parts	46.0068	45.4900	39.8056
123	Dryer Misc. Parts	39.2610	38.8200	33.9691
124	Range Misc. Parts	177.6261	175.7700	155.3526
125	Refrigerator Misc. Parts	114.1256	112.7100	97.1380

Note: All dollar (\$) values are stated in U.S. dollars.

Twenty-one of the purchased items, codes 101-121, are based on actual materials and components used in the manufacture of the finished products. Four of the purchased items, codes 122-125, are fictitious items that represent the balance of the firm's expenditure on purchased materials used in the manufacture of its finished products, over and above that associated with purchased items 101-121. For example, on the basis of the product structure information

developed for washers, purchased materials used in the washers cost \$157.00 per unit, assuming the use of the United States supplier. Reducing the cost of materials value by 1.5 percent to account for inbound transportation cost and subtracting the cost of purchased items 101-121 used in the washer, provides the price of the purchased item 122, washer mp, (i.e. washer miscellaneous parts) which is \$45.49 for the United States supplier option. This same approach is used to determine the price for the other "miscellaneous parts" purchased items 123-125.

The approach used to determine estimates of the product cost structure has several limitations. First, the 1990 Annual Survey of Manufactures data are aggregate level data for an entire industry. The costs associated with individual firms within the industry may differ significantly from the industry average figures. Second, cost of materials and value of shipments data may include significant amounts of duplication. Third, the cost of materials and production labor cost include both direct and indirect components. Despite these limitations the results of the cost structure estimating procedure appeared to be reasonable when compared to the cost structure data provided by suppliers.

The primary difference between supplier-provided and estimated cost structure data is in the area of labor expenditure. The suppliers' data typically included a

direct labor category and an overhead category. The overhead category included indirect production labor. The data used for the cost estimating procedure lumped together direct and indirect production labor, therefore the labor cost calculated through the author's procedure tends to be higher than supplier provided labor figures. This is not a serious limitation of the research, but is a point that needs to be recognized when reviewing the cost structure data used in this study.

The procedure used to develop purchased item prices for the Canadian and Mexican supplier locations is based on the United States purchased item cost structure with an adjustment for differences in production worker compensation costs in these countries. The limitations related to the procedure are discussed in this section. The key limitation is that price differences are based solely on differences in production labor compensation costs. This approach does not take into account differences in the costs associated with materials, manufacturing overhead, or sales, general, and administrative expense that may exist between suppliers. The approach also fails to recognize differences in production labor compensation rates at an industry level in Canada and Mexico. The comparative compensation index values used are aggregate measures for all manufacturing industries within their respective countries. It was assumed that differences that exist across industries were

similar to those found in the United States, therefore the index value was applied to the United States suppliers' labor rate to develop the Canadian and Mexican wage rate for the specific industry.

FINISHED PRODUCTS

Information requirements for finished products include price, weight, freight rate classification, a cost of goods sold value, and assembly information that indicates the type and quantity of purchased items required to produce the finished products. The majority of finished product information was gathered from secondary sources.

Finished product unit prices are used in the simulation model to develop revenue data. Price information is also required in order to establish tariff costs associated with international transactions. The prices for the finished products examined in this study are average prices, established at the five digit standard industrial classification (SIC) code level. This average price was calculated by dividing the 1990 value of industry shipments (U.S. Department of Commerce 1992) by the 1990 industry shipments in units for each of the finished products (Association of Home Appliance Manufacturers 1992). This procedure resulted in the following average prices for the

finished products, washers and dryers \$276.00, ranges \$405.00, and refrigerators \$474.00.

Due to the fact that both clothes washers and clothes dryers are classified under the same SIC code at the five digit level it was necessary to establish separate prices for these products. A brief survey of household appliance prices indicated that, on average, washers tended to be priced somewhat higher than dryers (Sears 1992). Given this observation, the washer and dryer prices were set at \$300.00 and \$250.00, respectively.

The simulation model requires a cost of goods sold value for use in inventory carrying cost calculations. It is assumed that the cost of goods sold value for the finished products is eighty percent of the finished product price. This amount is somewhat higher than the cost of goods sold value of seventy-three percent developed from data presented in RMA Annual Statement Studies 1991 (Robert Morris Associates 1991) for the period in question, but is consistent with the value used in Taylor's study (Taylor 1991).

The procedures used to develop the cost structure for the United States manufacturing location and pricing for Canadian and Mexican manufacturing locations are presented in Appendix C. The price development procedure is similar to the one used for purchased items with one additional step

regarding the cost of materials. The initial finished product prices are based on the assumption that each manufacturing location uses its domestic supplier option.

Weights of the finished products considered in this study are based on a review of actual weights for these products. The weights used are as follows, washers 220 pounds, dryers 152 pounds, ranges 176 pounds, and refrigerators 240 pounds. It should be noted, however, that there is a wide range of weights found within each finished product category. Key finished product information is summarized in Table 12.

Table 12

Finished Product Information

<u>Item No.</u>	<u>Finished Product</u>	<u>SIC Code</u>	<u>Cost Of Goods Sold (US\$)</u>	<u>U.S. Manufacturer Price (US\$)</u>	<u>Canadian Manufacturer Price (US\$)</u>	<u>Mexican Manufacturer Price (US\$)</u>	<u>Product Weight (Pounds)</u>
201	Washer	3633	240.00	300.00	304.63	245.69	220
202	Dryer	3633	200.00	250.00	254.06	205.23	152
203	Range	3631	324.00	405.00	411.71	331.15	176
204	Refrigerator	3632	379.20	474.00	482.22	378.26	240

FACILITY LOCATIONS

The geographic locations of manufacturing plants and distribution centers for the hypothetical firm are based on locations that are representative of actual locations used in the household appliance industry. The distribution center facilities also include key future gateway locations within the North American countries. Data used to determine the household appliance industry manufacturing plant and distribution center locations were collected from telephone interviews with household appliance industry representatives (Whirlpool 1992) and from secondary sources (Taylor 1991, Association of Home Appliance Manufacturers 1992).

Suppliers were arbitrarily assigned to locations approximately one hundred miles from the manufacturing plant locations. It is assumed that a local supplier option is available for each manufacturing plant location. The reason for this approach is that specific supplier locations within the given country are not being examined, but rather differences in the total cost associated with supplier options in each country. Significant variability in distance between the domestic suppliers and the domestic manufacturing plant could potentially alter the results of the study strictly on the basis of the supplier location selected.

Two freight transfer facilities are also included in the study to reflect the current practices in United States-Mexico cross-border transportation practices. The facility locations used in the study are presented in Table 13.

Table 13

Facility Locations

<u>Suppliers</u>	<u>Manufacturing</u>	<u>Transfer Points</u>
Woodstock, ON Fort Wayne, IN Reynosa, TAMPS	Toronto, ON Indianapolis, IN Monterrey, N.L.	Nuevo Laredo, COAH Ciudad Juarez, CHIH
Distribution Centers		
<u>Canada</u>	<u>United States</u>	<u>Mexico</u>
Moncton, NB Montreal, PQ Toronto, ON Niagara Falls, ON Windsor, ON Winnipeg, MB Regina, SK Calgary, AL Edmonton, AL Vancouver, BC	Worcester, MA Newark, NJ Buffalo, NY Cleveland, OH Detroit, MI Chicago, IL Minneapolis, MN Kansas City, MO Indianapolis, IN Raleigh, NC Atlanta, GA Memphis, TN Dallas, TX Denver, CO Phoenix, AZ Los Angeles, CA San Francisco, CA Salt Lake City, UT Reno, NV Seattle, WA	Nuevo Laredo, COAH Ciudad Juarez, CHIH Hermosillo, SON Chihuahua, CHIH Monterrey, N.L. Tampico, TAMPS San Louis Potosi, S.L.P. Guadalajara, JAL. Mexico City, D.F. Merida, YUC

FACILITIES COST

The simulation model requires information concerning the fixed and variable costs associated with the operation of manufacturing plants and distribution center facilities. The information used is based on approximate United States cost levels for the household appliance industry with wage levels and facilities costs adjusted to reflect cost differentials within the United States and in Canada and Mexico. Secondary source information in this area was supplemented with data collected from telephone interviews with representatives from the household appliance industry.

Manufacturing Facilities Fixed Costs

Manufacturing facility fixed costs were assumed to be at the same level, on a per unit basis, at all manufacturing plant locations. A per unit fixed cost value was calculated based on the sum of the manufacturing overhead and sales, general, and administrative expense values established for each finished product using the cost structure procedure presented in Appendix C. The fixed cost values were multiplied by the initial domestic demand quantity for each finished product to provide an estimated fixed cost amount for each manufacturing location. This amount was then reduced by the fixed cost amounts associated with the distribution center facilities utilized in the separate

country simulation runs in an effort to avoid "double-counting" of product fixed costs.

The simulation model allows fixed costs to be adjusted at manufacturing facilities in a step function manner according to specified changes in production volume. This provision was used to accommodate potential shifts in production volume between manufacturing locations under different levels of integration. However, total manufacturing fixed costs within the system are held at a constant level for all levels of integration. The assumption is that reductions in fixed costs that occurred at a location as a result of production volume being shifted to a different manufacturing plant location were offset by increases in fixed costs at the other manufacturing plant locations. Development of initial fixed cost values for each manufacturing location are presented in Appendix D. Initial fixed costs for the manufacturing locations are presented in Table 14.

Table 14
Manufacturing Facilities Fixed Costs

<u>Location</u>	<u>Fixed Costs</u> <u>(US\$ 000)</u>
Indianapolis	1,380,670.4
Toronto	112,239.7
Monterrey	6,388.5

Manufacturing Facilities Variable Costs

There are three variable cost factors associated with each manufacturing facility location. These are materials, labor, and transfer handling. Materials cost is the sum of the prices for all purchased items used in the manufacture of the finished products. The labor cost is the per unit labor cost associated with each finished product. Transfer handling cost is the per unit cost associated with the handling of finished products required for shipments from manufacturing to distribution center facilities.

The materials cost is a function of sources utilized for the purchased items used in the manufacture of the finished products. The labor cost value and transfer handling cost vary according to the manufacturing plant location. Variable labor and transfer handling costs for the manufacturing locations are presented in Table 15. The development of the labor and transfer handling costs is presented in Appendix D.

Table 15

**Variable Labor And Transfer Handling Costs Per Unit
By Manufacturing Location**

<u>Finished Product</u>	<u>Manufacturing Location</u>		
	<u>U.S. (US \$)</u>	<u>Canada (US \$)</u>	<u>Mexico (US \$)</u>
Washer	35.32	38.15	4.24
Dryer	28.22	30.48	3.89
Range	45.72	49.38	5.49
Refrigerator	67.14	72.51	8.06
Transfer Handling Cost Per Unit	\$2.50	\$2.35	\$1.40

Distribution Center Facilities Fixed Costs

Distribution center facilities utilized in the study are assumed to be public warehouse facilities. These facilities typically have a fixed component in their pricing structure (Taylor 1991). The fixed component varies according to the cost of warehouse space in the specific location. A base value of \$1.75 million is assumed for the Indianapolis distribution center facility. Of this amount, \$750,000 is assumed to be the base fixed cost amount for all United States and Canadian distribution center facilities. This amount is applied at all facilities and is not adjusted. The remaining \$1 million dollar amount is a function of the market rate for warehouse space in the specific geographic location. This portion of the distribution center fixed cost is adjusted using a space cost index developed to reflect geographic differences in warehouse space cost.

Distribution center fixed costs in the United States and Canada range from a low of \$1.3 million in Atlanta to a high of \$2.1 million in San Francisco.

A different approach for the development of fixed costs was required for the Mexican distribution center facilities due to the relatively low product volume that moves through these facilities and the limited amount of publicly available information regarding Mexican distribution operations. Fixed costs values of \$20,000 were applied to all Mexican distribution facilities with the exception of Monterrey which was set at \$100,000 and the two border facilities, Nuevo Laredo and Ciudad Juarez, which were set at \$1.3 million for the most likely level of integration simulation (simulation B2A) only. Under the most likely level of integration these facilities are able to directly service United States markets and therefore could receive a much higher level of product volume. Distribution center fixed costs used in the study and their development are presented in Appendix D.

The fixed costs figures may appear high upon first review, but it must be kept in mind that the study is addressing industry level volumes. However, on a per unit basis the fixed cost values are on the same order of magnitude as those in Taylor's research (Taylor 1991).

Distribution Center Facilities Variable Costs

The distribution center variable cost is the per unit handling cost associated with customer orders. A variable cost of five dollars per unit was assumed for the Indianapolis distribution center facility. This value was considered reasonable by industry representatives and consultants familiar with the household appliance industry (The Lyte Group, Inc. 1992, Whirlpool 1992). These individuals did note, however, there is significant variability in handling costs within and between finished product types. Customer handling costs used in this study range from a high of \$5.51 in Detroit to a low of \$2.80 in the Mexican facilities. The development of distribution center variable costs is presented in Appendix D.

Inventory Carrying Cost

An inventory carrying cost of fifteen percent of the product value is used in the study. Interviews with industry representatives and consultants that have performed network studies in the industry indicated inventory carrying cost values typically used range from twelve to twenty percent (A.T. Kearney 1992, The Lyte Group 1992, Whirlpool 1992). The fifteen percent value used falls within this range.

The cost of goods sold values for the United States manufactured finished products are used as the basis for the simulation model's inventory carrying cost calculations. This approach may overstate the inventory carrying cost if significant production shifts to non-United States manufacturing facilities. The simulation model does not adjust its calculations according to manufacturing locations.

TRANSPORTATION COST

Transportation freight rate data are required by the simulation model to determine the costs associated with the movement of purchased items and finished products between supplier, transfer point, manufacturing plant, distribution center, and market locations. Truckload rates are used for shipments between suppliers and manufacturing plants and for shipments between manufacturing plants and distribution centers. Shipments from distribution centers to market areas include truckload and four less-than-truckload (LTL) shipment sizes.

The transportation costs are based on actual and estimated freight rates for the individual countries and for cross-border linkages. Freight rates for shipments within the United States are based on rates contained in the Yellow Freight System, Inc. Zip Disk program (Yellow Freight

System, Inc. 1992). These rates are the same as those on file with the Interstate Commerce Commission under Tariff ICC YFSY 500-K. Freight rates for shipments within Canada are based on rates contained in the CPRates program (CP Express and Transport, Ltd. 1992).

Rates for shipments within Mexico were not available in computerized program format and required the development of a distance-based linear regression. The linear regression was developed from point to point rates for truckload and less-than-truckload shipments provided by a major Mexican carrier (Transportadora Nacional S.A. de C.V. 1992). Details regarding the development of intra-Mexican freight rates are presented in Appendix E.

United States-Canada freight rates are based on rates contained in the Yellow Freight System, Inc. Zip Disk United States/Canada program (Yellow Freight System, Inc. 1992). These rates are the same as those on file with the Interstate Commerce Commission under Tariff ICC YFSY 510-H.

Freight rates for shipments between the United States or Canada and Mexico are based on Yellow Freight System rates from the United States or Canadian location to a Mexican transfer point facility and then applying the Mexican freight rate developed through the regression from the transfer point to the Mexican location. Rates developed

under this approach are applicable for shipments either originating in or terminating in Mexico.

In order to more accurately reflect the freight rates that major customers would receive from trucking companies, the rates presented on the freight programs were discounted. Yellow Freight Rates were discounted by sixty percent. CP Rates were converted to U.S. dollars and discounted thirty-five percent. Mexican freight rates are stated in U.S. dollars, but were not discounted. Interviews with trucking industry representatives and consultants familiar with current trucking practices considered this level of discounting to be reasonable (The Lyte Group, Inc. 1992, Taylor 1992, Yellow Freight Systems, Inc. 1992).

The National Motor Freight Classifications used to determine the appropriate freight rates for the purchased items and finished products addressed in the study are presented in Table 16. The classifications are used in the Yellow Freight System programs to determine the appropriate freight rates for each item. The specific classifications used were provided by Yellow Freight Systems (Yellow Freight Systems, Inc. 1992). CP and Mexican rates do not incorporate the use of a freight rate classification system.

Table 16

National Motor Freight Classifications

<u>Item No.</u>	<u>Description</u>	<u>NMF Classification</u>
101	Aluminum Components	85
102	Belts	77.5
103	Compressors	70
104	Copper Components	60
105	Cord Sets	65
106	Corrugated Packaging	70
107	Fasteners	70
108	Door Gaskets	70
109	Knobs	100
110	1 Speed Motors	70
111	2 Speed Motors	70
112	Paint (Powder)	55
113	Plastic Components	100
114	Polypropylene Resin	60
115	Pumps	85
116	Relays	77.5
117	Steel	50
118	Switches	77.5
119	Timers/Motors	77.5
120	Wiring Harnesses	65
121	Misc. Electronics	77.5
122	Washer Misc. Part s	100
123	Dryer Misc. Parts	100
124	Range Misc. Parts	85
125	Refrigerator Misc. Parts	92.5
201	Washers	100
202	Dryers	100
203	Ranges	85
204	Refrigerators	92.5

Tariff and cross-border transaction costs associated with international transactions were added to the freight rate files to determine the cost associated with the movement of purchased items and finished products between countries. This required the development of twelve freight rate files to reflect the different combinations of tariffs and cross-border transaction costs examined in the research questions. The actual freight rates are the same in all cases. However, the tariff and cross-border transaction cost added to the freight rates vary according to the tariff and cross-border transaction costs level required. The freight rate files used in the study are presented in Table 17.

Table 17**Freight Rate Files**

<u>File Code</u>	<u>Description</u>	<u>Tariff Levels</u>	<u>Cross-Border Transaction Costs Level</u>
(United States-Canada Research Questions)			
88A1	Initial Integration	Base Levels	Current Estimate
88B1	Most Likely Case	100% Reduction	50% Reduction
88C1	Change in Tariffs	50% Reduction	Current Estimate
88C2		100% Reduction	Current Estimate
88D1	Change in Cross-Border Transaction Costs	Base Levels	25% Reduction
88D2		Base Levels	50% Reduction
(North American Research Questions)			
92A1	Initial Integration	Base Levels	Current Estimate
92B1	Most Likely Case	100% Reduction	50% Reduction
92C1	Change in Tariffs	50% Reduction	Current Estimate
92C2		100% Reduction	Current Estimate
92D1	Change in Cross-Border Transaction Costs	Base Levels	25% Reduction
92D2		Base Levels	50% Reduction

TARIFFS

Tariff rates employed in the study are based on actual tariffs and estimates of future tariff levels. Actual tariffs are used for the base value and are then adjusted to represent expected future rates. Three tariff levels are examined in the study, the base level, a fifty percent reduction from the base level, and a complete removal of the tariff. Tariff data were collected from 1988 and 1992 tariff schedules and telephone interviews with customs officials. The base tariff rates are presented in Table 18.

The tariff cost per purchased item or finished product unit is determined by multiplying the tariff rate by the price of the purchased item or finished product. This amount is converted into a tariff cost per hundredweight value. The tariff cost per hundredweight value is then added to the appropriate freight rates.

<u>Description</u>	1988			1992		
	<u>CN</u> on <u>US</u>	<u>US</u> on <u>CN</u>		<u>CN</u> on <u>MX</u>	<u>US</u> on <u>CN</u>	<u>MX</u> on <u>US</u>
Aluminum Components	10.3	3.0				
Belts	17.5	5.1		2.0	0.0	15.0
Compressors	9.2	3.4		10.5	2.5	15.0
Copper Components	4.0	1.5		1.8	0.6	20.0
Cord Sets	10.2	5.3		2.4	0.9	15.0
Corrugated Packaging	10.2	0.0		6.1	3.1	15.0
Fasteners	11.1	6.2		2.0	0.0	10.0
Door Gaskets	13.6	3.5		6.1	3.7	15.0
Knobs	13.6	6.5		8.1	2.1	20.0
1 Speed Motors	9.3	5.0		8.1	3.9	20.0
2 Speed Motors	9.3	5.0		7.5	2.5	10.0
Paint (Powder)	9.2	5.9		7.5	2.5	10.0
Plastic Components	13.6	6.5		1.8	0.7	15.0
Polypropylene Resin	10.0	12.5		8.1	3.1	20.0
Pumps	9.3	3.0		2.0	2.5	0.0
Relays	10.3	5.3		1.8	0.6	20.0
Steel	10.0	9.5		2.0	3.1	15.0
Switches	10.9	5.3		6.0	5.7	10.0
Timers/Motors	10.3	5.3		6.5	3.1	10.0
Wiring Harnesses	10.3	5.3		6.1	3.1	10.0
Misc. Electronics	10.3	5.3		6.1	3.1	15.0
Washer MP	12.5	3.9		7.5	1.6	20.0
Dryer MP	0.0	5.1		0.0	0.7	20.0
Range MP	12.6	3.9		7.5	0.0	20.0
Refrigerator MP	12.5	2.9		7.5	1.7	20.0

Table 18 (cont'd.)

<u>Description</u>	1988		1992			
	CN on <u>US</u>	US on <u>CN</u>	CN on <u>US</u>	CN on <u>MX</u>	US on <u>CN</u>	MX on <u>US</u>
Washers	12.5	3.9	7.5	8.0	1.6	20.0
Dryers	0.0	3.9	0.0	8.0	1.6	20.0
Ranges	12.6	3.9	7.5	8.0	0.0	20.0
Refrigerators	12.5	2.9	7.5	8.0	1.7	20.0

Source:

1988 tariffs, Tariff Schedule of Canada, Annex 401.2, The Department of External Affairs, Ottawa 1988, fax from Customs and Excise Division of Revenue Canada, and Tariff Schedules of the United States Annotated (1987), United States International Trade Commission Publication 1910, U.S. Government Printing Office, Washington 1986. 1992 tariffs, Telephone interview and fax from Customs and Excise Division of Revenue Canada, Harmonized Tariff Schedule of the United States (1992), United States International Trade Commission, U.S. Government Printing Office, Washington 1992., and fax from Office of Mexico, U.S. Department of Commerce.

Note:

Column headings should be interpreted in the following manner. "CN on US" indicates Canadian tariffs on goods imported from the United States for the indicated period.

CROSS-BORDER TRANSACTION COSTS

Cross-border transaction costs are estimated values that represent the additional costs associated with international transactions. This is an area where firms interviewed did not have exact information available, but did use general rules in an effort to account for the additional costs associated with cross-border transactions. The specific values applied in this area were found to vary according to locations involved and whether the transactions involved purchased items or finished products. Cross-border transaction costs for purchased items were discussed in terms of a percentage of the purchase price. Cross-border transaction costs for finished goods were discussed in terms of a dollar amount per truckload shipment (Sanyo 1992, Whirlpool 1992, Xerox 1992).

The base cross-border values used in this study attempt to reflect the differences in conducting transactions between the United States and Canada and between the United States or Canada and Mexico. The base cross-border transaction costs value applied to purchased items moving between the United States and Canada is 2.5 percent of the purchased item price. The base value for finished goods shipments that occur between manufacturing plant and distribution centers or between distribution centers and markets is two hundred dollars per truckload shipment. Base cross-border

transaction costs value for purchased items moving between the United States or Canada and Mexico is ten percent of the purchased item price. The base value for finished goods shipments that either occur between manufacturing plant and distribution centers or between distribution centers and markets is four hundred dollars per truckload shipment. The average value of a truckload shipment of finished products in this study is approximately \$30,000.

The reason for the lower cross-border transaction costs values applied to United States - Canada transactions compared to transactions involving Mexico is based on the superior infrastructure that exists between the United States and Canada, regulations allowing operating authority to trucking firms that allow operation in either country, lower degree of language barrier, an assumed lower level of experience with Mexican transactions within the firm, and geographic proximity of Canadian facilities and markets to the United States and vice versa.

The cross-border transaction costs per purchased item were determined by multiplying the cross-border transaction costs rate by the price of the purchased item. In the case of finished products, a per unit amount was determined by dividing the per truckload charge by the number of units in a truckload. One-hundred-ten units was the truckload shipment quantity used for washers, dryers, and ranges.

Seventy units was the truckload shipment quantity used for refrigerators. The cross-border transaction costs per unit is then converted into a cross-border transaction costs per hundredweight value. The cross-border transaction costs per hundredweight is then added to the appropriate freight rates.

VERIFICATION/VALIDATION

Once the data required to operationalize the simulation model were collected and entered, the model and data were verified and validated. Verification is defined by Law and Kelton (1981) as "...determining whether a simulation model performs as intended, i.e. debugging the computer program." Where the Netsim II model is a proven static simulation model that has been used in over one hundred studies (A.T. Kearney, Inc. 1990), the verification process centered on the data rather than the model itself. Therefore the verification activities consisted of extensive reviews of the data used in the model to make certain that data are accurate and input in the proper format. These reviews were conducted by the author and by experienced Netsim II users.

The validation options available for the model are somewhat restricted given the exploratory nature of the study and limited historical data to use for comparative purposes for the model's output. Given this situation, the validation activities focused on multiple test runs to make certain that model outputs were consistent with specific changes in inputs and on efforts to establish a high face validity of the model. The efforts to establish a model with high face validity required a review of the model and data with experts in the use of the simulation model and individuals knowledgeable about the research topic (Law and Kelton

1981). The approach used is consistent with the four types of validation recommended in Closs' work (1978) and used in Taylor's research (1991).

The first type of validation performed focused on error detection. Over fifty simulation runs were conducted prior to the actual analysis runs. These runs were conducted to test the model over a range of variable environments and solution options. During the test runs Netsim II's built-in error detection facilities were extremely useful in identifying error conditions. The most common error conditions related to missing freight rates required to link network facilities and failure to activate all facilities required for a specific simulation run.

The second type of validation performed focused on determining if changes in per unit input data were accurately reflected in the model output. Reviews of input data including variable costs, product weights, and demand were conducted and the output was found to be correct.

The third type of validation related to the determination of the general reasonableness of the model output. Primary areas considered here were facilities utilized and general cost levels. Model output was discussed with experienced Netsim II users and individuals familiar with the research

topic. All considered the results to be reasonable (The Lyte Group, Inc. 1992, Taylor 1992).

The fourth type of validation relates to the industry reasonableness of the model. This level of validation was somewhat more difficult to perform, given the limited availability of appropriate data to use for benchmarking. However, model output for the most likely levels of integration was compared with published logistics cost data (Council of Logistics Management 1990) and with the results of Taylor's research (1991). The basis of comparison was the total logistics cost to sales ratio which is presented in Table 19.

Table 19
Comparison Of Logistics Cost To Sales Ratios

<u>Data Source</u>	<u>Total Logistics Cost As A Percent Of Sales</u>
1990 Average For All Industries	7.2
1990 Average For Consumer Durables	6.5
Taylor 1991 United States-Canada	8.5
Taylor 1991 United States-Canada-Mexico	10.1
Model Output United States-Canada	9.8
Model Output United States-Canada-Mexico	11.6

Sources: "Physical Distribution Costs - Performance In Selected Industries, 1990.", Annual Conference Proceedings, Council of Logistics Management, Oakbrook, IL 1990.

Taylor, John, C. "The United States-Canada-Mexico Free Trade Area: A Logistics Perspective On Distribution Center Location Implications In An Integrated North American Market." Ph.D. dissertation, Michigan State University, 1991.

The model output results are higher than the comparative benchmarks used. The differences between the model output and the industry data may be explained in part by differences in products considered. The finished products examined in this study would fall within the category of consumer durables, but would tend to be among the most costly of these products from a logistics perspective. The higher logistics cost level for the United States-Canada-Mexico case is likely the result of the higher transportation costs associated with all manufacturing activities being performed in Mexico.

Differences with Taylor's (1991) research appear to be the result of differences in the inventory carrying cost component of total logistics cost. Taylor's research used a lower inventory carrying cost percentage, fourteen versus the fifteen percent value used in this study. Taylor's research also used a lower price for the appliances considered in his study. These factors resulted in inventory carrying cost as a percentage of sales of less than one percent. In the current study, the inventory carrying cost represents approximately 2.3 percent of sales. When the inventory carrying cost differences are taken into consideration the results of the current study compare quite favorably with Taylor's results.

CHAPTER 5 - SIMULATION RESULTS

INTRODUCTION

Chapter 5 presents the results of the simulations conducted for each research question. A complete list of simulation runs performed along with independent variable levels is presented in Table 6 of Chapter 3. Conclusions and implications derived from these results are discussed in Chapter 6.

Chapter 5 is divided into two main sections. The first section presents the results of the United States-Canada simulations. The second section presents the results of the North American simulations.

The results are presented by research question and simulations performed to address the specific research question. The results of each simulation are then presented in a summary table format together with the results of the simulation used as the basis for comparison. Differences that appear between simulations are presented and reasons for these differences discussed. Detailed results of the United States-Canada and North American simulations are presented by simulation number in Appendix F and Appendix G, respectively.

UNITED STATES-CANADA RESULTS

The United States-Canada simulations were conducted using the service/least cost solution approach of the Netsim II model. The sort-down heuristic contained in the model was also used. For each research question there are ten Canadian and twenty United States distribution center facilities available. Manufacturing plants are available in Toronto and Indianapolis. Suppliers for each purchased item are available in Woodstock and Fort Wayne.

Each United States-Canada simulation determined the least cost network of nine distribution center facilities using the service/least cost solution and the sort-down heuristic. The solution approach is discussed in detail in Appendix A.

The overall objective in each simulation was to identify the lowest cost network of distribution center facilities, manufacturing plants, and suppliers required to manufacture and distribute the firm's finished products given the service constraint and levels of independent variables associated with the specific simulation. The service constraint used for the United States-Canada research questions was that market areas were to be serviced by distribution centers within an eight hundred mile radius. The assumption being that eight hundred miles approximated two day service from distribution center to market area. In

the event that a market did not fall within an eight hundred miles of a distribution center facility it would be serviced by the lowest cost distribution center facility, regardless of distance. All market areas are eligible for service from all distribution centers in all cases, with the exception of the initial separate country simulation.

SUMMARY OF UNITED STATES-CANADA RESULTS

A brief summary of the United States-Canada results is presented in Table 20. A summary of purchase expenditure and total systems cost results by research question for the United States-Canada simulations is presented in Table 21. Results by individual research question are then presented.

Table 20**Summary of United States-Canada Results**

1. Changes in independent variables examined have a relatively minor effect on total systems cost. The largest difference is found between the initial integration (A1B) and the most likely (A2A) simulations, total systems variable cost per unit decreases by \$0.42, a reduction of approximately 0.15 percent.
2. Distribution center network configurations vary somewhat under different levels of the independent variables. The most significant differences are found between the initial integration (A1B) and most likely (A2A) simulations. The number of Canadian facilities is reduced from three to two. Only one of the initial integration distribution centers, the Toronto facility, is utilized in the most likely simulation.
3. Increases in Canadian demand of five and ten percent do not change the distribution center configuration.
4. Distribution centers located in Toronto and Indianapolis which are adjacent to the manufacturing plants account for the majority of finished product volume distributed in their respective countries.
5. Canadian distribution centers, other than Toronto, receive dryers from the Indianapolis manufacturing plant for all integrated simulations.
6. Under the most likely (A2A) and one hundred percent tariff reduction (A3D) simulations, the Canadian distribution center, other than Toronto, receives all finished products from the Indianapolis manufacturing plant.
7. The Toronto and Indianapolis manufacturing plants are used in all simulations.
8. The Toronto and Indianapolis manufacturing plants use only domestic suppliers in all simulations regardless of the level of independent variables in effect.

Table 20 (cont'd.)

9. Market areas are serviced by foreign distribution centers in several simulations. This phenomenon occurs to its greatest extent in the most likely (A2A) and one hundred percent tariff reduction (A3D) simulations. In these simulations the Worcester distribution center services eight of the thirty Canadian market areas and the Regina distribution center services two United States market areas.

Table 21**Purchase Expenditure And Total Systems Cost For
United States-Canada Simulations**

<u>Simulation</u>	<u>Purchase Expenditure (US\$ Millions)</u>	<u>Total Systems Cost (US\$ Millions)</u>
A1A	5,071.4	8,678.1
A1B	5,071.2	8,681.0
A2A	5,089.4	8,698.4
A3A	5,090.8	8,709.0
A3B	5,110.5	8,736.9
A3C	5,071.0	8,679.4
A3D	5,069.8	8,671.8
A3E	5,071.2	8,681.0
A3F	5,071.2	8,680.9

RESEARCH QUESTION A1 - INITIAL INTEGRATION

Research question A1 asks what is the least total cost supplier, manufacturing plant, and distribution center system, given the specified service constraints, for an integrated United States-Canada system and how does it differ from a separate country design. Two simulations were conducted to address the question. Results of these simulations are presented in Table 22.

Table 22
Separate Countries (A1A) - Initial Integration (A1B) Comparison

	<u>Simulations</u>		<u>Difference</u>	<u>Percentage Change</u>
	<u>A1A</u>	<u>A1B</u>		
Total Demand (Units 000)	24,886.8	24,886.8	0.0	0.000
Total Purchases	5,071,355.2	5,071,176.2	(179.0)	(0.004)
Total Mfg Cost	7,839,808.3	7,839,160.5	(647.8)	(0.008)
Total DC Cost	353,805.9	353,985.7	179.8	0.051
Total Trans. Cost	541,767.7	544,957.0	3,189.3	0.589
Total Systems Cost	8,678,143.8	8,681,019.2	2,875.4	0.033
Transportation Cost				
Inbound Freight	57,238.1	57,084.1	(154.0)	(0.269)
Internal Freight	140,698.1	137,575.6	(3,122.5)	(2.219)
Customer Freight	343,831.6	350,297.3	6,465.7	1.880
Total Trans. Cost	541,767.7	544,957.0	3,189.3	0.589
Fixed Cost				
Total Mfg Fixed Cost	1,492,910.1	1,492,910.1	0.0	0.000
Total DC Fixed Cost	14,710.0	14,730.0	20.0	0.136
Total Fixed Cost	1,507,620.1	1,507,640.1	20.0	0.001
Variable Cost				
Total Variable Cost	7,170,523.7	7,173,379.1	2,855.4	0.040
Variable Cost / Unit(\$)	288.13	288.24	0.11	0.040

Note: All values stated in thousands of US dollars unless otherwise indicated.

Table 22 (cont'd.)

Simulation A1A				Simulation A1B			
<u>Facilities Utilized</u>	<u>Type</u>	<u>Percent</u>		<u>Facilities Utilized</u>	<u>Type</u>	<u>Percent</u>	
Woodstock	S	7.7		Woodstock	S	7.4	
Ft. Wayne	S	92.3		Ft. Wayne	S	92.6	
Toronto	M	7.9		Toronto	M	7.3	
Indianapolis	M	92.1		Indianapolis	M	92.7	
Montreal	DC	2.1		Moncton	DC	0.7	
Toronto	DC	3.8		Toronto	DC	5.2	
Edmonton	DC	2.0		Edmonton	DC	2.0	
Worcester	DC	5.6		Worcester	DC	5.6	
Indianapolis	DC	48.0		Indianapolis	DC	51.0	
Raleigh	DC	5.5		Atlanta	DC	10.4	
Atlanta	DC	10.2		Dallas	DC	9.3	
Dallas	DC	9.4		Los Angeles	DC	10.6	
Los Angeles	DC	13.3		Salt Lake City	DC	5.2	

Note: Facility type codes are as follows: S = suppliers, M = manufacturing plants, DC = distribution centers. Percent provides measure of throughput for network facilities. Supplier values are the percentage of total purchase dollars sourced from the supplier location. Manufacturing and distribution center values are the percentage of total finished product demand (units) handled by the specific facility.

Separate Country Results

The separate country simulation (A1A) assumes the firm's operations in each country are completely independent of one another. No cross-border transactions are allowed.

In order to develop the separate country distribution center networks, simulations were conducted for each country. In the Canadian simulation, suppliers are located in Woodstock, a manufacturing plant in Toronto and ten distribution centers options which are located throughout the country are available. The simulation model is instructed to sort-down to the least cost configuration of three distribution center facilities.

In the United States simulation, suppliers are established in Fort Wayne, a manufacturing plant in Indianapolis, and twenty distribution center options located throughout the country are available. The simulation model is instructed to sort-down to the least cost configuration of six distribution centers.

The six United States and three Canadian facilities determined in the Canadian and United States simulations were used as the distribution centers for simulation A1A along with the Toronto and Indianapolis manufacturing plants and the Woodstock and Fort Wayne suppliers. In simulation

A1A all facilities and market areas are restricted to the use of domestic sources (i.e. manufacturing plants use only domestic suppliers, distribution centers receive all finished products from the domestic manufacturing plant, and market areas are serviced by domestic distribution centers).

In Canada, the three distribution centers utilized are located in Montreal, Toronto, and Edmonton. The six United States distribution centers utilized are located in Worcester, Indianapolis, Raleigh, Atlanta, Dallas, and Los Angeles.

All Canadian distribution centers receive their finished products from the Toronto manufacturing plant. All United States distribution centers receive their finished products from the Indianapolis manufacturing plant. The Toronto and Indianapolis plants receive all purchased items from the domestic suppliers.

In simulation A1A total purchases cost is \$5,071.4 million (58.4 percent of total systems cost). Total manufacturing cost is \$7,839.8 million (90.3 percent of total systems cost). Total distribution center cost is \$353.8 million (4.1 percent of total systems cost). Total transportation cost is \$541.8 million (6.2 percent of total systems cost). Total systems cost is \$8,678.1 million. Total systems

variable cost per unit is \$288.13. See Table F-1 in Appendix F for additional detailed results.

The Indianapolis distribution center handles forty-eight percent of the total finished product volume within the overall system. This is the result of its central location along with the absence of inbound transportation cost. It is assumed that the Indianapolis distribution center facility is adjacent to the Indianapolis manufacturing plant. The same relationship exists between the Toronto manufacturing plant and distribution center. As a result of this situation, the Indianapolis and Toronto distribution centers are typically the sources for market areas that are not located within the service constraint distance of eight hundred miles of a distribution center. An example of this situation is seen when market areas located in Washington state are serviced by the Indianapolis distribution center.

Initial Integration Results

The initial integration simulation (A1B) permits cross-border transactions at all echelons within the firm's operations. All facilities and market areas are to use the lowest cost sources. Thirty distribution center options are available. Ten are located in Canada and twenty are located in the United States. The simulation model is instructed to determine the least cost distribution center network of nine

facilities. Full tariffs, cross-border transaction costs and base finished product demand levels are in effect.

The nine distribution centers that are utilized include three Canadian and six United States facilities. The three Canadian distribution center facilities utilized are located in Moncton, Toronto, and Edmonton. The six United States distribution center facilities utilized are located in Worcester, Indianapolis, Atlanta, Dallas, Los Angeles, and Salt Lake City.

Canadian distribution centers receive the majority of their finished products from the Toronto manufacturing plant with one exception. The Moncton and Regina distribution centers receive dryers from the Indianapolis manufacturing plant. Both the Toronto and Indianapolis plants source all purchased items from the domestic suppliers.

In simulation A1B total purchases are \$5,071.2 million (58.4 percent of total systems cost). Total manufacturing cost is \$7,839.2 million (90.3 percent of total systems cost). Total distribution center cost is \$354.0 million (4.1 percent of total systems cost). Total transportation cost is \$545.0 million (6.3 percent of total systems cost). Total systems cost is \$8,681.0 million. Total systems variable cost per unit is \$288.24.

Several differences exist between the separate country (A1A) and initial integration (A1B) simulations. The separate country distribution centers located in Montreal and Raleigh were not retained by the simulation model in the initial integration network. Facilities located in Moncton and Salt Lake City were selected for the initial integration network.

In simulation A1B, six of the ten market areas previously serviced by the Montreal distribution center are serviced by the Moncton distribution center. The remaining four market areas, which include Montreal and part of Quebec province, are serviced by the Toronto distribution center.

The majority of the market areas serviced by the Raleigh distribution center in simulation A1A are serviced by the Indianapolis distribution center in simulation A1B. In simulation A1B the Salt Lake City distribution center is used. This facility services Rocky Mountain, Central, Southwest, and Northwest market areas that are serviced by the Indianapolis, Dallas, and Los Angeles distribution centers in the separate country simulation.

There are also differences in the source of dryers for the Moncton and Edmonton distribution centers. In the separate country simulation all distribution centers are required to use the domestic manufacturing source for finished product. When this restriction is removed in simulation A1B, the

Moncton and Edmonton distribution centers receive their dryers from the Indianapolis manufacturing plant. This is the result of dryers entering Canada duty free, the relatively low cross-border transaction cost between the United States and Canada, and the slightly lower cost to manufacture dryers at the Indianapolis plant.

The initial integration simulation has a slightly higher total systems cost than the separate country simulation. The initial integration total systems cost is approximately \$2.9 million higher than the separate country simulation, a percentage change of 0.033. This difference is primarily the result of an increase of approximately \$6.5 million in customer freight costs (i.e. the cost to transport finished products from distribution centers to market areas) which is partially offset by a reduction in transfer freight costs of approximately \$3.3 million.

The customer freight increase is caused by the removal of the Raleigh distribution center facility. The majority of the market areas that are serviced by the Raleigh distribution center in simulation A1A are serviced by the Indianapolis distribution center in simulation A1B which results in higher customer freight costs to service these markets.

This slight increase in total systems costs illustrates one of the limitations of the simulation model. Once a distribution center facility is removed by the sort-down heuristic it is not considered in any following iterations for that specific solution. This approach can lead to the situation presented in the comparison of simulations A1A and A1B, where the total systems costs differ. This situation is recognized by the firm that sells the Netsim II product and instructs users that caution must be taken when using the sort-down heuristic. It further recommends that users experiment with distribution center configurations after using the sort-down heuristic to determine if improvements are possible through reintroducing distribution centers that may have been deleted during earlier iterations. This approach was not taken in this study due to the fact that it has the potential to bias the results on the basis of which facilities are selected for further review. The approach taken here is to use the results of the simulation model without performing additional simulations with deleted facilities to attempt further improvement of results. However, it is recognized the potential for improvement does exist.

It should be noted, however, that the results that are presented may not be the globally optimum solution. The simulation model used is not an optimization model, but

rather a simulation model with heuristics that attempt to provide the best solution.

RESEARCH QUESTION A2 - MOST LIKELY CASE

Research question A2 asks what is the least total cost supplier, manufacturing plant, and distribution center system, given specified service constraints, for an integrated United States-Canada system under the "most likely" levels of independent variables and how does it differ from the initial integrated United States-Canada system developed in research question A1. Simulation A2A independent variable settings are as follows, a five percent increase in Canadian demand, zero tariffs, and a fifty percent reduction in cross-border transaction costs. The initial integration independent variable settings are as follows, current demand, full tariffs, and full estimated cross-border transaction costs. The results of simulation A2A along with the initial integration simulation run A1B are presented in Table 23.

Table 23
Initial Integration (A1B) - Most Likely (A2A) Comparison

	<u>Simulations</u>		<u>Difference</u>	<u>Percentage Change</u>
	<u>A1B</u>	<u>A2A</u>		
Total Demand (Units 000)	24,886.8	24,984.6	97.8	0.393
Total Purch. Cost	5,071,176.2	5,089,388.2	18,212.0	0.359
Total Mfg. Cost	7,839,160.5	7,859,384.8	20,224.3	0.258
Total DC Cost	353,985.7	353,599.0	(386.7)	(0.109)
Total Trans. Cost	544,957.0	542,120.0	(2,837.0)	(0.521)
Total Systems Cost	8,681,019.2	8,698,443.0	17,423.8	0.201
Transportation Cost				
Inbound Freight	57,084.1	56,660.8	(423.3)	(0.742)
Internal Freight	137,575.6	144,770.2	7,194.6	5.230
Customer Freight	350,297.3	340,689.0	(9,608.3)	(2.743)
Total Trans.	544,957.0	542,120.0	(2,837.0)	(0.521)
Fixed Cost				
Total Mfg Fixed Cost	1,492,910.1	1,492,910.1	0.0	0.000
Total DC Fixed Cost	14,730.0	14,590.0	(140.0)	(0.950)
Total Fixed Cost	1,507,640.1	1,507,500.1	(140.0)	(0.009)
Variable Cost				
Total Variable Cost	7,173,379.1	7,190,942.9	17,563.8	0.245
Variable Cost / Unit(\$)	288.24	287.82	(0.42)	(0.148)

Note: All values stated in thousands of US dollars unless otherwise indicated.

Table 23 (cont'd.)

Simulation A1B				Simulation A2A			
<u>Facilities Utilized</u>	<u>Type</u>	<u>Percent</u>		<u>Facilities Utilized</u>	<u>Type</u>	<u>Percent</u>	
Woodstock	S	7.4		Woodstock	S	4.8	
Ft. Wayne	S	92.6		Ft. Wayne	S	95.2	
Toronto	M	7.3		Toronto	M	4.9	
Indianapolis	M	92.7		Indianapolis	M	95.1	
Moncton	DC	0.7		Toronto	DC	4.9	
Toronto	DC	5.2		Regina	DC	2.7	
Edmonton	DC	2.0		Worcester	DC	6.5	
Worcester	DC	5.6		Indianapolis	DC	45.3	
Indianapolis	DC	51.0		Raleigh	DC	5.5	
Atlanta	DC	10.4		Atlanta	DC	10.0	
Dallas	DC	9.3		Dallas	DC	9.3	
Los Angeles	DC	10.6		Los Angeles	DC	10.6	
Salt Lake City	DC	5.2		Salt Lake City	DC	5.2	

Note:

Facility type codes are as follows: S = suppliers, M = manufacturing plants, DC = distribution centers. Percent provides measure of throughput for network facilities. Supplier values are the percentage of total purchase dollars sourced from the supplier location. Manufacturing and distribution center values are the percentage of total finished product demand (units) handled by the specific facility.

Two Canadian distribution centers located in Toronto and Regina are utilized. The seven United States distribution centers utilized are located in Worcester, Indianapolis, Raleigh, Atlanta, Dallas, Los Angeles, and Salt Lake City.

The Toronto distribution center receives all of its finished products from the Toronto manufacturing plant. The Regina distribution center receives all of its finished products from the Indianapolis manufacturing plant. All distribution centers located in the United States receive all finished products from the Indianapolis manufacturing plant. Both the Toronto and Indianapolis manufacturing plants source all purchased items from the domestic supplier options.

In simulation A2A total purchases cost is \$5,089.4 million (58.5 percent of total systems cost). Total manufacturing cost is \$7,859.4 million (90.4 percent of total systems cost). Total distribution center cost is \$353.6 million (4.1 percent of total systems cost). Total transportation cost is \$542.1 million (6.2 percent of total systems cost). Total systems cost is \$8,698.4 million. Total systems variable cost per unit is \$287.82.

Several differences exist between the initial integration (A1B) and most likely case (A2A) simulations. Simulation A2A incorporates a five percent increase in Canadian

finished product demand. This results in 24,984,600 units in the system, an increase of 0.39 percent.

There are several differences in the distribution centers utilized. The number of Canadian facilities is reduced from three to two. The Moncton and Edmonton distribution centers are not retained in simulation A2A. Distribution centers in Toronto and Regina are utilized.

The Toronto distribution center continues to be a viable facility in the most likely case simulation which is expected given the level of demand that falls within the service constraint area and the absence of transfer freight cost between the Toronto manufacturing plant and distribution center. Use of the Regina distribution center is the result of its ability to service the Western Canadian and North Dakota market areas.

The number of United States distribution centers increases from six to seven. The distribution center located in Raleigh is added to the six original simulation A1B distribution centers. The addition of this facility results in a decrease in the number of market areas serviced by the Indianapolis distribution center from 109 to 99. Use of the Raleigh facility is largely responsible for the 0.52 percent reduction in the customer freight costs, even though the

total number of units transported with the systems increased by 0.39 percent.

In the initial integration simulation no market areas are serviced by foreign distribution centers. In the most likely case simulation eight of the thirty Canadian market areas are serviced by the Worcester distribution center and the Regina distribution center services two North Dakota market areas. The shift of Canadian market areas to the Worcester distribution center increases its share of total finished products distributed within the system from 5.6 to 6.5 percent.

In the initial integration simulation only dryers were sourced in the United States for the Canadian distribution centers other than Toronto. In the most likely case simulation the United States manufacturing plant is the source for all finished products for the Regina distribution center. This change results in reduction in the percentage of finished product units manufactured at the Toronto manufacturing facility from 7.3 to 4.9 percent of the system total. The Indianapolis manufacturing plant percentage of finished products manufactured increased from 92.7 percent to 95.1 percent.

The most likely case simulation shows little change in the relationship between total purchases, total manufacturing,

total distribution, and total transportation cost factors. Total systems cost increased by \$17.4 million or 0.20 percent. However, when addressed in terms of total systems variable cost per unit, there is a reduction of \$0.42 per unit or approximately 0.15 percent.

RESEARCH QUESTION A3 - CHANGES IN INDEPENDENT VARIABLES

Research question A3 asks how changes in the levels of the independent variables for tariffs, cross-border transaction costs, and non-United States finished product demand affect the supplier, manufacturing plant, and distribution center system in terms of locations utilized and total systems cost when compared to the least cost system developed in research question A1B. Six simulation runs were required to address this question. The results of these simulations are presented by independent variable examined in the following section.

Non-United States Finished Product Demand

Simulation A3A assumes a five percent increase in Canadian demand for finished products. Simulation A3B assumes a ten percent increase in Canadian demand. Both simulations permit cross-border transactions at all echelons within the firm's operations. All market areas and facilities are to use the lowest cost sources. Full tariff and cross-border

transaction costs are in effect. Results of simulations A3A and A3B are presented in Tables 24 and 25 respectively.

Table 24

**Initial Integration (A1B) - Five Percent Increase
In Canadian Demand (A3A) Comparison**

	<u>Simulations</u>		<u>Difference</u>	<u>Percentage Change</u>
	<u>A1B</u>	<u>A3A</u>		
Total Demand (Units 000)	24,886.8	24,984.6	97.8	0.393
Total Purch. Cost	5,071,176.2	5,090,834.9	19,658.7	0.388
Total Mfg. Cost	7,839,160.5	7,864,099.4	24,938.9	0.318
Total DC Cost	353,985.7	355,291.1	1,305.4	0.369
Total Trans. Cost	544,957.0	546,991.8	2,034.8	0.373
Total Systems Cost	8,681,019.2	8,708,988.2	27,969.0	0.322
Transportation Cost				
Inbound Freight	57,084.1	57,394.1	310.0	0.543
Internal Freight	137,575.6	138,236.6	661.0	0.480
Customer Freight	350,297.3	351,361.1	1,063.8	0.304
Total Trans.	544,957.0	546,991.8	2,034.8	0.373
Fixed Cost				
Total Mfg Fixed Cost	1,492,910.1	1,492,910.1	0.0	0.000
Total DC Fixed Cost	14,730.0	14,730.0	0.0	0.000
Total Fixed Cost	1,507,640.1	1,507,640.1	0.0	0.000
Variable Cost				
Total Variable Cost	7,173,379.1	7,201,348.1	27,969.0	0.390
Variable Cost / Unit(\$)	288.24	288.23	(0.01)	(0.003)

Note: All values stated in thousands of US dollars unless otherwise indicated.

Table 24 (cont'd.)

Simulation A1B				Simulation A3A			
<u>Facilities Utilized</u>	<u>Type</u>	<u>Percent</u>		<u>Facilities Utilized</u>	<u>Type</u>	<u>Percent</u>	
Woodstock	S	7.4		Woodstock	S	7.7	
Ft. Wayne	S	92.6		Ft. Wayne	S	92.3	
Toronto	M	7.3		Toronto	M	7.6	
Indianapolis	M	92.7		Indianapolis	M	92.4	
Moncton	DC	0.7		Moncton	DC	0.8	
Toronto	DC	5.2		Toronto	DC	5.4	
Edmonton	DC	2.0		Edmonton	DC	2.0	
Worcester	DC	5.6		Worcester	DC	5.6	
Indianapolis	DC	51.0		Indianapolis	DC	50.8	
Atlanta	DC	10.4		Atlanta	DC	10.3	
Dallas	DC	9.3		Dallas	DC	9.3	
Los Angeles	DC	10.6		Los Angeles	DC	10.6	
Salt Lake City	DC	5.2		Salt Lake City	DC	5.2	

Note: Facility type codes are as follows: S = suppliers, M = manufacturing plants, DC = distribution centers. Percent provides measure of throughput for network facilities. Supplier values are the percentage of total purchase dollars sourced from the supplier location. Manufacturing and distribution center values are the percentage of total finished product demand (units) handled by the specific facility.

Table 25
Initial Integration (A1B) - Ten Percent Increase
In Canadian Demand (A3B) Comparison

	<u>Simulations</u>		<u>Difference</u>	<u>Percentage Change</u>
	<u>A1B</u>	<u>A3B</u>		
Total Demand (Units 000)	24,886.8	25,082.4	195.6	0.786
Total Purch. Cost	5,071,176.2	5,110,454.8	39,278.6	0.775
Total Mfg. Cost	7,839,160.5	7,888,988.7	49,828.2	0.636
Total DC Cost	353,985.7	356,595.0	2,609.3	0.737
Total Trans. Cost	544,957.0	549,027.1	4,070.1	0.747
Total Systems Cost	8,681,019.2	8,736,907.4	55,888.2	0.644
Transportation Cost				
Inbound Freight	57,084.1	57,703.4	619.3	1.085
Internal Freight	137,575.6	138,898.2	1,322.6	0.961
Customer Freight	350,297.3	352,425.5	2,128.2	0.608
Total Trans.	544,957.0	549,027.1	4,070.1	0.747
Fixed Cost				
Total Mfg Fixed Cost	1,492,910.1	1,492,910.1	0.0	0.000
Total DC Fixed Cost	14,730.0	14,730.0	0.0	0.000
Total Fixed Cost	1,507,640.1	1,507,640.1	0.0	0.000
Variable Cost				
Total Variable Cost	7,173,379.1	7,229,267.3	55,888.2	0.779
Variable Cost / Unit(\$)	288.24	288.22	(0.02)	(0.007)

Note: All values stated in thousands of US dollars unless otherwise indicated.

Simulation A1B

Simulation A1B

<u>Facilities Utilized</u>	<u>Type</u>	<u>Percent</u>	<u>Facilities Utilized</u>	<u>Type</u>	<u>Percent</u>
Woodstock	S	7.4	Woodstock	S	8.0
Ft. Wayne	S	92.6	Ft. Wayne	S	92.0
Toronto	M	7.3	Toronto	M	7.9
Indianapolis	M	92.7	Indianapolis	M	92.1
Moncton	DC	0.7	Moncton	DC	0.8
Toronto	DC	5.2	Toronto	DC	5.6
Edmonton	DC	2.0	Edmonton	DC	2.1
Worcester	DC	5.6	Worcester	DC	5.6
Indianapolis	DC	51.0	Indianapolis	DC	50.6
Atlanta	DC	10.4	Atlanta	DC	10.3
Dallas	DC	9.3	Dallas	DC	9.2
Los Angeles	DC	10.6	Los Angeles	DC	10.5
Salt Lake City	DC	5.2	Salt Lake City	DC	5.2

Note:

Facility type codes are as follows: S = suppliers, M = manufacturing plants, DC = distribution centers. Percent provides measure of throughput for network facilities. Supplier values are the percentage of total purchase dollars sourced from the supplier location. Manufacturing and distribution center values are the percentage of total finished product demand (units) handled by the specific facility.

The least cost networks developed in simulations A3A and A3B were identical and included three Canadian and six United States distribution centers. The distribution centers are located in Moncton, Toronto, Edmonton, Worcester, Indianapolis, Atlanta, Dallas, Los Angeles, and Salt Lake City.

Canadian distribution centers receive the majority of their finished products from the Toronto manufacturing plant with the exception of dryers. The Moncton and Regina distribution centers receive dryers from the Indianapolis manufacturing plant. All United States distribution centers receive all finished products from the Indianapolis plant. The manufacturing plants source all purchased items from the domestic supplier options.

Simulation A3A purchases cost is \$5,090.8 million (58.5 percent of total systems cost). Total manufacturing cost is \$7,864.1 million (90.3 percent of total systems cost). Total distribution center cost is \$355.3 million (4.1 percent of total systems cost). Total transportation cost is \$547.0 million (6.3 percent of total systems cost). Total systems cost is \$8,709.0 million. Total systems variable cost per unit is \$288.23.

Simulation A3B purchases cost is \$5,110.5 million (58.5 percent of total systems cost). Total manufacturing cost is

\$7,889.0 million (90.3 percent of total systems cost). Total distribution center cost is \$356.6 million (4.1 percent of total systems cost). Total transportation cost is \$549.0 million (6.3 percent of total systems cost). Total systems cost is \$8,736.9 million. Total systems variable cost per unit is \$288.22.

When compared to simulation A1B, simulations A3A and A3B present no differences in the distribution centers used or the market areas that these facilities service. There are no differences in the source manufacturing facilities used for the distribution centers or suppliers used for purchased items.

In comparing the results of simulations A3A and A3B with A1B the only differences that appear relate to the increases in Canadian finished product demand. In simulation A3A the five percent increase in Canadian demand increases the total units produced within the system by 97,800 or approximately 0.39 percent. The total systems cost for A3A increases by approximately \$28 million or 0.32 percent. In simulation A3B the ten percent increase in Canadian demand increases the total units produced within the system by 195,600 or approximately 0.79 percent. The total systems cost for A3B increases by approximately \$55.9 million or 0.64 percent. The reason for the lower increases in total systems cost

than the increases in demand is that fixed costs are held constant for all levels of demand.

When the variable portion of total systems cost is viewed on a per unit basis there are minor decreases. The variable cost per unit of A3A is \$0.01 lower than A1B. The variable cost per unit of A3B is \$0.02 lower than A1B. These reductions are the result of decreases in transportation costs associated with the increases in Canadian demand. The average cost of customer freight per unit is slightly lower in Canada than in the United States. Increasing the amount of Canadian demand in the system lowers the average transportation cost per unit by \$0.01 and \$0.02 respectively.

In summary, the levels of increases in Canadian finished product demand examined in the study have the anticipated small impact on total systems and unit costs. These changes in finished product demand do not alter the system structure.

Tariffs

Simulations A3C and A3D address reductions in tariff levels. Cross-border transactions are permitted at all echelons within the firm's operations. All market areas and facilities are to use the lowest cost sources. Full cross-

border transaction costs and base levels for finished product demand are in effect.

Simulation A3C assumes a fifty percent reduction in tariffs. Simulation A3D assumes a one hundred percent reduction in tariffs. The results of simulations A3C and A3D are presented in Tables 26 and 27, respectively.

Table 26
Initial Integration (A1B) - Fifty Percent Tariff Reduction (A3C) Comparison

	<u>Simulations</u>		<u>Difference</u>	<u>Percentage Change</u>
	<u>A1B</u>	<u>A3C</u>		
Total Demand (Units 000)	24,886.8	24,886.8	0.0	0.000
Total Purch. Cost	5,071,176.2	5,071,044.5	(131.7)	(0.003)
Total Mfg. Cost	7,839,160.5	7,838,741.5	(419.0)	(0.005)
Total DC Cost	353,985.7	352,745.7	(1,240.0)	(0.350)
Total Trans. Cost	544,957.0	544,933.9	(23.1)	(0.004)
Total Systems Cost	8,681,019.2	8,679,393.9	(1,625.3)	(0.019)
Transportation Cost				
Inbound Freight	57,084.1	57,027.2	(56.9)	(0.100)
Internal Freight	137,575.6	146,021.1	8,445.5	6.139
Customer Freight	350,297.3	341,885.7	(8,411.6)	(2.401)
Total Trans.	544,957.0	544,933.9	(23.1)	(0.004)
Fixed Cost				
Total Mfg Fixed Cost	1,492,910.1	1,492,910.1	0.0	0.000
Total DC Fixed Cost	14,730.0	14,710.0	(20.0)	(0.136)
Total Fixed Cost	1,507,640.1	1,507,620.1	(20.0)	(0.001)
Variable Cost				
Total Variable Cost	7,173,379.1	7,171,773.8	(1,605.3)	(0.022)
Variable Cost / Unit(\$)	288.24	288.18	(0.06)	(0.022)

Note: All values stated in thousands of US dollars unless otherwise indicated.

Simulation A1B			Simulation A3C		
<u>Facilities Utilized</u>	<u>Type</u>	<u>Percent</u>	<u>Facilities Utilized</u>	<u>Type</u>	<u>Percent</u>
Woodstock	S	7.4	Woodstock	S	7.1
Ft. Wayne	S	92.6	Ft. Wayne	S	92.9
Toronto	M	7.3	Toronto	M	7.0
Indianapolis	M	92.7	Indianapolis	M	93.0
Moncton	DC	0.7	Toronto	DC	5.5
Toronto	DC	5.2	Edmonton	DC	2.0
Edmonton	DC	2.0	Worcester	DC	6.0
Worcester	DC	5.6	Indianapolis	DC	45.7
Indianapolis	DC	51.0	Raleigh	DC	5.5
Atlanta	DC	10.4	Atlanta	DC	10.1
Dallas	DC	9.3	Dallas	DC	9.3
Los Angeles	DC	10.6	Los Angeles	DC	10.6
Salt Lake City	DC	5.2	Salt Lake City	DC	5.2

Table 27

Initial Integration (A1B) - One Hundred Percent Tariff Reduction (A3D) Comparison

	Simulations		<u>Difference</u>	<u>Percentage Change</u>
	<u>A1B</u>	<u>A3D</u>		
Total Demand (Units 000)	24,886.8	24,886.8	0.0	0.000
Total Purch. Cost	5,071,176.2	5,069,798.6	(1,377.6)	(0.027)
Total Mfg. Cost	7,839,160.5	7,834,670.9	(4,489.6)	(0.057)
Total DC Cost	353,985.7	352,305.8	(1,679.9)	(0.475)
Total Trans. Cost	544,957.0	541,194.4	(3,762.6)	(0.690)
Total Systems Cost	8,681,019.2	8,671,785.4	(9,233.8)	(0.106)
Transportation Cost				
Inbound Freight	57,084.1	56,385.7	(698.4)	(1.223)
Internal Freight	137,575.6	145,000.4	7,424.8	5.397
Customer Freight	350,297.3	339,808.3	(10,489.0)	(2.994)
Total Trans.	544,957.0	541,194.4	(3,762.6)	(0.690)
Fixed Cost				
Total Mfg Fixed Cost	1,492,910.1	1,492,910.1	0.0	0.000
Total DC Fixed Cost	14,730.0	14,590.0	(140.0)	(0.950)
Total Fixed Cost	1,507,640.1	1,507,500.1	(140.0)	(0.009)
Variable Cost				
Total Variable Cost	7,173,379.1	7,164,285.3	(9,093.8)	(0.127)
Variable Cost / Unit(\$)	288.24	287.87	(0.37)	(0.127)

Note: All values stated in thousands of US dollars unless otherwise indicated.

In simulation A3C two Canadian and seven United States distribution center facilities are utilized. These facilities are located in Toronto, Edmonton, Worcester, Indianapolis, Raleigh, Atlanta, Dallas, Los Angeles, and Salt Lake City.

The Toronto distribution center receives all of its finished products from the Toronto manufacturing plant. The Edmonton distribution center receives its washers, ranges, and refrigerators from the Toronto plant. Dryers are sourced from the Indianapolis manufacturing plant. Distribution centers located in the United States receive all finished products from the Indianapolis manufacturing plant. Both the Toronto and Indianapolis manufacturing plants source all purchased items from the domestic supplier options.

In simulation A3C total purchased item cost is \$5,071.0 million (58.4 percent of total systems cost). Total manufacturing cost is \$7,838.7 million (90.3 percent of total systems cost). Total distribution center cost is \$352.7 million (4.1 percent of total systems cost). Total transportation cost is \$544.9 million (6.3 percent of total systems cost). Total systems cost is \$8,679.4 million. Total systems variable cost per unit is \$288.18.

There are several differences in the distribution center facilities utilized between simulation A1B and A3C. The

number of Canadian facilities is reduced from three to two. The Moncton distribution center is not retained in simulation A3C. Distribution centers located in Toronto and Edmonton are utilized.

The number of United States distribution centers increased from six to seven. The distribution center located in Raleigh is the additional facility. Use of this facility results in a decrease in the number of market areas serviced by the Indianapolis distribution center from 109 to 100.

In simulation A1B, no market areas are serviced by foreign distribution centers. In the simulation A3C, four Canadian market areas are serviced by the Worcester distribution center. This increases the percentage of total finished product volume handled by the Worcester distribution center from 5.6 to 6.0 percent.

There are no changes in the relationship between the total system cost components of total purchases, total manufacturing cost, total distribution cost, total transportation cost and total systems cost. Total systems cost decreases by approximately 0.02 percent. Total systems variable cost per unit is reduced by \$0.06 per unit.

The reduction in total systems cost is the result of servicing the four Canadian market areas from the Worcester

distribution center and the addition of the Raleigh distribution center. The benefits of the Raleigh distribution center are the same as discussed earlier in simulation A2A, (i.e. lowering the average customer freight cost per unit to service these market areas). The tariff reduction has no effect on the cost associated with sourcing dryers for the Edmonton distribution center from Indianapolis, as dryers enter Canada from the United States duty free.

In simulation A3D two Canadian and seven United States distribution center facilities are utilized. These facilities are located in Toronto, Regina, Worcester, Indianapolis, Raleigh, Atlanta, Dallas, Los Angeles, and Salt Lake City. This configuration is identical to simulation A3C with one exception, the Edmonton distribution center retained in simulation A3C is replaced by the facility located in Regina.

The Toronto distribution center receives all of its finished products from the Toronto manufacturing plant. The Regina distribution center receives all of its finished products from the Indianapolis manufacturing plant. The manufacturing plants source all purchased items from the domestic suppliers.

Simulation A3D total purchases cost is \$5,069.8 million (58.5 percent of total systems cost). Total manufacturing cost is \$7,834.7 million (90.3 percent of total systems cost). Total distribution center cost is \$352.3 million (4.1 percent of total systems cost). Total transportation cost is \$541.2 million (6.2 percent of total systems cost). Total systems cost is \$8,671.8 million. Total systems variable cost per unit is \$288.87.

There are several differences in the distribution center facilities utilized between A1B and A3D. The number of Canadian facilities is reduced from three to two. The Moncton and Edmonton facilities are not retained in simulation A3D. Distribution centers in Toronto and Regina are utilized. The changes in the United States distribution center configuration are identical to those discussed in simulation A3C.

In simulation A1B only dryers are sourced from the Indianapolis manufacturing plant by the Edmonton distribution center. In simulation A3D the Edmonton distribution center is replaced by a facility in Regina. However, the Regina distribution center receives all of its finished products from the Indianapolis plant. This change results in a reduction in manufacturing volume at the Toronto plant from 7.3 percent in simulation A1B to 4.7 percent of total finished products manufactured in

simulation A3D. The Indianapolis plant manufacturing plant volume increases from 92.7 to 95.3 percent of the system total between these simulations.

In simulation A1B no market areas are serviced by foreign distribution centers. In simulation A3D eight Canadian market areas are serviced by the Worcester distribution center and two United States market areas, located in North Dakota, are serviced by the Regina distribution center. This increases the percentage of total finished product volume handled by the Worcester distribution center from 5.6 to 6.5 percent.

In comparing simulations A1B and A3D, total systems cost decreases by approximately 0.106 percent. Total systems variable cost per unit decreased from \$288.24 to \$287.87, a reduction of \$0.37 per unit.

The reduction in total systems cost is the result of servicing the eight Canadian market areas from the Worcester distribution center and from the ability to source the Regina distribution center from the Indianapolis manufacturing plant on a tariff-free basis. As discussed in earlier simulations, the addition of the Raleigh distribution center also contributes to the reduction in total systems cost by lowering the customer freight cost

associated with servicing the Raleigh distribution center's market areas.

In summary, the reductions in tariffs examined in the study result in small, but appreciable decreases in total systems costs. More significantly, the reductions in tariffs result in changes in the distribution center configuration and lead to the servicing of market areas by foreign distribution centers. In the initial integration simulation (A1B) no market areas are serviced by foreign distribution centers. As tariffs are reduced the number market areas serviced by foreign distribution centers increases from four in simulation A3C to ten in simulation A3D. In simulation A3D this phenomenon includes occurs in both directions. The Worcester distribution center services eight markets in eastern Canada while the Regina facility services two market areas in North Dakota.

Cross-Border Transaction Costs

Simulations A3E and A3F address reductions in cross-border transaction costs. Cross-border transactions are permitted at all echelons within the firm's operations. All market areas and facilities are to use the lowest cost sources. Full tariffs and base level for finished product demand are in effect.

Simulation A3E assumes a twenty-five percent reduction in cross-border transaction costs. Simulation A3F assumes a fifty percent reduction in cross-border transaction costs. A summary of the results of simulation A3E and A3F are presented in Table 28 and 29, respectively.

Table 28

**Initial Integration (A1B) - Twenty-five Percent Reduction In
Cross-Border Transaction Costs (A3E) Comparison**

	Simulations		Difference	Percentage Change
	<u>A1B</u>	<u>A3E</u>		
Total Demand (Units 000)	24,886.8	24,886.8	0.0	0.000
Total Purch. Cost	5,071,176.2	5,071,176.2	0.0	0.000
Total Mfg. Cost	7,839,160.5	7,839,160.5	0.0	0.000
Total DC Cost	353,985.7	353,985.7	0.0	0.000
Total Trans. Cost	544,957.0	544,889.0	(68.0)	(0.012)
Total Systems Cost	8,681,019.2	8,680,951.1	(68.1)	(0.001)
Transportation Cost				
Inbound Freight	57,084.1	57,084.1	0.0	0.000
Internal Freight	137,575.6	137,507.6	(68.0)	(0.049)
Customer Freight	350,297.3	350,297.3	0.0	0.000
Total Trans.	544,957.0	544,889.0	(68.0)	(0.012)
Fixed Cost				
Total Mfg Fixed Cost	1,492,910.1	1,492,910.1	0.0	0.000
Total DC Fixed Cost	14,730.0	14,730.0	0.0	0.000
Total Fixed Cost	1,507,640.1	1,507,640.1	0.0	0.000
Variable Cost				
Total Variable Cost	7,173,379.1	7,173,311.0	(68.1)	(0.001)
Variable Cost / Unit(\$)	288.24	288.24	(0.00)	(0.001)

Note: All values stated in thousands of US dollars unless otherwise indicated.

Simulation A1B

Simulation A1B				Simulation A3E			
<u>Facilities Utilized</u>	<u>Type</u>	<u>Percent</u>		<u>Facilities Utilized</u>	<u>Type</u>	<u>Percent</u>	
Woodstock	S	7.4		Woodstock	S	7.4	
Ft. Wayne	S	92.6		Ft. Wayne	S	92.6	
Toronto	M	7.3		Toronto	M	7.3	
Indianapolis	M	92.7		Indianapolis	M	92.7	
Moncton	DC	0.7		Moncton	DC	0.7	
Toronto	DC	5.2		Toronto	DC	5.2	
Edmonton	DC	2.0		Edmonton	DC	2.0	
Worcester	DC	5.6		Worcester	DC	5.6	
Indianapolis	DC	51.0		Indianapolis	DC	51.0	
Atlanta	DC	10.4		Atlanta	DC	10.4	
Dallas	DC	9.3		Dallas	DC	9.3	
Los Angeles	DC	10.6		Los Angeles	DC	10.6	
Salt Lake City	DC	5.2		Salt Lake City	DC	5.2	

Note:

Table 29

**Initial Integration (A1B) - Fifty Percent Reduction In
Cross-Border Transaction Costs (A3F) Comparison**

	<u>Simulations</u>		<u>Difference</u>	<u>Percentage Change</u>
	<u>A1B</u>	<u>A3F</u>		
Total Demand (Units 000)	24,886.8	24,886.8	0.0	0.000
Total Purch. Cost	5,071,176.2	5,071,176.2	0.0	0.000
Total Mfg. Cost	7,839,160.5	7,839,160.5	0.0	0.000
Total DC Cost	353,985.7	353,985.7	0.0	0.000
Total Trans. Cost	544,957.0	544,821.0	(136.0)	(0.025)
Total Systems Cost	8,681,019.2	8,680,883.1	(136.1)	(0.002)
Transportation Cost				
Inbound Freight	57,084.1	57,084.1	0.0	0.000
Internal Freight	137,575.6	137,439.5	(136.1)	(0.099)
Customer Freight	350,297.3	350,297.3	0.0	0.000
Total Trans.	544,957.0	544,821.0	(136.0)	(0.025)
Fixed Cost				
Total Mfg Fixed Cost	1,492,910.1	1,492,910.1	0.0	0.000
Total DC Fixed Cost	14,730.0	14,730.0	0.0	0.000
Total Fixed Cost	1,507,640.1	1,507,640.1	0.0	0.000
Variable Cost				
Total Variable Cost	7,173,379.1	7,173,243.0	(136.1)	(0.002)
Variable Cost / Unit(\$)	288.24	288.23	(0.01)	(0.002)

Note: All values stated in thousands of US dollars unless otherwise indicated.

Table 29 (cont'd.)

Simulation A1B			Simulation A3F		
<u>Facilities Utilized</u>	<u>Type</u>	<u>Percent</u>	<u>Facilities Utilized</u>	<u>Type</u>	<u>Percent</u>
Woodstock	S	7.4	Woodstock	S	7.4
Ft. Wayne	S	92.6	Ft. Wayne	S	92.6
Toronto	M	7.3	Toronto	M	7.3
Indianapolis	M	92.7	Indianapolis	M	92.7
Moncton	DC	0.7	Moncton	DC	0.7
Toronto	DC	5.2	Toronto	DC	5.2
Edmonton	DC	2.0	Edmonton	DC	2.0
Worcester	DC	5.6	Worcester	DC	5.6
Indianapolis	DC	51.0	Indianapolis	DC	51.0
Atlanta	DC	10.4	Atlanta	DC	10.4
Dallas	DC	9.3	Dallas	DC	9.3
Los Angeles	DC	10.6	Los Angeles	DC	10.6
Salt Lake City	DC	5.2	Salt Lake City	DC	5.2

The least cost network developed in simulations A3E and A3F were identical and included three Canadian and six United States distribution centers. The distribution centers are located in Moncton, Toronto, Edmonton, Worcester, Indianapolis, Atlanta, Dallas, Los Angeles, and Salt Lake City.

Canadian distribution centers receive the majority of their finished products from the Toronto manufacturing plant with the exception of dryers. The Moncton and Edmonton distribution centers receive dryers from the Indianapolis manufacturing plant. All distribution centers located in the United States receive all finished products from the Indianapolis manufacturing plant. Both the Toronto and Indianapolis manufacturing plants source all purchased items from domestic suppliers.

Simulation A3E total purchases cost is \$5,071.2 million (58.4 percent of total systems cost). Total manufacturing cost is \$7,839.2 million (90.3 percent of total systems cost). Total distribution center cost is \$354.0 million (4.1 percent of total systems cost). Total transportation cost is \$544.9 million (6.3 percent of total systems cost). Total systems cost is \$8,681.0 million. Total systems variable cost per unit is \$288.24.

In simulation A3F total purchases cost is \$5,071.2 million (58.4 percent of total systems cost). Total manufacturing cost is \$7,839.2 million (90.3 percent of total systems cost). Total distribution center cost is \$354.0 million (4.1 percent of total systems cost). Total transportation cost is \$544.8 million (6.3 percent of total systems cost). Total systems cost is \$8,680.9 million. Total systems variable cost per unit is \$288.23.

When compared to simulation A1B, simulations A3E and A3F present virtually the same results. There is no additional cross-border activity. There are no differences in the distribution center facilities used or the market areas that these facilities service. There are no differences in the source manufacturing facilities used for the distribution centers or suppliers used for purchased items. There are no differences in the volume of activity associated with distribution centers, manufacturing plants or supplier locations.

The only differences that occur are insignificant reductions in total systems cost. The twenty-five percent reduction in cross-border transaction costs in simulation A3E results in a \$68,000 decrease in total systems cost. However, this decrease is of such a small magnitude that it has no effect on the total systems variable cost per unit. The fifty percent reduction in cross-border transaction costs in

simulation A3F resulted in a \$136,100 decrease in total systems cost. This reduced total systems variable cost per unit by one cent.

In summary, the reductions in the levels of cross-border transaction costs examined in the study had virtually no effect on the network structure or total systems cost.

RESEARCH QUESTION A4 - SOURCING SERIES

Research question A4 asks how do changes in the levels of the independent variables for tariffs and cross-border transaction costs affect the supplier locations utilized and the total systems cost when the United States and Canadian manufacturing plant and distribution center locations service only their respective domestic market areas. Eight simulations were performed to address this research question.

The sourcing pattern indicates which suppliers are utilized as a source of purchased items and what portion of the firm's purchases are sourced from a specific supplier. No changes in the sourcing pattern occurs in any of United States-Canada simulations. In all cases, the Toronto manufacturing plant sources all of its purchased items from the Woodstock suppliers and the Indianapolis manufacturing

plant sources all of its purchased items from the Fort Wayne suppliers.

Although the prices for purchased items from the United States suppliers located in Fort Wayne are somewhat lower than the Canadian suppliers, differences are not large enough to offset the additional transportation costs from Fort Wayne to the Toronto manufacturing plant regardless of tariff and cross-border transaction costs treatment.

The only change that occur are related to the five percent increase in Canadian demand found in simulation A2A. This merely increases the quantity of purchased items from the Woodstock suppliers. Given this situation, the results of A4 simulations were identical to the results of the separate country simulation (A1A). The detailed results of the research question A4 simulations are not presented in Appendix F as they merely duplicate the results presented for simulation A1A.

RESEARCH QUESTION A5 - PURCHASED ITEM CHARACTERISTICS

Research question A5 asks how do changes in the levels of the independent variables for tariffs and cross-border transaction costs affect the purchased item groups which were established on the basis of purchased item price, labor content, and transportation cost characteristics.

Additional simulations were not required to address this research question. The results of the research question 4 simulations were analyzed from the perspective of groups of purchased items which possess similar characteristics in terms of price, labor content, and transportation cost.

As discussed in research question 4 findings above, no changes sourcing patterns occurred in any of the simulations. Therefore, it was not possible to examine the affect of changes in the level of tariff and cross-border transaction costs on the purchased item groups as no changes occurred.

NORTH AMERICAN RESULTS

The North American simulations also used the service/least cost solution approach and sort-down heuristic. For each research question there were ten Canadian, ten Mexican, and twenty United States distribution center facilities available for use. Manufacturing facilities were available in Toronto, Monterrey and Indianapolis. Suppliers for each purchased item were available in Woodstock, Reynosa, and Fort Wayne. Each North American simulation determined the least cost network of eleven distribution center facilities.

The overall objective in each simulation was to identify the lowest cost network of distribution center facilities, manufacturing plants, and suppliers required to manufacture and distribute the firm's finished products given the service constraint and levels of independent variables associated with the simulation. The service constraint used for the North American research questions was that market areas were to be serviced by distribution centers within an eight hundred mile radius, but in no case were market areas to be serviced by distribution centers located outside of a 1,200 mile radius. The assumption being that eight hundred miles approximated two day service from distribution center to market and that 1,200 miles approximated three day service. In the event that a market did not fall within eight hundred miles of a distribution center facility it

would be serviced by the lowest cost distribution center facility within the 1,200 mile maximum distance.

The 1,200 mile maximum distance between distribution centers and market areas was not applied to Mexico. Employing this constraint in the Mexican market would have necessitated the use of additional distribution center facilities, which, given the size of the Mexican market, did not seem warranted.

All Canadian market areas are eligible for service from all United States distribution centers that fall within the 1,200 mile limit. All United States market areas are eligible for service from Canadian distribution centers within the 1,200 mile limit.

Given the service constraint distance, there is no servicing of Mexican market areas by Canadian distribution centers and vice versa under any circumstances. Cross-border transactions between distribution centers and market areas are permitted between Mexico and the United States only under the most likely level of integration, presented in simulation B2A. The reason for this restriction is that given current infrastructure and border crossing procedures it did not seem likely that distribution centers in Mexico would be able to provide timely service to United States market areas.

It was also necessary to exclude the Mexican distribution centers from the sort-down solutions. In view of the size of the Mexican market and volume of finished product that is likely to pass through any given distribution center the fixed cost for distribution centers were established at levels significantly lower than those used for the Canadian and United States facilities. If these facilities are included in the sort-down solution they tend to be retained. This is not because they are particularly cost effective locations, but rather because removal of these facilities has very limited effect on total systems cost.

The sort-down heuristic removes the distribution center that either reduces total systems cost by the greatest amount or, if removing any additional facility will increase total systems cost, it will remove the facility that will increase total systems cost the least. In the North American simulations the removal of each distribution center down to the eleven facilities specified reduces total systems cost. If low fixed cost Mexican distribution centers are allowed to be included in the sort-down procedure it likely that an inappropriate number of Mexican facilities would be retained simply because their removal has a limited effect on total systems cost. Therefore, the two distribution centers that were identified in the Mexican separate country simulation are used in all North American simulations.

In the most likely North American simulation (B2A), the distribution centers at Nuevo Laredo and Ciudad Juarez are included in the sort-down solution. The fixed costs for these facilities are set to levels on par with the Canadian and United States distribution centers for this simulation only. The reason for the level of fixed costs employed is the same as presented in the previous paragraph.

SUMMARY OF NORTH AMERICAN RESULTS

A brief summary of the North America results is presented in Table 30. Results specific to research questions B4 and B5 which examines the suppliers used as sources for purchased items under various levels of the independent variables are presented in Table 31. A summary of purchase expenditure and total systems cost results by research question for all North American simulations is presented in Table 32. Results by individual research question are then presented.

Table 30**Summary of North American Results**

1. When permitted, all manufacturing activities take place at the Mexican plant located in Monterrey, regardless of tariff and cross-border transaction costs treatment.
2. The shift of manufacturing activities to Mexico and the associated use of the Mexican suppliers reduces total systems cost by approximately 14.4 percent even though full tariff and cross-border transaction costs are in effect.
3. Reductions in tariffs and cross-border transaction costs reduce total systems cost, but have no effect on distribution centers, manufacturing plants, or suppliers utilized.
4. The use of the Mexican manufacturing plant changes the configuration of distribution centers used to service the United States market areas compared to the distribution centers utilized when a United States manufacturing plant is the source of finished product.
5. Canadian and United States manufacturing plants are used only in simulations where their use is mandatory (i.e. the separate country simulation, B3A, and the sourcing series simulations, B4A-B4H).
6. Canadian and United States suppliers are used only in simulations where the use of the Canadian and United States manufacturing facilities is mandatory (i.e. the separate country simulation, B3A, and the sourcing series simulations, B4A-B4H).
7. Exclusive use of the Mexican manufacturing plant leads to a significant increase in the internal transfer portion of the firm's total transportation cost.
8. Increases in non-United States demand for finished product have no effect on the distribution center configuration and increase total systems cost components in a linear manner.

Table 31**Summary of North American Sourcing Series Results**

1. When permitted, a significant number of purchased items are sourced from the Mexican supplier located in Reynosa, regardless of tariff and cross-border transaction costs levels in effect.
2. As tariff and cross-border transaction costs are reduced the number of purchased items sourced in Mexico by the Canadian and United States manufacturing plants increases.
3. When tariffs are removed and cross-border transaction costs are reduced by fifty percent both the Canadian and United States manufacturing plants source nineteen of twenty-five purchased items in Mexico. This level of foreign sourcing reduces the average cost of the firm's finished products by \$8.49 per unit when compared to domestic sourcing.
4. Increased use of the Mexican manufacturing plant leads to a significant increase in the inbound portion of the firm's total transportation cost.

Table 32

**Purchase Expenditure And Total Systems Cost For
North American Simulations**

<u>Simulation</u>	<u>Purchase Expenditure (US\$ Millions)</u>	<u>Total Systems Cost (US\$ Millions)</u>
B1A	5,092.3	8,704.1
B1B	4,533.9	7,452.0
B2A	4,556.5	7,324.0
B3A	4,556.5	7,483.4
B3B	4,579.7	7,515.5
B3C	4,533.9	7,428.9
B3D	4,533.9	7,405.7
B3E	4,533.9	7,425.3
B3F	4,533.9	7,398.5
B4A	5,092.3	8,702.4
B4B	4,748.6	8,652.0
B4C	4,738.9	8,650.8
B4D	4,718.7	8,646.7
B4E	4,689.3	8,591.0
B4F	4,634.8	8,508.0
B4G	4,675.7	8,588.0
B4H	4,624.8	8,524.7

RESEARCH QUESTION B1 - INITIAL INTEGRATION

Research question B1 asks what is the least total cost supplier, manufacturing plant, and distribution center system, given the specified service constraints, for an integrated United States-Canada-Mexico system and how does it differ from a separate country design. Two simulations were conducted to address the question. Results of these simulations are presented in Table 33.

Table 33
Separate Countries (B1A) - Initial Integration (B1B) Comparison

	<u>Simulations</u>		<u>Difference</u>	<u>Percentage Change</u>
	<u>B1A</u>	<u>B1B</u>		
Total Demand (Units 000)	24,992.8	24,992.8	0.0	0.000
Total Purch. Cost	5,092,347.4	4,533,937.5	(558,409.9)	(10.966)
Total Mfg. Cost	7,868,245.9	6,270,132.2	(1,598,113.7)	(20.311)
Total Tran. Pt. Cost	N/A	46,469.1	46,469.1	N/A
Total DC Cost	347,993.2	336,518.9	(11,474.3)	(3.297)
Total Trans. Cost	545,384.5	859,847.3	314,462.8	57.659
Total Systems Cost	8,704,112.9	7,452,043.2	(1,252,069.7)	(14.385)
Transportation Cost				
Inbound Freight	57,510.7	60,924.3	3,413.6	5.936
Internal Freight	145,160.7	459,504.2	314,343.5	216.549
Customer Freight	342,713.1	339,418.8	(3,294.3)	(0.961)
Total Trans.	545,384.5	859,847.3	314,462.8	57.659
Fixed Cost				
Total Mfg Fixed Cost	1,499,298.6	1,499,298.6	0.0	0.000
Total DC Fixed Cost	15,080.0	14,710.0	(370.0)	(2.454)
Total Fixed Cost	1,514,378.6	1,514,008.6	(370.0)	(0.024)
Variable Cost				
Total Variable Cost	7,189,734.3	5,938,034.6	(1,251,699.7)	(17.410)
Variable Cost / Unit(\$)	287.67	237.59	(50.08)	(17.410)

Note: All values stated in thousands of US dollars unless otherwise indicated.

Table 33 (cont'd.)

Simulation B1A			Simulation B1B		
<u>Facilities Utilized</u>	<u>Type</u>	<u>Percent</u>	<u>Facilities Utilized</u>	<u>Type</u>	<u>Percent</u>
Woodstock	S	0.4	Reynosa	S	100.0
Reynosa	S	7.7			
Ft. Wayne	S	91.9	Nuevo Laredo	TP	81.3
			Cuidad Juarez	TP	18.3
Toronto	M	7.8	Monterrey	M	100.0
Monterrey	M	0.4			
Indianapolis	M	91.8			
Montreal	DC	2.1	Toronto	DC	4.8
Toronto	DC	3.5	Regina	DC	1.5
Edmonton	DC	2.3	Mexico City	DC	0.1
Mexico City	DC	0.1	Monterrey	DC	0.4
Monterrey	DC	0.4	Newark	DC	17.4
Worcester	DC	5.6	Kansas City	DC	4.7
Indianapolis	DC	49.6	Atlanta	DC	21.3
Atlanta	DC	10.2	Memphis	DC	21.0
Dallas	DC	9.3	Dallas	DC	10.7
Los Angeles	DC	10.6	Phoenix	DC	12.3
Salt Lake City	DC	6.5	Salt Lake City	DC	6.0

Note:

Facility type codes are as follows: S = suppliers, M = manufacturing plants, TP = transfer point, DC = distribution centers. Percent provides measure of throughput for network facilities. Supplier values are the percentage of total purchase dollars sourced from the supplier location. Manufacturing, transfer points, and distribution center values are the percentage of total finished product demand (units) handled by the specific facility.

Separate Country Results

Under the separate country simulation (B1A) the firm's operations in each country are completely independent of one another. No cross-border transactions are allowed.

In order to develop the separate country distribution center networks, simulations were conducted for each country. In the Canadian simulation, suppliers are located in Woodstock, a manufacturing plant in Toronto, and ten distribution centers are available. The simulation model is instructed to sort-down to the least cost configuration of three distribution centers.

In the Mexican simulation, suppliers are located in Reynosa, a manufacturing plant in Monterrey, and ten distribution centers are available. The simulation model is instructed to sort-down to the least cost configuration of two distribution centers.

In the United States simulation, suppliers are established in Fort Wayne, a manufacturing plant in Indianapolis, and twenty distribution centers are available. The simulation model is instructed to sort-down to the least cost configuration of six distribution centers.

The three Canadian, two Mexican, and six United States distribution centers determined in the initial separate country simulations are then used as the distribution center facilities for simulation B1A along with the Woodstock, Reynosa, and Fort Wayne suppliers and Toronto, Monterrey, and Indianapolis manufacturing plants. In simulation B1A all facilities and market areas are restricted to the use of domestic sources.

In Canada, the three distribution centers are located in Montreal, Toronto, and Edmonton. The two Mexican distribution centers are located in Monterrey and Mexico City. The six United States distribution centers are located in Worcester, Indianapolis, Atlanta, Dallas, Los Angeles, and Salt Lake City.

All distribution centers receive their finished products from the domestic manufacturing plant. The three manufacturing plants receive all purchased items from the domestic suppliers.

Total purchases cost is \$5,092.3 million (58.5 percent of total systems cost). Total manufacturing cost is \$7,868.2 million (90.4 percent of total systems cost). Total distribution center cost is \$348.0 million (4.0 percent of total systems cost). Total transportation cost is \$545.4 million (6.3 percent of total systems cost). Total systems

cost is \$8,704.1 million. Total systems variable cost per unit is \$287.67.

Initial Integration Results

The initial integration simulation (B1B) permits cross-border transactions at all echelons within the firm's operations. All facilities and market areas are to use the lowest cost sources. Thirty distribution centers are available, ten in Canada and twenty in the United States. Two Mexican distribution centers are utilized, but are not included in the sort-down process. The simulation model is instructed to determine the least cost distribution center network of eleven facilities, including the two established Mexican distribution centers. Full tariffs, cross-border transaction costs, and base levels of finished product demand are in effect.

The eleven distribution centers that are utilized include two Canadian, two Mexican, and seven United States facilities. The distribution centers are located in Toronto, Regina, Mexico City, Monterrey, Newark, Kansas City, Atlanta, Memphis, Dallas, Phoenix, and Salt Lake City.

All distribution centers receive all finished products from the Monterrey manufacturing plant. The Toronto and Indianapolis plants are not utilized. All purchased items

are sourced from the suppliers located in Reynosa. The suppliers in Woodstock and Fort Wayne are not used.

Total purchases cost is \$4,533.9 million (60.8 percent of total systems cost). Total manufacturing cost is \$6,270.1 million (84.1 percent of total systems cost). Total distribution center cost is \$336.5 million (4.5 percent of total systems cost). Total transportation cost is \$859.8 million (11.5 percent of total systems cost). Total systems cost is \$7,452.0 million. Total systems variable cost per unit is \$237.59.

Significant differences were found between the separate country (B1A) and initial integration (B1B) simulations in several areas. The configuration of distribution centers changes dramatically. The number of Canadian distribution centers is reduced from three to two. The facilities located in Montreal and Edmonton are not retained in simulation B1B. A facility in Regina is used along with the Toronto distribution center.

As for the United States, of the six distribution centers utilized in simulation B1A, only three are utilized in simulation B1B. Distribution centers located in Newark, Kansas City, Memphis, and Phoenix are used along with the Atlanta, Dallas, and Salt Lake City distribution centers which were retained from simulation B1A.

The number of market areas serviced by United States distribution centers also changed. In simulation B1A, the highest volume distribution center located in Indianapolis handled just under fifty percent of the total finished product volume within the system. In simulation B1B, no one distribution center handles over 21.3 percent of the total finished product volume within the system.

In simulation B1A, no market areas are serviced by foreign distribution centers. In simulation B1B, there are several instances where market areas are serviced by foreign distribution centers. The Newark distribution center services seven Canadian market areas. The Salt Lake City distribution center services one Canadian market area. The Regina facility services one United States market area.

There are also differences in the source of finished products for the Canadian and United States distribution centers. Although full tariffs and cross-border transaction costs are in effect, all finished product manufacturing activity shifts to the Mexican manufacturing facility located in Monterrey. In the separate country simulation all distribution centers are required to use the domestic manufacturing source for finished product.

When compared to simulation B1A, simulation B1B presents significant changes in the relationship among the major

total systems cost components. Total purchases cost increased from 58.5 to 60.8 percent of total systems cost. Total manufacturing cost decreased from 90.4 to 84.1 percent of total systems cost. Total distribution center cost increased slightly from 4.0 to 4.5 percent of total systems cost. Total transportation cost increased from 6.3 to 11.5 percent of total systems cost.

The initial integration total systems cost is approximately \$1.2 billion lower than the total systems cost in the separate country simulation. This represents a reduction of approximately 14.4 percent. The decrease is a direct result of the movement of all manufacturing to the Mexican plant and all purchased items being sourced from the lower-cost Mexican suppliers.

RESEARCH QUESTION B2 - MOST LIKELY CASE

Research question B2 asks what is the least total cost supplier, manufacturing plant, and distribution center system, given specified service constraints, for an integrated United States-Canada-Mexico system under the "most likely" levels of independent variables and how does it differ from the initial integrated United States-Canada-Mexico system developed in research question A1. Simulation B2A independent variable settings are as follows, a five percent increase in Canadian demand and a twenty-five

percent increase in Mexican demand, zero tariffs, and a fifty percent reduction in cross-border transaction costs. The results of simulation B2A along with the initial integration simulation run B1B are presented in Table 34.

Table 34
Initial Integration (B1B) - Most Likely (B2A) Comparison

	<u>Simulations</u>		<u>Difference</u>	<u>Percentage Change</u>
	<u>B1B</u>	<u>B2A</u>		
Total Demand (Units 000)	24,992.8	25,116.5	123.7	0.495
Total Purch. Cost	4,533,937.5	4,556,476.3	22,538.8	0.497
Total Mfg. Cost	6,270,132.2	6,293,842.4	23,710.2	0.378
Total Tran. Pt. Cost	46,469.1	0.0	(46,469.1)	(100.000)
Total DC Cost	336,518.9	334,774.2	(1,744.7)	(0.518)
Total Trans. Cost	859,847.3	756,597.3	(103,250.0)	(12.008)
Total Systems Cost	7,452,043.2	7,323,987.7	(128,055.5)	(1.718)
Transportation Cost				
Inbound Freight	60,924.3	61,226.2	301.9	0.496
Internal Freight	459,504.2	349,443.4	(110,060.8)	(23.952)
Customer Freight	339,418.8	345,927.6	6,508.8	1.918
Total Trans.	859,847.3	756,597.3	(103,250.0)	(12.008)
Fixed Cost				
Total Mfg Fixed Cost	1,499,298.6	1,499,298.6	0.0	0.000
Total DC Fixed Cost	14,710.0	14,090.0	(620.0)	(4.215)
Total Fixed Cost	1,514,008.6	1,513,388.6	(620.0)	(0.041)
Variable Cost				
Total Variable Cost	5,938,034.6	5,810,599.1	(127,435.5)	(2.146)
Variable Cost / Unit(\$)	237.59	231.35	(6.24)	(2.628)

Note: All values stated in thousands of US dollars unless otherwise indicated.

Table 34 (cont'd.)

Simulation B1B		Simulation B2A		
<u>Facilities Utilized</u>	<u>Type</u>	<u>Percent</u>	<u>Facilities Utilized</u>	<u>Type</u> <u>Percent</u>
Reynosa	S	100.0	Reynosa	S 100.0
Monterrey	M	100.0	Monterrey	M 100.0
Nuevo Laredo	TP	81.3		
Cuidad Juarez	TP	18.3		
Toronto	DC	4.8	Toronto	DC 5.0
Regina	DC	1.5	Regina	DC 2.8
Mexico City	DC	0.1	Nuevo Laredo	DC 9.8
Monterrey	DC	0.4	Cuidad Juarez	DC 6.5
Newark	DC	17.4	Mexico City	DC 0.1
Kansas City	DC	4.7	Monterrey	DC 0.4
Atlanta	DC	21.3	Newark	DC 12.7
Memphis	DC	21.0	Kansas City	DC 5.9
Dallas	DC	10.7	Raleigh	DC 14.7
Phoenix	DC	12.3	Atlanta	DC 29.5
Salt Lake City	DC	6.0	Los Angeles	DC 12.6

Note:

Facility type codes are as follows: S = suppliers, M = manufacturing plants, TP = transfer point, DC = distribution centers. Percent provides measure of throughput for network facilities. Supplier values are the percentage of total purchase dollars sourced from the supplier location. Manufacturing, transfer points, and distribution center values are the percentage of total finished product demand (units) handled by the specific facility.

The eleven distribution centers that are utilized include two Canadian, four Mexican, and five United States facilities. The distribution centers are located in Toronto, Regina, Nuevo Laredo, Ciudad Juarez, Mexico City, Monterrey, Newark, Kansas City, Raleigh, Atlanta, and Los Angeles.

All distribution centers receive all finished products from the Monterrey manufacturing plant. The Toronto and Indianapolis plants are not utilized. All purchased items are sourced from the suppliers located in Reynosa. The suppliers in Woodstock and Fort Wayne are not used.

Total purchases cost is \$4,556.5 million (62.2 percent of total systems cost). Total manufacturing cost is \$6,293.8 million (85.9 percent of total systems cost). Total distribution center cost is \$334.8 million (4.6 percent of total systems cost). Total transportation cost is \$756.6 million (10.3 percent of total systems cost). Total systems cost is \$7,324.0 million. Total systems variable cost per unit is \$231.35.

There are several differences found between the initial integration (B1B) and most likely (B2A) simulations. The configuration of distribution centers changes. The number of United States distribution center is reduced from seven to five. The distribution centers located in Memphis,

Dallas, Phoenix, and Salt Lake City used in simulation B1B are not retained in B2A. Raleigh and Los Angeles distribution centers are added to the remaining United States B1B simulation distribution centers located in Newark, Kansas City, and Atlanta.

The number of Mexican distribution centers increases from two to four. Distribution centers located in Nuevo Laredo and Ciudad Juarez are added to simulation B1B facilities located in Mexico City and Monterrey. The new Mexican distribution centers service a total of fifty market areas. All but six of these market areas are located in the United States.

The number of United States market areas serviced by the Regina distribution center increased from one to five. In addition to the Minot, North Dakota market area serviced in simulation B1B, the Montana market areas are also serviced by Regina in simulation B2A.

There are no differences in the source of finished products as all finished product manufacturing activity takes place at the Monterrey manufacturing plant. All purchased items are sourced from the Reynosa suppliers.

There are changes in the relationship among the major total systems cost components. Total purchases increases from

60.8 to 62.2 percent of total systems cost. However, on a per unit basis there is no change. Total manufacturing cost increased from 84.1 to 85.9 percent of total systems cost. Total transportation cost decreased from 11.5 to 10.3 percent of total systems cost.

When compared to simulation B1B, simulation B2A presents a reduction of total systems cost of \$128 million or appropriately 1.7 percent. On a total systems variable cost basis this results in \$6.24 per unit reduction or approximately 2.6 percent. This reduction takes place though finished product demand increased by 123,700 units. The decrease is direct result of the removal of all tariffs and the fifty percent reduction in cross-border transaction costs. Another contributing factor is the removal of the handling charge that occurs at the transfer points for finished products.

RESEARCH QUESTION B3 - CHANGES IN INDEPENDENT VARIABLES

Research question B3 asks how do changes in the levels of the independent variables for tariffs, cross-border transaction costs, and non-United States finished product demand affect the supplier, manufacturing plant, and distribution center system in terms of locations utilized and total systems cost when compared to least cost system

developed in research question B1B. Six simulation runs were required to address this question.

The least cost networks developed for all six simulations (B3A-B3F) are identical. This network includes two Canadian, two Mexican and seven United States distribution centers. Distribution centers are located in Toronto, Regina, Mexico City, Monterrey, Newark, Kansas City, Atlanta, Memphis, Dallas, Phoenix, and Salt Lake City. This is also the same network developed in the initial integration simulation (B1B).

For simulations B3A-B3F, all distribution centers receive all finished products from the Monterrey manufacturing plant. The Toronto and Indianapolis plants are not utilized. All purchased items are sourced from the suppliers located in Reynosa. The suppliers in Woodstock and Fort Wayne are not used. Additional results are presented by independent variable examined in the following section.

Non-United States Finished Product Demand

Simulation B3A assumes a five percent increase in Canadian and a twenty-five percent increase in Mexican demand for finished products. Simulation B3B assumes a ten percent increase in Canadian demand and a fifty percent increase in

Mexican demand. Both simulations permit cross-border transactions at all echelons within the firm's operations. All market areas and facilities are to use the lowest cost sources. Full tariff and cross-border transaction costs are in effect. Results of B3A and B3B are presented in Tables 35 and 36, respectively.

Table 35

**Initial Integration (B1B) - Five Percent Increase In Canadian Demand/
Twenty-five Percent Increase In Mexican Demand (B3A) Comparison**

	Simulations		<u>Difference</u>	<u>Percentage Change</u>
	<u>B1B</u>	<u>B3A</u>		
Total Demand (Units 000)	24,992.8	25,116.5	123.7	0.495
Total Purch. Cost	4,533,937.5	4,556,476.3	22,538.8	0.497
Total Mfg. Cost	6,270,132.2	6,293,842.4	23,710.2	0.378
Total Tran. Pt. Cost	46,469.1	46,649.4	180.3	0.388
Total DC Cost	336,518.9	338,098.7	1,579.8	0.469
Total Trans. Cost	859,847.3	866,033.1	6,185.8	0.719
Total Systems Cost	7,452,043.2	7,483,397.4	31,354.2	0.421
Transportation Cost				
Inbound Freight	60,924.3	61,226.2	301.9	0.496
Internal Freight	459,504.2	463,529.8	4,025.6	0.876
Customer Freight	339,418.8	341,277.1	1,858.3	0.547
Total Trans.	859,847.3	866,033.1	6,185.8	0.719
Fixed Cost				
Total Mfg Fixed Cost	1,499,298.6	1,499,298.6	0.0	0.000
Total DC Fixed Cost	14,710.0	14,710.0	0.0	0.000
Total Fixed Cost	1,514,008.6	1,514,008.6	0.0	0.000
Variable Cost				
Total Variable Cost	5,938,034.6	5,969,388.8	31,354.2	0.528
Variable Cost / Unit(\$)	237.59	237.67	0.08	0.033

Note: All values stated in thousands of US dollars unless otherwise indicated.

Table 36

**Initial Integration (B1B) - Ten Percent Increase In Canadian Demand/
Fifty Percent Increase In Mexican Demand (B3B) Comparison**

	Simulations		Difference	Percentage Change
	B1B	B3B		
Total Demand (Units 000)	24,992.8	25,244.7	251.9	1.008
Total Purch. Cost	4,533,937.5	4,579,672.2	45,734.7	1.009
Total Mfg. Cost	6,270,132.2	6,318,246.9	48,114.7	0.767
Total Tran. Pt. Cost	46,469.1	46,829.6	360.5	0.776
Total DC Cost	336,518.9	339,723.0	3,204.1	0.952
Total Trans. Cost	859,847.3	872,244.6	12,397.3	1.442
Total Systems Cost	7,452,043.2	7,515,506.6	63,463.4	0.852
Transportation Cost				
Inbound Freight	60,924.3	61,537.5	613.2	1.006
Internal Freight	459,504.2	467,552.3	8,048.1	1.751
Customer Freight	339,418.8	343,154.8	3,736.0	1.101
Total Trans.	859,847.3	872,244.6	12,397.3	1.442
Fixed Cost				
Total Mfg Fixed Cost	1,499,298.6	1,499,298.6	0.0	0.000
Total DC Fixed Cost	14,710.0	14,710.0	0.0	0.000
Total Fixed Cost	1,514,008.6	1,514,008.6	0.0	0.000
Variable Cost				
Total Variable Cost	5,938,034.6	6,001,498.0	63,463.4	1.069
Variable Cost / Unit(\$)	237.59	237.73	0.14	0.060

Note: All values stated in thousands of US dollars unless otherwise indicated.

Table 36 (cont'd.)

Simulation B1B		Simulation B3B		
<u>Facilities Utilized</u>	<u>Type</u>	<u>Percent</u>	<u>Facilities Utilized</u>	<u>Type</u> <u>Percent</u>
Reynosa	S	100.0	Reynosa	S 100.0
Monterrey	M	100.0	Monterrey	M 100.0
Nuevo Laredo	TP	81.3	Nuevo Laredo	TP 81.2
Cuidad Juarez	TP	18.3	Cuidad Juarez	TP 18.2
Toronto	DC	4.8	Toronto	DC 5.2
Regina	DC	1.5	Regina	DC 1.6
Mexico City	DC	0.1	Mexico City	DC 0.1
Monterrey	DC	0.4	Monterrey	DC 0.5
Newark	DC	17.4	Newark	DC 17.3
Kansas City	DC	4.7	Kansas City	DC 4.6
Atlanta	DC	21.3	Atlanta	DC 21.1
Memphis	DC	21.0	Memphis	DC 20.8
Dallas	DC	10.7	Dallas	DC 10.6
Phoenix	DC	12.3	Phoenix	DC 12.1
Salt Lake City	DC	6.0	Salt Lake City	DC 6.0

Note:

Facility type codes are as follows: S = suppliers, M = manufacturing plants, TP = transfer point, DC = distribution centers. Percent provides measure of throughput for network facilities. Supplier values are the percentage of total purchase dollars sourced from the supplier location. Manufacturing, transfer points, and distribution center values are the percentage of total finished product demand (units) handled by the specific facility.

In simulation B3A total purchases cost is \$4,556.5 million (60.9 percent of total systems cost). Total manufacturing cost is \$6,293.8 million (84.1 percent of total systems cost). Total distribution center cost is \$338.5 million (4.5 percent of total systems cost). Total transportation cost is \$866.0 million (11.8 percent of total systems cost). Total systems cost is \$7,483.4 million. Total systems variable cost per unit is \$237.67.

In simulation B3B total purchases cost is \$4,579.7 million (60.9 percent of total systems cost). Total manufacturing cost is \$6,318.2 million (84.1 percent of total systems cost). Total distribution center cost is \$339.7 million (4.5 percent of total systems cost). Total transportation cost is \$872.2 million (11.6 percent of total systems cost). Total systems cost is \$7,483.4 million. Total systems variable cost per unit is \$237.73.

In comparing simulation B3A and B3B results to simulation B1B the only differences that are seen relate to the increases in non-United States finished product demand and the associated increases in total systems cost. In simulation B3A the five percent increase in Canadian demand and twenty-five percent increase in Mexican demand increases the total finished product demand by 123,700 units or approximately 0.495 percent. The total systems cost for B3A increases by approximately \$31.4 million or 0.42 percent.

In simulation B3B the ten percent increase in Canadian demand and fifty percent increase in Mexican demand increases the total finished product demand by 251,900 units or approximately one percent. The total systems cost for B3B increases by approximately \$63.5 million or 0.85 percent. The reason for the lower increase in total systems than the increase in demand is that fixed costs are held constant for all levels of demand.

When the variable portion of total systems cost is viewed on a per unit basis there are minor increases in cost. The variable cost per unit for simulation B3A is \$0.08 higher than simulation B1B. The variable cost per unit for simulation B3B is \$0.14 higher than simulation B1B. These increases are the result of an increase in the portion of total finished product demand represented by the Canadian market areas. Given that all manufacturing takes place at the Monterrey plant, the Canadian market areas are the most expensive to service from a transportation perspective. It is the increase in transportation, tariff, and cross-border transaction cost that cause the increase in variable cost per unit.

In summary, the levels of increases in Canadian and Mexican finished product demand examined in the study have the anticipated small impact on total systems and unit costs.

These changes in finished product demand do not alter the system structure.

Tariffs

Simulations B3C and B3D address reductions in tariff levels. Cross-border transactions are permitted at all echelons within the firm's operations. All market areas and facilities are to use the lowest cost sources. Full cross-border transaction costs and base level for finished product demand are in effect.

Simulation B3C assumes a fifty percent reduction in tariffs. Simulation B3D assumes a one hundred percent reduction in tariffs. The results of simulation B3C and B3D are presented in Tables 5-37 and 5-38, respectively.

Table 37

Initial Integration (B1B) - Fifty Percent Tariff Reduction (B3C) Comparison

	Simulations		<u>Difference</u>	<u>Percentage Change</u>
	<u>B1B</u>	<u>B3C</u>		
Total Demand (Units 000)	24,992.8	24,992.8	0.0	0.000
Total Purch. Cost	4,533,937.5	4,533,937.5	0.0	0.000
Total Mfg. Cost	6,270,132.2	6,270,132.2	0.0	0.000
Total Tran. Pt. Cost	46,469.1	46,469.1	0.0	0.000
Total DC Cost	336,518.9	336,518.9	0.0	0.000
Total Trans. Cost	859,847.3	836,678.8	(23,168.5)	(2.694)
Total Systems Cost	7,452,043.2	7,428,874.7	(23,168.5)	(0.311)
Transportation Cost				
Inbound Freight	60,924.3	60,924.3	0.0	0.000
Internal Freight	459,504.2	441,149.1	(18,355.1)	(3.995)
Customer Freight	339,418.8	334,605.4	(4,813.4)	(1.418)
Total Trans.	859,847.3	836,678.8	(23,168.5)	(2.694)
Fixed Cost				
Total Mfg Fixed Cost	1,499,298.6	1,499,298.6	0.00	0.000
Total DC Fixed Cost	14,710.0	14,710.0	0.00	0.000
Total Fixed Cost	1,514,008.6	1,514,008.6	0.00	0.000
Variable Cost				
Total Variable Cost	5,938,034.6	5,914,866.1	(23,168.5)	(0.390)
Variable Cost / Unit(\$)	237.59	236.66	(0.93)	(0.390)

Note: All values stated in thousands of US dollars unless otherwise indicated.

Table 38
Initial Integration (B1B) - One Hundred Percent Tariff Reduction (B3D) Comparison

	<u>Simulations</u>		<u>Difference</u>	<u>Percentage Change</u>
	<u>B1B</u>	<u>B3D</u>		
Total Demand (Units 000)	24,992.8	24,992.8	0.0	0.000
Total Purch. Cost	4,533,937.5	4,533,937.5	0.0	0.000
Total Mfg. Cost	6,270,132.2	6,270,132.2	0.0	0.000
Total Tran. Pt. Cost	46,469.1	46,469.1	0.0	0.000
Total DC Cost	336,518.9	336,518.9	0.0	0.000
Total Trans. Cost	859,847.3	813,519.0	(46,328.3)	(5.388)
Total Systems Cost	7,452,043.2	7,405,714.9	(46,328.3)	(0.622)
Transportation Cost				
Inbound Freight	60,924.3	60,924.3	0.0	0.000
Internal Freight	459,504.2	422,805.4	(36,698.8)	(7.987)
Customer Freight	339,418.8	329,789.3	(9,629.5)	(2.837)
Total Trans.	859,847.3	813,519.0	(46,328.3)	(5.388)
Fixed Cost				
Total Mfg Fixed Cost	1,499,298.6	1,499,298.6	0.0	0.000
Total DC Fixed Cost	14,710.0	14,710.0	0.0	0.000
Total Fixed Cost	1,514,008.6	1,514,008.6	0.0	0.000
Variable Cost				
Total Variable Cost	5,938,034.6	5,891,706.3	(46,328.3)	(0.780)
Variable Cost / Unit(\$)	237.59	235.74	(1.85)	(0.780)

Note: All values stated in thousands of US dollars unless otherwise indicated.

Table 38 (cont'd.)

Simulation B1B			Simulation B3D		
<u>Facilities Utilized</u>	<u>Type</u>	<u>Percent</u>	<u>Facilities Utilized</u>	<u>Type</u>	<u>Percent</u>
Reynosa	S	100.0	Reynosa	S	100.0
Monterrey	M	100.0	Monterrey	M	100.0
Nuevo Laredo	TP	81.3	Nuevo Laredo	TP	81.3
Cuidad Juarez	TP	18.3	Cuidad Juarez	TP	18.3
Toronto	DC	4.8	Toronto	DC	4.8
Regina	DC	1.5	Regina	DC	1.5
Mexico City	DC	0.1	Mexico City	DC	0.1
Monterrey	DC	0.4	Monterrey	DC	0.4
Newark	DC	17.4	Newark	DC	17.4
Kansas City	DC	4.7	Kansas City	DC	4.7
Atlanta	DC	21.3	Atlanta	DC	21.3
Memphis	DC	21.0	Memphis	DC	21.0
Dallas	DC	10.7	Dallas	DC	10.7
Phoenix	DC	12.3	Phoenix	DC	12.3
Salt Lake City	DC	6.0	Salt Lake City	DC	6.0

Note:

Facility type codes are as follows: S = suppliers, M = manufacturing plants, TP = transfer point, DC = distribution centers. Percent provides measure of throughput for network facilities. Supplier values are the percentage of total purchase dollars sourced from the supplier location. Manufacturing, transfer points, and distribution center values are the percentage of total finished product demand (units) handled by the specific facility.

In simulation B3C total purchases cost is \$4,533.9 million (61.0 percent of total systems cost). Total manufacturing cost is \$6,270.1 million (84.4 percent of total systems cost). Total distribution center cost is \$336.5 million (4.5 percent of total systems cost). Total transportation cost is \$836.7 million (11.3 percent of total systems cost). Total systems cost is \$7,428.9 million. Total systems variable cost per unit is \$236.66.

In simulation B3D total purchases cost is \$4,533.9 million (61.2 percent of total systems cost). Total manufacturing cost is \$6,270.1 million (84.7 percent of total systems cost). Total distribution center cost is \$336.5 million (4.5 percent of total systems cost). Total transportation cost is \$813.5 million (11.0 percent of total systems cost). Total systems cost is \$7,405.7 million. Total systems variable cost per unit is \$235.74.

In comparing simulations B3C and B3D to simulation B1B there are no differences in the distribution center facilities used or the market areas that these facilities service. The only differences that are seen relate to the decrease in tariffs which reduces total systems cost by approximately \$23.2 million or \$0.93 per unit when tariffs are reduced by fifty percent (simulation B3C) and total systems cost are reduced by approximately \$46.3 million or \$1.85 per unit when tariffs are completely removed (simulation B3D).

In summary, the reductions in tariffs examined in the study result in decreases in total systems costs. The North American tariff simulation results differ from the results of the United States-Canada in that tariff reductions have no effect on the system structure.

Cross-Border Transaction Costs

Simulations B3E and B3F examine the effects of reductions in cross-border transaction costs. Cross-border transactions are permitted at all echelons within the firm's operations. All market areas and facilities are to use the lowest cost sources. Full tariff and base demand levels are in effect.

Simulation B3E assumes a twenty-five percent reduction in cross-border transaction costs. Simulation B3F assumes a fifty percent reduction in cross-border transaction costs. A summary of the results of simulation B3E and B3F are presented in Table 39 and 40, respectively.

Table 39

**Initial Integration (B1B) - Twenty-five Percent Reduction In
Cross-Border Transaction Costs (B3E) Comparison**

	Simulations		<u>Difference</u>	<u>Percentage Change</u>
	<u>B1B</u>	<u>B3E</u>		
Total Demand (Units 000)	24,992.8	24,992.8	0.0	0.000
Total Purch. Cost	4,533,937.5	4,533,937.5	0.0	0.000
Total Mfg. Cost	6,270,132.2	6,270,132.2	0.0	0.000
Total Tran. Pt. Cost	46,469.1	46,469.1	0.0	0.000
Total DC Cost	336,518.9	336,518.9	0.0	0.000
Total Trans. Cost	859,847.3	833,088.0	(26,759.3)	(3.112)
Total Systems Cost	7,452,043.2	7,425,283.9	(26,759.3)	(0.359)
Transportation Cost				
Inbound Freight	60,924.3	60,924.3	0.0	0.000
Internal Freight	459,504.2	432,973.8	(26,530.4)	(5.770)
Customer Freight	339,418.8	339,189.9	(228.9)	(0.067)
Total Trans.	859,847.3	833,088.0	(26,759.3)	(3.112)
Fixed Cost				
Total Mfg Fixed Cost	1,499,298.6	1,499,298.6	0.0	0.000
Total DC Fixed Cost	14,710.0	14,710.0	0.0	0.000
Total Fixed Cost	1,514,008.6	1,514,008.6	0.0	0.000
Variable Cost				
Total Variable Cost	5,938,034.6	5,911,275.3	(26,759.3)	(0.451)
Variable Cost / Unit(\$)	237.59	236.52	(1.07)	(0.451)

Note: All values stated in thousands of US dollars unless otherwise indicated.

Table 39 (cont'd.)

Simulation B1B			Simulation B3E		
<u>Facilities Utilized</u>	<u>Type</u>	<u>Percent</u>	<u>Facilities Utilized</u>	<u>Type</u>	<u>Percent</u>
Reynosa	S	100.0	Reynosa	S	100.0
Monterrey	M	100.0	Monterrey	M	100.0
Nuevo Laredo	TP	81.3	Nuevo Laredo	TP	81.3
Cuidad Juarez	TP	18.3	Cuidad Juarez	TP	18.3
Toronto	DC	4.8	Toronto	DC	4.8
Regina	DC	1.5	Regina	DC	1.5
Mexico City	DC	0.1	Mexico City	DC	0.1
Monterrey	DC	0.4	Monterrey	DC	0.4
Newark	DC	17.4	Newark	DC	17.4
Kansas City	DC	4.7	Kansas City	DC	4.7
Atlanta	DC	21.3	Atlanta	DC	21.3
Memphis	DC	21.0	Memphis	DC	21.0
Dallas	DC	10.7	Dallas	DC	10.7
Phoenix	DC	12.3	Phoenix	DC	12.3
Salt Lake City	DC	6.0	Salt Lake City	DC	6.0

Note:

Facility type codes are as follows: S = suppliers, M = manufacturing plants, TP = transfer point, DC = distribution centers. Percent provides measure of throughput for network facilities. Supplier values are the percentage of total purchase dollars sourced from the supplier location. Manufacturing, transfer points, and distribution center values are the percentage of total finished product demand (units) handled by the specific facility.

Table 40

**Initial Integration (B1B) - Fifty Percent Reduction In
Cross-Border Transaction Costs (B3F) Comparison**

	Simulations		<u>Difference</u>	<u>Percentage Change</u>
	<u>B1B</u>	<u>B3F</u>		
Total Demand (Units 000)	24,992.8	24,992.8	0.0	0.000
Total Purch. Cost	4,533,937.5	4,533,937.5	0.0	0.000
Total Mfg. Cost	6,270,132.2	6,270,132.2	0.0	0.000
Total Tran. Pt. Cost	46,469.1	46,469.1	0.0	0.000
Total DC Cost	336,518.9	336,518.9	0.0	0.000
Total Trans. Cost	859,847.3	806,324.9	(53,522.4)	(6.225)
Total Systems Cost	7,452,043.2	7,398,520.8	(53,522.4)	(0.718)
Transportation Cost				
Inbound Freight	60,924.3	60,924.3	0.0	0.000
Internal Freight	459,504.2	406,443.4	(53,060.8)	(11.547)
Customer Freight	339,418.8	338,957.2	(461.6)	(0.136)
Total Trans.	859,847.3	806,324.9	(53,522.4)	(6.225)
Fixed Cost				
Total Mfg Fixed Cost	1,499,298.6	1,499,298.6	0.0	0.000
Total DC Fixed Cost	14,710.0	14,710.0	0.0	0.000
Total Fixed Cost	1,514,008.6	1,514,008.6	0.0	0.000
Variable Cost				
Total Variable Cost	5,938,034.6	5,884,512.2	(53,522.4)	(0.901)
Variable Cost / Unit(\$)	237.59	235.45	(2.14)	(0.901)

Note: All values stated in thousands of US dollars unless otherwise indicated.

Table 40 (cont'd.)

Simulation B1B		Simulation B3F	
<u>Facilities Utilized</u>	<u>Type</u>	<u>Facilities Utilized</u>	<u>Type</u>
Reynosa	S	Reynosa	S
Monterrey	M	Monterrey	M
Nuevo Laredo	TP	Nuevo Laredo	TP
Cuidad Juarez	TP	Cuidad Juarez	TP
Toronto	DC	Toronto	DC
Regina	DC	Regina	DC
Mexico City	DC	Mexico City	DC
Monterrey	DC	Monterrey	DC
Newark	DC	Newark	DC
Kansas City	DC	Kansas City	DC
Atlanta	DC	Atlanta	DC
Memphis	DC	Memphis	DC
Dallas	DC	Dallas	DC
Phoenix	DC	Phoenix	DC
Salt Lake city	DC	Salt Lake City	DC

In simulation B3E total purchases cost is \$4,533.9 million (61.1 percent of total systems cost). Total manufacturing cost is \$6,270.1 million (84.4 percent of total systems cost). Total distribution center cost is \$336.5 million (4.5 percent of total systems cost). Total transportation cost is \$833.1 million (11.2 percent of total systems cost). Total systems cost is \$7,425.3 million. Total systems variable cost per unit is \$236.52.

In simulation B3F total purchases cost is \$4,533.9 million (61.3 percent of total systems cost). Total manufacturing cost is \$6,270.1 million (84.7 percent of total systems cost). Total distribution center cost is \$336.5 million (4.5 percent of total systems cost). Total transportation cost is \$806.3 million (10.9 percent of total systems cost). Total systems cost is \$7,398.5 million. Total systems variable cost per unit is \$235.45.

When compared to simulation B1B there are no differences in the distribution center facilities used or the market areas that these facilities service. There are no differences in the source manufacturing facilities used for the distribution centers or suppliers used for purchased items. The only differences that are seen relate to decreases in total systems cost. The twenty-five percent reduction in cross-border transaction costs (simulation B3E) reduces total systems cost by approximately \$26.8 million or \$1.07

per unit. The fifty percent reduction in cross-border transaction costs (simulation B3F) reduces total systems cost by approximately \$53.5 million or \$2.14 per unit.

In summary, the reductions in the levels of cross-border transaction costs examined in the study result in a reduction in total systems cost, but have virtually effect on the network structure.

RESEARCH QUESTION B4 - SOURCING SERIES

Research question B4 asks how do changes in the levels of the independent variables for tariffs and cross-border transaction costs affect the supplier locations utilized and the total systems cost when the United States, Canadian, Mexican manufacturing plant and distribution center locations service only their respective domestic market areas. Ten simulations were performed to address this research question.

In all research question B4 simulations distribution centers service only domestic market areas. Distribution centers receive all finished products from the domestic manufacturing plant. With the exception of the separate country simulation B4A, where plants are required to use domestic sources, manufacturing locations are instructed to use the least cost source of purchased items.

The sourcing series research questions do not utilize the sort-down heuristic in the solutions. The distribution network is specified and does not change. The distribution centers used in the sourcing series simulations are the product of separate country simulations which resulted in the least cost network of distribution centers for each country considered separately.

After an initial review of the sourcing series simulation the following observations were made. At no time does the Monterrey manufacturing plant use any suppliers other than those located in Reynosa. In all simulations where foreign sourcing is permitted, at least part of the Toronto and Indianapolis manufacturing plants' purchased item requirements are sourced with the Mexican suppliers in Reynosa. At no time does the Toronto plant use United States suppliers or does the Indianapolis plant use Canadian suppliers. Given these findings the discussion presented in the remainder of this chapter focuses on changes in the sourcing patterns from the perspective of the Canadian and United States manufacturing plants.

Separate Country Results

Under the separate country simulation (B4A) the firm's operations in each country are completely independent of one another. No cross-border transactions are allowed.

The three manufacturing plants receive all purchased items from the domestic suppliers. Purchases by supplier location are as follows, Woodstock \$392.6 million (7.7 percent of total purchases), Reynosa \$21.0 million (0.4 percent of total purchases), and Fort Wayne \$4,678.7 million (91.9 percent of total purchases).

Total purchase expenditure is \$5,092.3 million (58.5 percent of total systems cost). Total manufacturing cost is \$7,866.5 million (90.4 percent of total systems cost). Total distribution center cost is \$348.0 million (4.0 percent of total systems cost). Total transportation cost is \$543.6 million (6.3 percent of total systems cost). Total systems cost is \$8,702.4 million. Total systems variable cost per unit is \$287.60.

The total systems cost for simulation B4A differs from the total systems cost for simulation B1A by approximately \$1.7 million. However, the results of these two simulations should be identical. The reason for the discrepancy is that prior to conducting the research question 4 simulations, it

was discovered that the weight of purchased item 108, door gaskets, had been incorrectly entered. A freight unit value of 0.20 hundredweight was entered rather than the actual freight unit weight of 0.02 hundredweight.

The necessary corrections were made prior to conducting the research question 4 simulations. This error resulted in slightly higher inbound transportation costs for the previously conducted United States-Canada and North American simulations. However, its effect on total systems cost was negligible and it had no effect on facilities utilized.

Initial Integration Results

The initial integration simulation (B4B) permits foreign sourcing of purchased items. Full tariffs, cross-border transaction costs, and base levels of finished product demand are in effect. The results of the separate country (B4A) and initial integration simulations (B4B) are presented in Table 41.

Table 41

Separate Countries (B4A) - Initial Integration (B4B) Comparison

	Simulations		
	<u>B4A</u>	<u>B4B</u>	<u>Difference</u>
Total Demand (Units 000)	24,992.8	24,992.8	0.0
Total Purch. Cost	5,092,347.4	4,748,573.3	(343,774.1)
Total Mfg. Cost	7,866,507.5	7,816,161.1	(50,346.4)
Total DC Cost	347,993.2	347,993.2	0.0
Total Trans. Cost	543,646.1	837,073.7	293,427.6
Total Systems Cost	8,702,374.4	8,652,028.0	(50,346.4)
Transportation Cost			
Inbound Freight	55,772.4	349,200.0	293,427.6
Internal Freight	145,160.6	145,160.6	0.0
Customer Freight	342,713.1	342,713.1	0.0
Total Trans.	543,646.1	837,073.7	293,427.6
Fixed Cost			
Total Mfg Fixed Cost	1,499,298.6	1,499,298.6	0.0
Total DC Fixed Cost	15,080.0	15,080.0	0.0
Total Fixed Cost	1,514,378.6	1,514,378.6	0.0
Variable Cost			
Total VC	7,187,995.8	7,137,649.4	(50,346.4)
Variable Cost / Unit(\$)	287.60	285.59	(2.01)

Note: All values stated in thousands of US dollars unless otherwise indicated.

(0.700)
(0.700)

526.116
0.000
0.000
53.974

0.000
(6.751)
(0.640)
0.000
53.974
(0.579)

Table 41 (cont'd.)

Simulations B4A-B4H

<u>Facilities Utilized</u>	<u>Type</u>	<u>Percent</u>
Woodstock	S	
Reynosa	S	
Ft. Wayne	S	
Toronto	M	7.8
Monterrey	M	0.4
Indianapolis	M	91.8
Montreal	DC	2.1
Toronto	DC	3.5
Edmonton	DC	2.3
Mexico City	DC	0.1
Monterrey	DC	0.4
Worcester	DC	5.6
Indianapolis	DC	49.6
Atlanta	DC	10.2
Dallas	DC	9.3
Los Angeles	DC	10.6
Salt Lake City	DC	6.5

Note:

Facility type codes are as follows: S = suppliers, M = manufacturing plants, TP = transfer point, DC = distribution centers. Percent provides measure of throughput for network facilities. Supplier values are the percentage of total purchase dollars sourced from the supplier location. Manufacturing, transfer points, and distribution center values are the percentage of total finished product demand (units) handled by the specific facility. Facilities used are the same for simulations B4A - B4H.

Canadian Plant

Indianapolis Plant

Note: Plants use domestic sources unless indicated by M = Mexican supplier.

The Toronto manufacturing plant sources twenty-two purchased items domestically and three in Mexico. The Indianapolis manufacturing plant sources fifteen purchased items domestically and ten in Mexico. Total purchase expenditure by supplier location is as follows, Woodstock \$374.0 million (7.9 percent of total purchases), Reynosa \$2,322.1 million (48.9 percent of total purchases), and Fort Wayne \$2,052.5 million (43.2 percent of total purchases).

Total purchases cost is \$4,748.6 million (54.9 percent of total systems cost). Total manufacturing cost is \$7,816.2 million (90.3 percent of total systems cost). Total distribution center cost is \$348.0 million (4.0 percent of total systems cost). Total transportation cost is \$837.1 million (9.7 percent of total systems cost). Total systems cost is \$8,652.0 million. Total systems variable cost per unit is \$285.59.

In comparing the separate country (B4A) and initial integration (B4B) simulations there are significant differences in the source of purchased items for the Toronto and United States manufacturing plants. Although full tariffs and cross-border transaction costs are in effect, once the domestic sourcing requirement is removed, several purchased items are sourced in Mexico. Three purchased items are sourced in Mexico by the Toronto plant. This results in a decrease of \$18.6 million (4.6 percent) in

purchases from the Canadian suppliers. Ten purchased items are sourced in Mexico by the Indianapolis plant. This results in a decrease of over \$2.6 billion (56.1 percent) in purchases from the United States suppliers.

When compared to simulation B4A, simulation B4B presents two changes in the relationship among key systems cost factors. Total purchases decreases from 58.5 to 54.9 percent of total systems cost. Total transportation cost increases from 6.3 to 9.7 percent of total systems cost.

The initial integration simulation (B4B) total systems cost is approximately \$50.3 million lower than the total systems cost in the separate country simulation, a reduction of approximately 0.6 percent. This decrease is direct result of use of the lower cost Mexican suppliers by the Toronto and Indianapolis manufacturing plants.

Tariffs

Simulations B4C and B4D address reductions in tariff levels. Foreign sourcing of purchased items is permitted. Full cross-border transaction costs and base levels for finished product demand are in effect.

Simulation B4C assumes a fifty percent reduction in tariffs. Simulation B4D assumes a one hundred percent reduction in

tariffs. The results of simulations B4C and B4D are presented in Tables 42 and 43, respectively.

Table 42

Initial Integration (B4B) - Fifty Percent Tariff Reduction (B4C) Comparison

	Simulations		<u>Difference</u>	<u>Percentage Change</u>
	<u>B4B</u>	<u>B4C</u>		
Total Demand (Units 000)	24,992.8	24,992.8	0.0	0.000
Total Purch. Co	4,748,573.3	4,738,872.8	(9,700.5)	(0.204)
Total Mfg. Cost	7,816,161.1	7,814,969.7	(1,191.4)	(0.015)
Total DC Cost	347,993.2	347,993.2	0.0	0.000
Total Trans. Co	837,073.7	845,582.8	8,509.1	1.017
Total Systems Cost	8,652,028.0	8,650,836.6	(1,191.4)	(0.014)
Transportation Cost				
Inbound Freight	349,200.0	357,709.1	8,509.1	2.437
Internal Freight	145,160.6	145,160.6	0.0	0.000
Customer Freight	342,713.1	342,713.1	0.0	0.000
Total Trans.	837,073.7	845,582.8	8,509.1	1.017
Fixed Cost				
Total Mfg Fixed Cost	1,499,298.6	1,499,298.6	0.0	0.000
Total DC Fixed Cost	15,080.0	15,080.0	0.0	0.000
Total Fixed Cost	1,514,378.6	1,514,378.6	0.0	0.000
Variable Cost				
Total Variable Cost	7,137,649.4	7,136,458.0	(1,191.4)	(0.017)
Variable Cost / Unit(\$)	285.59	285.54	(0.05)	(0.017)

Note: All values stated in thousands of US dollars unless otherwise indicated.

Table 42 (cont'd.)

Purchased Item Source Location	
Canadian Plant	Indianapolis Plant
No. Description	No. Description
101 Aluminum Components	101 Aluminum Components
102 Belts	102 Belts
103 Compressors	103 Compressors
104 Copper Components	104 Copper Components
105 Cord Sets	105 Cord Sets
106 Corrugated Packaging	106 Corrugated Packaging
107 Fasteners	107 Fasteners
108 Door Gaskets	108 Door Gaskets
109 Knobs	109 Knobs
110 1 Speed Motors	110 1 Speed Motors
111 2 Speed Motors	111 2 Speed Motors
112 Paint (Powder)	112 Paint (Powder)
113 Plastic Components	113 Plastic Components
114 Polypropylene Resin	114 Polypropylene Resin
115 Pumps	115 Pumps
116 Relays	116 Relays
117 Steel	117 Steel
118 Switches	118 Switches
119 Timers/Motors	119 Timers/Motors
120 Wiring Harnesses	120 Wiring Harnesses
121 Misc. Electronics	121 Misc. Electronics
122 Washer Misc. Parts	122 Washer Misc. Parts
123 Dryer Misc. Parts	123 Dryer Misc. Parts
124 Range Misc. Parts	124 Range Misc. Parts
125 Refrigerator Misc. Parts	125 Refrigerator Misc. Parts

Note: Plants use domestic sources unless indicated by M = Mexican supplier.

Table 43

Initial Integration (B4B) - One Hundred Percent Tariff Reduction (B4D) Comparison

	Simulations		<u>Difference</u>	<u>Percentage Change</u>
	<u>B4B</u>	<u>B4D</u>		
Total Demand (Units 000)	24,992.8	24,992.8	0.0	0.000
Total Purch. Cost	4,748,573.3	4,718,697.4	(29,875.9)	(0.629)
Total Mfg. Cost	7,816,161.1	7,810,857.3	(5,303.8)	(0.068)
Total DC Cost	347,993.2	347,993.2	0.0	0.000
Total Trans. Cost	837,073.7	861,645.8	24,572.1	2.935
Total Systems Cost	8,652,028.0	8,646,724.2	(5,303.8)	(0.061)
Transportation Cost				
Inbound Freight	349,200.0	373,772.1	24,572.1	7.037
Internal Freight	145,160.6	145,160.6	0.0	0.000
Customer Freight	342,713.1	342,713.1	0.0	0.000
Total Trans.	837,073.7	861,645.8	24,572.1	2.935
Fixed Cost				
Total Mfg Fixed Cost	1,499,298.6	1,499,298.6	0.0	0.000
Total DC Fixed Cost	15,080.0	15,080.0	0.0	0.000
Total Fixed Cost	1,514,378.6	1,514,378.6	0.0	0.000
Variable Cost				
Total Variable Cost	7,137,649.4	7,132,345.6	(5,303.8)	(0.074)
Variable Cost / Unit(\$)	285.59	285.38	(0.21)	(0.074)

Note: All values stated in thousands of US dollars unless otherwise indicated.

[illegible]

Note: Plants use domestic sources unless indicated by **M** = Mexican supplier.

The Toronto manufacturing plant sources nineteen purchased items domestically and six in Mexico. The Indianapolis manufacturing plant sources fourteen purchased items domestically and eleven in Mexico. Purchase expenditure by supplier location is as follows, Woodstock \$344.3 million (7.3 percent of total purchases), Reynosa \$2,377.9 million (50.2 percent of total purchases), and Fort Wayne \$2,016.6 million (42.6 percent of total purchases).

In simulation B4C total purchases cost is \$4,738.9 million (54.8 percent of total systems cost). Total manufacturing cost is \$7,815.0 million (90.3 percent of total systems cost). Total distribution center cost is \$348.0 million (4.0 percent of total systems cost). Total transportation cost is \$845.6 million (9.8 percent of total systems cost). Total systems cost is \$8,650.8 million. Total systems variable cost per unit is \$285.54.

In comparing simulations B4B and B4C, the fifty percent tariff reduction doubled the number of purchased items sourced in Mexico by the Toronto plant from three to six. This results in a decrease in purchases from the Canadian suppliers of \$29.7 million (7.9 percent). One additional item is sourced in Mexico by the Indianapolis plant over those sourced in simulation B4B. This reduced the amount of purchases from the Fort Wayne suppliers from \$2,052.5

million to \$2,016.6 million, a difference of \$35.9 million (1.7 percent).

The increased number of purchased items sourced in Mexico, along with the fifty percent reduction in tariffs on all foreign sourced items reduced total systems cost by \$1.2 million. This reduced the total systems variable cost per unit by \$0.05.

In simulation B4D the Toronto manufacturing plant sources fifteen purchased items domestically and ten in Mexico. The Indianapolis manufacturing plant sources fourteen purchased items domestically and eleven in Mexico. Purchase expenditure by supplier location is as follows, Woodstock \$194.5 million (4.1 percent of total purchases), Reynosa \$2,507.6 million (53.1 percent of total purchases), and Fort Wayne \$2,016.6 million (42.7 percent of total purchases).

In simulation B4D total purchases cost is \$4,718.7 million (54.6 percent of total systems cost). Total manufacturing cost is \$7,810.9 million (90.3 percent of total systems cost). Total distribution center cost is \$348.0 million (4.0 percent of total systems cost). Total transportation cost is \$861.6 million (10.0 percent of total systems cost). Total systems cost is \$8,646.7 million. Total systems variable cost per unit is \$285.38.

In comparing simulation B4B to B4D, the one hundred percent tariff reduction increases the number of purchased items sourced in Mexico by the Toronto plant from three to ten. This results in a decrease in purchases with the Canadian suppliers from \$374.0 million to \$194.5 million, a difference of \$179.5 million (48.0 percent). One additional item is sourced in Mexico by the Indianapolis plant over those sourced in simulation B4B. This reduced the amount of purchases from the Fort Wayne suppliers from \$2,052.5 million to \$2,016.6 million, a difference of \$35.9 million (1.7 percent).

The increased number of purchased items sourced in Mexico, along with the one hundred percent reduction in tariffs on all foreign sourced items reduced total systems cost by \$5.3 million. This reduced the total systems variable cost per unit by \$0.21.

The reason for the greater increase in the number of Mexican sourced items by the Toronto plant compared to the Indianapolis plant is that only two of the twenty-five purchased items are subject to United States' tariffs when imported from Mexico. From the perspective of the Indianapolis plant, the reduction in tariffs reduced the total cost of Mexican fasteners and steel only. The tariff reduction did lead the Indianapolis plant to source fasteners from the Mexican supplier.

The results of simulations B4C and B4D indicate that decreases in tariff rates increase the level of Mexican sourcing activity. This results in a reduction in the firm's expenditure for purchased items. In the case of the one hundred percent tariff reduction, total purchase expenditure decreases by \$29.9 million. A large percentage of this reduction is offset, however, by the \$24.6 million increase in inbound freight costs.

Cross-Border Transaction Costs

Simulations B4E and B4F address reductions in cross-border transaction costs. Foreign sourcing of purchased items is permitted. Full tariffs and base levels for finished product demand are in effect.

Simulation B4E assumes a twenty-five percent reduction in cross-border transaction costs. Simulation B4F assumes a fifty percent reduction in cross-border transaction costs. A summary of the results of simulations B4E and B4F are presented in Tables 44 and 45, respectively.

Table 44

**Initial Integration (B4B) - Twenty-five Percent Reduction In
Cross-Border Transaction Costs (B4E) Comparison**

	<u>Simulations</u>		<u>Difference</u>	<u>Percentage Change</u>
	<u>B4B</u>	<u>B4E</u>		
Total Demand (Units 000)	24,992.8	24,992.8	0.0	0.000
Total Purch. Cost	4,748,573.3	4,689,278.1	(59,295.2)	(1.249)
Total Mfg. Cost	7,816,161.1	7,755,171.2	(60,989.9)	(0.780)
Total DC Cost	347,993.2	347,993.2	0.0	0.000
Total Trans. Cost	837,073.7	835,379.0	(1,694.7)	(0.202)
Total Systems Cost	8,652,028.0	8,591,038.1	(60,989.9)	(0.705)
Transportation Cost				
Inbound Freight	349,200.0	347,505.3	(1,694.7)	(0.485)
Internal Freight	145,160.6	145,160.6	0.0	0.000
Customer Freight	342,713.1	342,713.1	0.0	0.000
Total Trans.	837,073.7	835,379.0	(1,694.7)	(0.202)
Fixed Cost				
Total Mfg Fixed Cost	1,499,298.6	1,499,298.6	0.0	0.000
Total DC Fixed Cost	15,080.0	15,080.0	0.0	0.000
Total Fixed Cost	1,514,378.6	1,514,378.6	0.0	0.000
Variable Cost				
Total Variable Cost	7,137,649.4	7,076,659.5	(60,989.9)	(0.854)
Variable Cost / Unit(\$)	285.59	283.15	(2.44)	(0.854)

Note: All values stated in thousands of US dollars unless otherwise indicated.

Table 44 (cont'd.)

Purchased Item Source Location	
Canadian Plant	Indianapolis Plant
<u>No.</u>	<u>No.</u>
<u>Description</u>	<u>Description</u>
101 Aluminum Components	101 Aluminum Components M
102 Belts	102 Belts M
103 Compressors	103 Compressors
104 Copper Components	104 Copper Components
105 Cord Sets	105 Cord Sets M
106 Corrugated Packaging	106 Corrugated Packaging
107 Fasteners	107 Fasteners M
108 Door Gaskets	108 Door Gaskets M
109 Knobs	109 Knobs
110 1 Speed Motors	110 1 Speed Motors
111 2 Speed Motors	111 2 Speed Motors
112 Paint (Powder)	112 Paint (Powder)
113 Plastic Components	113 Plastic Components M
114 Polypropylene Resin	114 Polypropylene Resin
115 Pumps	115 Pumps M
116 Relays	116 Relays M
117 Steel	117 Steel
118 Switches	118 Switches M
119 Timers/Motors	119 Timers/Motors
120 Wiring Harnesses	120 Wiring Harnesses M
121 Misc. Electronics	121 Misc. Electronics
122 Washer Misc. Parts	122 Washer Misc. Parts M
123 Dryer Misc. Parts	123 Dryer Misc. Parts M
124 Range Misc. Parts	124 Range Misc. Parts M
125 Refrigerator Misc. Parts	125 Refrigerator Misc. Parts M

Note: Plants use domestic sources unless indicated by M = Mexican supplier.

Table 45

**Initial Integration (B4B) - Fifty Percent Reduction In
Cross-Border Transaction Costs (B4F) Comparison**

	<u>Simulations</u>		<u>Difference</u>	<u>Percentage Change</u>
	<u>B4B</u>	<u>B4F</u>		
Total Demand (Units 000)	24,992.8	24,992.8	0.0	0.000
Total Purch. Cost	4,748,573.3	4,634,758.8	(113,814.5)	(2.397)
Total Mfg. Cost	7,816,161.1	7,672,139.3	(144,021.8)	(1.843)
Total DC Cost	347,993.2	347,993.2	0.0	0.000
Total Trans. Cost	837,073.7	806,866.5	(30,207.2)	(3.609)
Total Systems Cost	8,652,028.0	8,508,006.2	(144,021.8)	(1.665)
Transportation Cost				
Inbound Freight	349,200.0	318,992.8	(30,207.2)	(8.650)
Internal Freight	145,160.6	145,160.6	0.0	0.000
Customer Freight	342,713.1	342,713.1	0.0	0.000
Total Trans.	837,073.7	806,866.5	(30,207.2)	(3.609)
Fixed Cost				
Total Mfg Fixed Cost	1,499,298.6	1,499,298.6	0.0	0.000
Total DC Fixed Cost	15,080.0	15,080.0	0.0	0.000
Total Fixed Cost	1,514,378.6	1,514,378.6	0.0	0.000
Variable Cost				
Total Variable Cost	7,137,649.4	6,993,627.6	(144,021.8)	(2.018)
Variable Cost / Unit(\$)	285.59	279.83	(5.76)	(2.018)

Note: All values stated in thousands of US dollars unless otherwise indicated.

Table 45 (cont'd.)

Purchased Item Source Location	
Canadian Plant	Indianapolis Plant
<u>No.</u>	<u>No.</u>
<u>Description</u>	<u>Description</u>
101 Aluminum Components	101 Aluminum Components
102 Belts	102 Belts
103 Compressors	103 Compressors
104 Copper Components	104 Copper Components
105 Cord Sets	105 Cord Sets
106 Corrugated Packaging	106 Corrugated Packaging
107 Fasteners	107 Fasteners
108 Door Gaskets	108 Door Gaskets
109 Knobs	109 Knobs
110 1 Speed Motors	110 1 Speed Motors
111 2 Speed Motors	111 2 Speed Motors
112 Paint (Powder)	112 Paint (Powder)
113 Plastic Components	113 Plastic Components
114 Polypropylene Resin	114 Polypropylene Resin
115 Pumps	115 Pumps
116 Relays	116 Relays
117 Steel	117 Steel
118 Switches	118 Switches
119 Timers/Motors	119 Timers/Motors
120 Wiring Harnesses	120 Wiring Harnesses
121 Misc. Electronics	121 Misc. Electronics
122 Washer Misc. Parts	122 Washer Misc. Parts
123 Dryer Misc. Parts	123 Dryer Misc. Parts
124 Range Misc. Parts	124 Range Misc. Parts
125 Refrigerator Misc. Parts	125 Refrigerator Misc. Parts

Note: Plants use domestic sources unless indicated by M = Mexican supplier.

In simulation B4E the Toronto manufacturing plant sources twenty purchased items domestically and five in Mexico. The Indianapolis manufacturing plant sources nine purchased items domestically and sixteen in Mexico. Purchase expenditure by supplier location is as follows, Woodstock \$368.4 million (7.9 percent of total purchases), Reynosa \$2,958.5 million (63.1 percent of total purchases), and Fort Wayne \$1,362.3 million (29.1 percent of total purchases).

Simulation B4E total purchases cost is \$4,689.3 million (54.6 percent of total systems cost). Total manufacturing cost is \$7,755.2 million (90.3 percent of total systems cost). Total distribution center cost is \$348.0 million (4.0 percent of total systems cost). Total transportation cost is \$835.4 million (9.7 percent of total systems cost). Total systems cost is \$8,591.0 million. Total systems variable cost per unit is \$283.15.

In comparing simulation B4B to B4E, the twenty-five percent tariff reduction in cross-border transaction costs increases the number of purchased items sourced in Mexico by the Toronto plant from three to five. This results in a decrease in purchases from the Canadian suppliers from \$374.0 million to \$368.4 million, a difference of \$5.6 million (1.5 percent). Six additional purchased items are sourced in Mexico by the Indianapolis plant over those sourced in simulation B4B. This reduces the amount of

purchases from the Fort Wayne suppliers from \$2,052.5 million to \$1,362.3 million, a difference of \$690.2 million (33.6 percent).

The increased number of purchased items sourced in Mexico, along with the twenty-five percent reduction in cross-border transaction costs on all foreign sourced items reduced total systems cost by \$61.0 million. On a total systems variable cost basis this reduced the average variable cost per unit by \$2.44.

In simulation B4F the Toronto manufacturing plant sources eighteen purchased items domestically and seven in Mexico. The Indianapolis manufacturing plant sources six purchased items domestically and nineteen in Mexico. Purchase expenditure by supplier location is as follows, Woodstock \$344.3 million (7.4 percent of total purchases), Reynosa \$3,508.5 million (75.7 percent of total purchases), and Fort Wayne \$782.0 million (16.9 percent of total purchases).

Simulation B4F total purchases cost is \$4,634.8 million (54.5 percent of total systems cost). Total manufacturing cost is \$7,672.1 million (90.2 percent of total systems cost). Total distribution center cost is \$348.0 million (4.1 percent of total systems cost). Total transportation cost is \$806.9 million (9.5 percent of total systems cost).



Total systems cost is \$8,508.0 million. Total systems variable cost per unit is \$279.83.

In comparing simulation B4B to B4F, the fifty percent reduction in cross-border transaction costs increases the number of purchased items sourced in Mexico by the Toronto plant from three to seven. This results in a decrease in purchases from the Canadian suppliers from \$374.0 million to \$344.3 million, a difference of \$29.7 million (7.9 percent).

As for the Indianapolis plant, the reduction in cross-border transaction cost leads to all but six of the purchased items being sourced in Mexico. This reduces the amount of purchases from the Fort Wayne suppliers from \$2,052.5 million to \$782.0 million, a difference of \$1,270.5 million (61.9 percent).

The major shift from the United States to Mexican suppliers that resulted from the fifty percent reduction in cross-border transaction costs reduced total systems cost by \$144.0 million. On a total systems variable cost basis this reduced the average variable cost per unit by \$5.76.

The reductions in cross-border transaction costs have a limited effect on the level of foreign sourcing by the Toronto plant. The effect was much greater for the Indianapolis plant. The reason, which was discussed in the

previous section on tariff reduction, is that the majority of the purchased items enter the United States duty free.

The majority of purchased items entering Canada from Mexico are subject to tariff. Although cross-border transaction costs are reduced, full tariffs are still in effect. The reductions in cross-border transaction costs examined do not lower the total cost of Mexican purchased items high enough to make them more favorable than the Canadian supplier options in most cases.

Partial Implementation

Simulation B4G assumes a fifty percent reduction in tariffs and a twenty-five percent reduction in cross-border transaction costs. Base demand levels are in effect. The levels of independent variables used for this simulation represent the environment faced by the firm under partial implementation of a North American Free Trade Agreement. Foreign sourcing of purchased items is permitted. A summary of the results of simulation B4B and B4G are presented in Table 46.

Table 46

Initial Integration (B4B) - Partial Implementation (B4G) Comparison

	Simulations		<u>Difference</u>	<u>Change</u>
	<u>B4B</u>	<u>B4G</u>		
Total Demand (Units 000)	24,992.8	24,992.8	0.0	0.000
Total Purch. Cost	4,748,573.3	4,675,724.3	(72,849.0)	(1.534)
Total Mfg. Cost	7,816,161.1	7,752,168.9	(63,992.2)	(0.819)
Total DC Cost	347,993.2	347,993.2	0.0	0.000
Total Trans. Cost	837,073.7	845,930.5	8,856.8	1.058
Total Systems Cos	8,652,028.0	8,588,035.8	(63,992.2)	(0.740)
Transportation Cost				
Inbound Freight	349,200.0	358,056.8	8,856.8	2.536
Internal Freight	145,160.6	145,160.6	0.0	0.000
Customer Freight	342,713.1	342,713.1	0.0	0.000
Total Trans.	837,073.7	845,930.5	8,856.8	1.058
Fixed Cost				
Total Mfg Fixed Cost	1,499,298.6	1,499,298.6	0.0	0.000
Total DC Fixed Cost	15,080.0	15,080.0	0.0	0.000
Total Fixed Cost	1,514,378.6	1,514,378.6	0.0	0.000
Variable Cost				
Total Variable Cost	7,137,649.4	7,073,657.2	(63,992.2)	(0.897)
Variable Cost / Unit(\$)	285.59	283.03	(2.56)	(0.897)

Note: All values stated in thousands of US dollars unless otherwise indicated.

Table 46 (cont'd.)

Purchased Item	Source Location
Canadian Plant	
No.	Description
101 Aluminum Components	M
102 Belts	M
103 Compressors	
104 Copper Components	
105 Cord Sets	M
106 Corrugated Packaging	
107 Fasteners	M
108 Door Gaskets	
109 Knobs	
110 1 Speed Motors	
111 2 Speed Motors	
112 Paint (Powder)	
113 Plastic Components	M
114 Polypropylene Resin	
115 Pumps	M
116 Relays	M
117 Steel	
118 Switches	
119 Timers/Motors	
120 Wiring Harnesses	M
121 Misc. Electronics	
122 Washer Misc. Parts	
123 Dryer Misc. Parts	M
124 Range Misc. Parts	
125 Refrigerator Misc. Parts	M
Indianapolis Plant	
No.	Description
101 Aluminum Components	M
102 Belts	M
103 Compressors	
104 Copper Components	
105 Cord Sets	M
106 Corrugated Packaging	
107 Fasteners	M
108 Door Gaskets	
109 Knobs	
110 1 Speed Motors	
111 2 Speed Motors	
112 Paint (Powder)	
113 Plastic Components	M
114 Polypropylene Resin	
115 Pumps	M
116 Relays	M
117 Steel	
118 Switches	
119 Timers/Motors	
120 Wiring Harnesses	M
121 Misc. Electronics	
122 Washer Misc. Parts	
123 Dryer Misc. Parts	M
124 Range Misc. Parts	
125 Refrigerator Misc. Parts	M

Note: Plants use domestic sources unless indicated by **M** = Mexican supplier.

In simulation B4G the Toronto manufacturing plant sources sixteen purchased items domestically and nine in Mexico. The Indianapolis manufacturing plant sources nine purchased items domestically and sixteen in Mexico. Purchase expenditure by supplier location is as follows, Woodstock \$274.8 million (5.9 percent of total purchases), Reynosa \$3,038.6 million (65.0 percent of total purchases), and Fort Wayne \$1,362.3 million (29.1 percent of total purchases).

B4G total purchases cost is \$4,675.7 million (54.4 percent of total systems cost). Total manufacturing cost is \$7,752.2 million (90.3 percent of total systems cost). Total distribution center cost is \$348.0 million (4.1 percent of total systems cost). Total transportation cost is \$845.9 million (9.9 percent of total systems cost). Total systems cost is \$8,588.0 million. Total systems variable cost per unit is \$283.03.

In comparing simulation B4B to B4G, the twenty-five percent reduction in cross-border transaction costs and fifty percent reduction in tariffs increases the number of purchased items sourced in Mexico by the Toronto plant from three to nine. This results in a decrease in purchases from the Canadian suppliers from \$374.0 million to \$274.8 million, a difference of \$99.2 million (26.5 percent).

As for the Indianapolis plant, the reduction in cross-border transaction costs and tariffs increases the number of purchased items sourced in Mexico from ten to sixteen. This reduces the amount of purchases from the Fort Wayne suppliers from \$2,052.5 million to \$1,362.3 million, a difference of \$690.2 million (33.6 percent).

The shift by the Toronto and Indianapolis manufacturing plants from the Canadian and United States suppliers to Mexican suppliers associated with the "partial implementation" levels of cross-border transaction costs and tariff variables reduced total systems cost by \$64.0 million. On a total systems variable cost basis this reduced the average variable cost per unit by \$2.56.

Most Likely Case

Simulation B4H represents the "most likely" future environment. Independent variable settings are as follows, a five percent increase in Canadian demand and a twenty-five percent increase in Mexican demand, zero tariffs, and a fifty percent reduction in cross-border transaction costs. The results of simulation B4H along with the initial integration simulation run B4B are presented in Table 47.

Table 47
Initial Integration (B4B) - Most Likely (B4H) Comparison

	<u>Simulations</u>		<u>Difference</u>	<u>Percentage Change</u>
	<u>B4B</u>	<u>B4H</u>		
Demand (Units 000)	24,992.8	25,116.5	123.7	0.495
Total Purch. Cost	4,748,573.3	4,624,753.8	(123,819.5)	(2.608)
Total Mfg. Cost	7,816,161.1	7,685,475.0	(130,686.1)	(1.672)
Total DC Cost	347,993.2	349,585.3	1,592.1	0.458
Total Trans. Cost	837,073.7	826,838.9	(10,234.8)	(1.223)
Total Systems Cost	8,652,028.0	8,524,744.5	(127,283.5)	(1.471)
Transportation Cost				
Inbound Freight	349,200.0	337,154.7	(12,045.3)	(3.449)
Internal Freight	145,160.6	145,960.3	799.7	0.551
Customer Freight	342,713.1	343,723.9	1,010.8	0.295
Total Trans.	837,073.7	826,838.9	(10,234.8)	(1.223)
Fixed Cost				
Total Mfg Fixed Cost	1,499,298.6	1,499,298.6	0.0	0.000
Total DC Fixed Cost	15,080.0	15,080.0	0.0	0.000
Total Fixed Cost	1,514,378.6	1,514,378.6	0.0	0.000
Variable Cost				
Total Variable Cost	7,137,649.4	7,010,365.9	(127,283.5)	(1.783)
Variable Cost / Unit(\$)	285.59	279.11	(6.47)	(2.267)

Note: All values stated in thousands of US dollars unless otherwise indicated.

Table 47 (cont'd.)

Purchased Item Source Location

Canadian Plant		Indianapolis Plant	
No.	Description	No.	Description
101	Aluminum Components	101	Aluminum Components
102	Belts	102	Belts
103	Compressors	103	Compressors
104	Copper Components	104	Copper Components
105	Cord Sets	105	Cord Sets
106	Corrugated Packaging	106	Corrugated Packaging
107	Fasteners	107	Fasteners
108	Door Gaskets	108	Door Gaskets
109	Knobs	109	Knobs
110	1 Speed Motors	110	1 Speed Motors
111	2 Speed Motors	111	2 Speed Motors
112	Paint (Powder)	112	Paint (Powder)
113	Plastic Components	113	Plastic Components
114	Polypropylene Resin	114	Polypropylene Resin
115	Pumps	115	Pumps
116	Relays	116	Relays
117	Steel	117	Steel
118	Switches	118	Switches
119	Timers/Motors	119	Timers/Motors
120	Wiring Harnesses	120	Wiring Harnesses
121	Misc. Electronics	121	Misc. Electronics
122	Washer Misc. Parts	122	Washer Misc. Parts
123	Dryer Misc. Parts	123	Dryer Misc. Parts
124	Range Misc. Parts	124	Range Misc. Parts
125	Refrigerator Misc. Parts	125	Refrigerator Misc. Parts

Note: Plants use domestic sources unless indicated by M = Mexican supplier.

In simulation B4H the sourcing pattern for both the Toronto and Indianapolis manufacturing plants are identical. Both plants source six purchased items domestically and nineteen in Mexico. Purchase expenditure by supplier location is as follows, Woodstock \$70.4 million (1.5 percent of total purchases), Reynosa \$3,772.4 million (81.6 percent of total purchases), and Fort Wayne \$782.0 million (16.9 percent of total purchases).

Total purchases cost is \$4,624.8 million (54.3 percent of total systems cost). Total manufacturing cost is \$7,685.5 million (90.2 percent of total systems cost). Total distribution center cost is \$349.6 million (4.1 percent of total systems cost). Total transportation cost is \$826.8 million (9.7 percent of total systems cost). Total systems cost is \$8,524.7 million. Total systems variable cost per unit is \$279.11.

In comparing simulation B4B to B4H, the fifty percent reduction in cross-border transaction costs and one hundred percent reduction in tariffs increases the number of purchased items sourced in Mexico by the Toronto plant from three to nineteen. This results in a decrease in purchases from the Canadian suppliers from \$374.0 million to \$70.4 million, a difference of \$303.6 million (81.2 percent).

As for the Indianapolis plant, the reduction in cross-border transaction costs and tariffs increases the number of purchased items sourced in Mexico from ten to nineteen. This reduces the amount of purchases from the Fort Wayne suppliers from \$2,052.5 million to \$782.0 million, a difference of \$1,270.5 million (61.9 percent).

When compared to simulation B4B, simulation B4H presents a reduction of total systems cost of \$127.3 million or appropriately 1.5 percent. This reduction takes place even though volume increased by 123,700 units. On a total systems variable cost basis this results in a reduction of \$6.47 per unit or approximately 2.3 percent.

RESEARCH QUESTION B5 - PURCHASED ITEM CHARACTERISTICS

Research question B5 asks how do changes in the levels of the independent variables for tariffs and cross-border transaction costs affect purchased item groups which were established on the basis of purchased item price, labor content, and transportation cost characteristics. Additional simulations were not required to address this research question. The results of the eight simulations conducted for research question B4 were analyzed in terms of the purchased item characteristics of interest. The objective of this analysis is to identify the effects of changes in the levels of the independent variables for tariffs and cross-border transaction costs on purchase groups which were developed on the basis of the purchased item characteristics of price, labor content, and transportation cost. The process used to develop the purchased item groups is discussed in Chapter 3.

As discussed earlier in Research Question 4 results, no foreign sourcing occurs between the United States and Canada in any case and at no time does the Mexican manufacturing plant use foreign suppliers. Therefore, any changes in sourcing pattern that occur relate to purchased items which are sourced in either Canada or the United States in the separate country simulation (4A) shifting to the Mexican suppliers when foreign sourcing is allowed. The following

discussion focuses on changes in purchased item sources between Canada or the United States and Mexico.

Table 48 presents the number of purchased items by classification group that are sourced in the United States and Canada for the Research Question 4 simulations.

Table 48

**Number Of Purchase Items Sourced In United States and Canada
By Classification Groups**

Source Country / Category	Simulation Number / Number Of Purchased Items In Category							
<u>Canada</u>	<u>4A</u>	<u>4B</u>	<u>4C</u>	<u>4D</u>	<u>4E</u>	<u>4F</u>	<u>4G</u>	<u>4H</u>
HHH:	3	3	3	1	3	3	2	0
HHL:	4	2	2	0	2	1	0	0
HLH:	3	3	3	3	3	3	3	0
HLL:	3	3	3	3	3	3	3	0
LHH:	4	4	2	2	3	2	2	1
LHL:	2	1	1	0	0	0	0	0
LLH:	3	3	3	3	3	3	3	3
LLL:	3	3	3	3	3	3	3	2
<u>U.S.</u>								
HHH:	3	0	0	0	0	0	0	0
HHL:	4	0	0	0	0	0	0	0
HLH:	3	3	3	3	3	0	3	0
HLL:	3	3	3	3	0	0	0	0
LHH:	4	3	2	2	1	1	1	1
LHL:	2	0	0	0	0	0	0	0
LLH:	3	3	3	3	3	3	3	3
LLL:	3	3	3	3	2	2	2	2

Notes:

Classification abbreviations are presented in the following sequence: purchased item price, labor content, and transportation cost where H indicates High and L indicates Low (e.g. HLH indicates high price, low labor content, and high transportation cost). Key to simulations is as follows:

- 4A Separate Countries,
- 4B Initial Integration,
- 4C 50% Tariff Reduction,
- 4D 100% Tariff Reduction,
- 4E 25% Reduction In Cross-Border Transaction Costs
- 4F 50% Reduction In Cross-Border Transaction Costs
- 4G Partial Implementation Of NAFTA
- 4H Most Likely Case

Simulation 4A presents the separate country scenario where all manufacturing plants are required to source all purchased items domestically. Simulation 4B indicates once manufacturing plants have the option of foreign sourcing both the Canadian and United States manufacturing plants source some of their purchased items in Mexico regardless of tariff and cross-border transaction costs treatment.

In reviewing which purchased item classification groups continue to be sourced in Canada and the United States and those which are sourced in Mexico the following observations were made. First, in all cases, purchased items in high labor content and low transportation cost groups are most frequently sourced in Mexico, regardless of the level of purchased item price. Second, purchased items in the high price, high labor content, and high transportation cost group are the next most frequently sourced in Mexico. Third, purchased items in the low price, low labor content, and high transportation cost group are never sourced in Mexico. Four, purchased items in the low price, low labor content, and low transportation cost group are second least frequently sourced in Mexico.

Under the most likely simulation (4H) which includes zero tariffs and a fifty percent reduction in cross-border transaction costs the sourcing patterns for the United States and Canadian manufacturing plants are identical.

Only six purchased items are sourced in the United States and Canada. Five of the six purchased items are from the low price and low direct labor content groups. The other purchased item is a member of the low price, high labor content, and high transportation cost group.

A chi-square goodness of fit test was used to determine if changes in sourcing patterns were statistically significant. In order to perform this test the purchased items were regrouped on the basis of labor content and transportation cost only. The reason for this approach is that classification on the basis of the three characteristics discussed earlier results in cell sizes that fail to meet the chi-square test requirement that no more than twenty percent of the cells have expected values less than five (Weiss and Hassett 1987). Given the number of purchased items and initial classification scheme all cells have expected values less than five.

Prior to using the chi-square test a key assumption must be made. The assumption is that the simulation results tested represent a large, random sample of sourcing patterns for firms operating in the North American household appliance industry.

The chi-square test was first used to compare distribution of purchased items sourced within each country for the

separate country or domestic sourcing approach (Simulation 4A) to the initial integration case (Simulation 4B). The results of this test indicated that the changes in the sourcing patterns were statistically significant.

All other chi-square tests used the initial integration (Simulation 4B) results as the basis for the expected values and compared them to the results of Simulations 4C through 4H. These tests indicated that only in one of these comparisons were the changes in sourcing pattern statistically significant at the $p=0.05$ level. The change in sourcing patterns between the initial integration (Simulation B4B) and the most likely case (Simulation B4H) was statistically significant. Chi-square goodness of fit test results are presented in Table 49.

Table 49

Chi-Square Goodness Of Fit Test Results

Source Country / Category	Simulation Number / Number Of Purchased Items In Category							
<u>Canada</u>	<u>4A</u>	<u>4B</u>	<u>4C</u>	<u>4D</u>	<u>4E</u>	<u>4F</u>	<u>4G</u>	<u>4H</u>
HH:	7	7	5	3	6	5	4	1
HL:	6	3	2	0	2	1	0	0
LH:	6	6	6	6	6	6	6	3
LL:	6	6	6	6	6	6	6	2
<u>U.S.</u>								
HH:	7	3	2	2	1	1	1	1
HL:	6	0	0	0	0	0	0	0
LH:	6	6	6	6	6	3	6	3
LL:	6	6	6	6	2	2	2	2
<u>Mexico</u>								
HH:	7	11	14	16	14	15	16	19
HL:	6	15	16	18	16	17	18	18
LH:	6	6	6	6	6	9	6	12
LL:	6	6	6	6	10	10	10	14
X ²		2.52		8.03		13.82		
	25.57		8.49		13.29		40.89	

$$X^2 = 19.675$$

(0.05, 11)

Notes:

The first letter in classification group abbreviation indicates labor content level and the second letter indicates transportation cost level. H indicates High. L indicates Low. Key to simulations are as follows:

- 4A Separate Countries
- 4B Initial Integration
- 4C 50% Tariff Reduction
- 4D 100% Tariff Reduction
- 4E 25% Reduction In Cross-Border Transaction Costs
- 4F 50% Reduction In Cross-Border Transaction Costs
- 4G Partial Implementation Of NAFTA
- 4H Most Likely Case

The chi-square tests indicated that the changes in sourcing patterns were statistically significant in two of the comparisons considered. However, it should be noted that shifts in the sourcing pattern of practical significance occur in all of the Research Question 4 simulations. If only one purchased item moves from the Canadian or United States supplier to Mexico this event may be a highly significant from the perspective of the buying firm and all suppliers involved.

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CHAPTER 6 - SUMMARY OF RESULTS, CONCLUSIONS, IMPLICATIONS,
AND LIMITATIONS

INTRODUCTION

SUPPLIER, MANUFACTURING, AND DISTRIBUTION NETWORK LOCATION
CHANGES DUE TO THE TOTAL COST EFFECTS OF THE UNITED STATES-
CANADA AND NORTH AMERICAN FREE TRADE AGREEMENTS

section presents the summary of the research. The second section

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conclusions based on the research. By the third section

section addresses the research. The fourth section

academic, managerial, and policy implications. The fourth section

The fourth section addresses the research. The fifth section

research.

Ernest Lindley Nichols, Jr.

Volume II

By

A DISSERTATION

Submitted to
Michigan State University
United States partial fulfillment of the requirements
for the degree of
in Appendix F and G. The research presented in this section presents a
summary of all similar

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CHAPTER 6 - SUMMARY OF RESULTS, CONCLUSIONS, IMPLICATIONS, AND LIMITATIONS

INTRODUCTION

Chapter 6 presents a summary of the results, conclusions, implications, and limitations of the research. The first section presents the summary of results. The second section presents conclusions by research question and general conclusions based on the overall research. The third section addresses the implications of this study from academic, managerial, and governmental policy perspectives. The fourth section addresses the limitations of the research.

SUMMARY OF RESULTS

In this section the results of the simulations conducted for the study are summarized. The results are presented in detail in Chapter 5. Results are presented at a detailed level by individual simulation conducted to address the United States-Canada and North American research questions in Appendix F and G, respectively. Table 50 presents a summary of all simulation conducted.

Table 50

Summary of Simulation Results

North American Simulations

United States-Canada Simulations

No.	Simulation Description	Simulation Expenditure (US\$ Millions)	Total Systems Cost (US\$ Millions)	Average Variable Cost (US\$/Unit)	Net Profits (US\$ Millions)
No.	Description	Expenditure (US\$ Millions)	Total Systems Cost (US\$ Millions)	Average Variable Cost (US\$/Unit)	Net Profits (US\$ Millions)
A1A	Separate Countries	5,071.4	8,678.1	288.13	502.8
A1B	Initial Integration	5,071.2	8,681.0	288.24	500.0
A2A	Most Likely Case	5,089.4	8,698.4	287.82	517.9
A3A	5% Increase In Canadian Demand	5,090.8	8,709.0	288.23	507.4
A3B	10% Increase In Canadian Demand	5,110.5	8,736.9	288.22	514.8
A3C	50% Tariff Reduction	5,071.0	8,679.4	288.18	501.6
A3D	100% Tariff Reduction	5,069.8	8,671.8	287.87	509.2
A3E	25% Reduction In Cross-Border Transaction Costs	5,071.2	8,681.0	288.24	500.0
A3F	50% Reduction In Cross-Border Transaction Costs	5,071.2	8,680.9	288.23	500.1
A3F	75% Reduction In Cross-Border Transaction Costs	5,071.2	8,680.9	288.23	500.1

Table 50 (cont'd.)

North American Simulations

- Sourcing Series

No.	Simulation Description	Purchase Expenditure (US\$ Millions)	Total Systems Cost (US\$ Millions)	Average Variable Cost (US\$/Unit)	Net Profits (US\$ Millions)
B1A	Separate Countries	5,092.3	8,704.1	287.67	518.8
B1B	Initial Integration	4,533.9	7,452.0	237.59	1,770.9
B2A	Most Likely Case	4,556.5	7,324.0	231.35	1,944.7
B3A	5% Increase In Canadian Demand/ 25% Increase In Mexican Demand	4,556.5	7,483.4	237.67	1,785.3
B3B	10% Increase In Canadian Demand/ 50% Increase In Mexican Demand	4,579.7	7,515.5	237.73	1,800.3
B3C	50% Tariff Reduction	4,533.9	7,428.9	236.66	1,794.1
B3D	100% Tariff Reduction	4,533.9	7,405.7	235.74	1,817.3
B3E	25% Reduction In Cross-Border Transaction Costs	4,533.9	7,425.3	236.52	1,799.5
B3F	50% Reduction In Cross-Border Transaction Costs	4,533.9	7,398.5	235.45	1,824.4

Table 50 (cont'd.)

North American Simulations - Sourcing Series

No.	Simulation Description	Purchase Expenditure (US\$ Millions)	Total Systems Cost (US\$ Millions)	Average Variable Cost (US\$/Unit)	Net Profits (US\$ Millions)
B4A	Separate Countries	5,092.3	8,702.4	287.60	520.6
B4B	Initial Integration	4,748.6	8,652.0	285.59	570.9
B4C	50% Tariff Reduction	4,738.9	8,650.8	285.54	572.1
B4D	100% Tariff Reduction	4,718.7	8,646.7	285.38	576.2
B4E	25% Reduction In Cross-Border Transaction Costs	4,689.3	8,591.0	283.15	631.9
B4F	50% Reduction In Cross-Border Transaction Costs	4,634.8	8,508.0	279.83	714.9
B4G	Partial Implementation	4,675.7	8,588.0	283.03	634.9
B4H	Most Likely Case	4,624.8	8,524.7	279.11	744.0

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SUMMARY

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A summary of the results of the simulations conducted to address the United States-Canada and North American research questions follows. The reader must recognize that the results of a study of this type are highly data specific. Changes in key data can lead to significantly different results. Therefore, it is necessary to preface any discussion of results with the statement that all results are contingent on the specific data used in conducting the study.

SUMMARY OF UNITED STATES-CANADA RESULTS

Changes in the United States-Canada economic environment associated with the implementation of the United States-Canada Free Trade Agreement have a relatively minor effect on the facilities utilized and total systems cost. The relatively minor changes in total systems cost result from the fact that in this research although the United States manufacturing plant and suppliers offer finished products and purchased items at prices that are lower than the Canadian options, the differences are quite small. United States finished product prices are on average 1.6 percent lower than those manufactured in Canada. United States purchased item prices are on average approximately one percent lower than those provided by Canadian suppliers. Although the United States-Canada Free Trade Agreement reduces tariff and non-tariff barriers as represented by

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cross-border transaction costs, these changes are not large enough to result in major increases in cross-border activity. Furthermore, the increases in cross-border activity that do occur are not of a large enough magnitude to have a major impact on total systems costs.

The separate country simulation (A1A) provides a starting point for the analysis. In this simulation United States and Canadian operations are completely independent of each other. No cross-border transactions are permitted at any level. The separate country simulation resulted in a total systems cost of \$8,7678.1 million and an average variable cost per unit of \$288.13.

In the initial integration simulation (A1B) the firm takes an integrated perspective toward its United States and Canadian operations. Cross-border transactions are permitted at all levels within the system. Full tariff and cross-border transaction costs are in effect. This simulation resulted in minor changes in facilities utilized and total systems cost. The only cross-border transactions that occur are that the Canadian distribution centers in Edmonton and Moncton sourced dryers from the United States manufacturing plant located in Indianapolis. Total systems cost was \$8,681 million. The reason for the increase in total systems costs is the result of the sort-down solution approach. This situation is discussed in detail in the

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United States-Canada initial integration section in Chapter 5. Canada, no changes will occur here as the increases in demand are allocated across market areas based on the The reason that dryers are shipped to the Moncton and Edmonton distribution centers is that dryers entering Canada from the United States are not subject to tariff. When full tariffs, which average 12.5 percent of the finished product price, are in effect no cross-border activity takes place for any of the finished products except dryers. one hundred percent reduction. Increases in Canadian demand for finished products of five and ten percent were examined in simulations A3A and A3B. These increases have no effect on the configuration of distribution center facilities and when viewed from a variable cost per unit perspective have virtually no effect on systems costs. provided by the The ten percent increase in Canadian demand represents approximately 195,600 additional units demanded by the Canadian market areas. This increase is not large enough to alter the distribution center configuration. Given the fixed number of distribution centers within the United States-Canada network (i.e., nine distribution center facilities) and existing Canadian distribution center locations, the increases in demand are not large enough to cause the system to remove a United States facility and replace it with an additional Canadian distribution center.

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As for changes in distribution center locations within Canada, no changes will occur here as the increases in demand are allocated across market areas based on the existing market area demand percentages. Any increases in demand will merely raise demand in all market areas in a linear manner. (See the market area section in Chapter 4 for additional explanation.)

In simulations A3C and A3D tariffs are reduced by fifty and one hundred percent respectively. These tariff reductions affect the firm's operations in terms of both supply chain structure and total systems costs. As tariffs are reduced from a full tariff level by fifty and then by one hundred percent several changes occur including 1) a reduction in the number of Canadian distribution centers from three to two, 2) an increase in the number of finished products provided by the United States manufacturing plant to Canadian distribution centers, 3) market areas being serviced by foreign distribution centers, and 4) a reduction in total systems cost of \$1.6 million in simulation A3C and \$9.0 million in simulation A3D.

The reduction in total systems cost associated with simulation A3C when compared to simulation A1B is not directly attributable to a reduction in tariffs as no tariff costs are incurred in simulation A1B. In simulation A1B the only finished products moving between the United States and

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Canada are dryers which are not subject to tariff. In simulation A3C approximately \$1.7 million in tariffs costs are incurred. center relative to market areas becomes increasingly important because the small differences in In simulation A3D total systems cost is reduced by \$9.0 million when compared to simulation A1B. Approximately \$1.7 million of this reduction in total systems cost is the result of the complete removal of tariffs. In the case of the Worcester distribution center, simulations where When tariffs are reduced the Indianapolis and Toronto manufacturing plants differ only slightly in terms of the cost of finished products from the perspective of distribution center locations. United States manufactured finished products are on average 1.6 percent less costly than Canadian manufactured products. Which manufacturing plant can supply a specific distribution center with finished products at the lowest total cost becomes an issue of plant location relative to the distribution center and transportation costs. Where the freight rates used within and between the United States-Canada are comparable location is the key factor. points to approximately \$1.81 per unit for dryers, and The costs considered in determining which distribution center will service a specific market area, are based on the cost of the delivered cost of the finished product at the distribution center, variable handling costs, cost to transport the finished products to market areas, as well as,

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any tariffs and cross-border transaction costs which are in effect. As tariffs are reduced the location of the distribution center relative to market areas becomes increasingly important because the overall differences in cost between Canadian and United States distribution operations are relatively small.

The prime example of this situation is seen in the case of the Worcester distribution center. In all simulations where full tariffs are in effect the Worcester distribution center services only market areas in the United States. However, when tariff are reduced by fifty percent the Worcester distribution center services four Canadian market areas. When tariffs are completely removed the Worcester facility services eight Canadian market areas.

In simulations A3E and A3F cross-border transaction costs are reduced by twenty-five and fifty percent from the initial estimate. Cross-border transaction costs examined for United States-Canada finished product transactions were estimated at \$200 per truckload. This amounts to approximately \$1.82 per unit for washers, dryers, and ranges, and approximately \$2.86 for refrigerators when full cross-border transaction costs are in effect. These values represent less than one percent of the price of the finished product. by \$0.42 per unit when compared to the initial integration simulation A1B.

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Changes in the level of cross-border transaction costs variable of twenty-five and fifty percent are not large enough to overcome the cost differences between Canadian and United States manufacturing options. Therefore no additional cross-border activity results from reductions in cross-border transaction costs. Total systems costs are reduced by the amount of cross-border transaction cost savings associated with the existing volume of finished products (i.e., dryers) that are being shipped from the Indianapolis manufacturing plant to the Canadian distribution centers in Edmonton and Moncton. This results in a reduction in total systems cost of \$68,000 for simulation A3E and \$136,000 for simulation B3F.

SUMMARY OF NORTH AMERICAN CASES

The most likely case simulation (A2A) is characterized by the complete removal of tariffs, a fifty percent reduction in cross-border transaction costs, and a five percent increase in Canadian demand. This simulation represents the economic environment most likely to be encountered by firms after full implementation of the United States-Canada Free Trade Agreement. The distribution centers utilized and market areas serviced by distribution centers are identical to the one hundred percent tariff reduction simulation (A3D) which was discussed earlier in this section. The total systems cost on an average variable cost per unit basis is reduced by \$0.42 per unit when compared to the initial integration simulation A1B.

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Simulations were conducted to address research questions A4 and A5 which focused on supplier location and purchased item characteristics. No foreign sourcing takes place in any of the United States-Canada simulations. The prices of United States purchased items are, on average, approximately one percent less than the Canadian suppliers. This difference is not large enough offset the additional transportation cost associated with using the United States suppliers located in Fort Wayne when compared to the domestic sourcing option. The results of these simulations are not presented in Table 50 as they do not differ from the results of simulation A1A.

ts are 1.0% less than the Canadian suppliers. This difference is not large enough offset the additional transportation cost associated with using the United States suppliers located in Fort Wayne when compared to the domestic sourcing option. The results of these simulations are not presented in Table 50 as they do not differ from the results of simulation A1A.

SUMMARY OF NORTH AMERICAN RESULTS

Overall, the simulations conducted to address North American economic integration presented changes of a much greater magnitude than were found in the United States-Canada simulations. Mexican supplier and manufacturing options offer finished products and purchased items at prices that are considerably lower than the United States and Canadian options. Mexican finished product prices are on average 18.6 percent lower than those manufactured in the United States and approximately twenty percent lower than Canadian manufactured products. In simulations B3A and B3B. The increases in demand have no effect on the configuration of distribution center facilities and when viewed from a

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In the separate country simulation (B1A) United States, Canadian, and Mexican operations are completely independent of each other. In this simulation no cross-border transactions are permitted at any level. Total systems costs for the separate country simulation were \$8,704.1 million. are primarily the result of increases in the

Canadian demand which is not met by the United States.

In the initial integration simulation (B1B) the firm adopts an integrated perspective toward its North American operations. Cross-border transactions are permitted at all levels within the system. Full tariff and cross-border transaction costs are in effect. This simulation resulted in significant changes in facilities utilized and total systems cost when compared to the simulation B1A.

not large enough to offset the increase in cost.

In simulation B1B all North American manufacturing activities shift to Mexico even though full tariff and cross-border transaction costs are in effect. This shift to Mexican production leads to significant changes in the distribution center configuration within the United States. Total systems cost were \$7,452 million a reduction of over 1.2 billion dollars or 14.4 percent.

any United States distribution center. The current increases in Canadian and Mexican demand for finished products were examined in simulations B3A and B3B. The increases in demand have no effect on the configuration of distribution center facilities and when viewed from a

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variable cost per unit perspective have a very small effect on systems costs. Total systems costs for simulations B3A and B3B were \$7,483.4 million and \$7,515.6 million, respectively. Average variable cost per units for these simulations increased by \$0.08 and \$0.14 per unit. The increases are primarily the result of increases in the Canadian demand which is the most expensive to serve with a Mexican source of finished products.

The largest increase in finished product demand was addressed in simulation B3B and included a ten percent increase in Canadian demand and a fifty percent increase in Mexican demand. The combined increase in demand totaled approximately 251,900 additional units. This increase is not large enough to alter the distribution center configuration. The reason for this situation is the same as discussed earlier in the United States-Canada section. Given the fixed number of distribution centers within the United States-Canada-Mexico the increase in demand is not large enough to cause the system to remove a United States facility and replace it with an additional Canadian or Mexican distribution center, or is it large enough to "draw" any United States distribution centers from their current locations.

In simulations B3E and B3F changes in the level of cross-tariff reductions of fifty and one hundred percent are examined. The tariff reductions

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have no effect on the supply chain structure. The tariff reductions decrease total systems costs by approximately \$23 million and \$46 million, respectively. Tariff reductions only affect finished products entering Canada as these finished products enter the United States from Mexico duty free.

The most likely case of cross-border transaction costs is summarized by

The cross-border transaction costs examined for United States-Canada finished product transactions were estimated at \$200 per truckload. This amounts to approximately \$1.82 per unit for washers, dryers, and ranges, and approximately \$2.86 for refrigerators when full cross-border transaction costs are in effect. The cross-border transaction costs examined for transactions between the United States or Canada and Mexico were estimated at \$400 per truckload. This amounts to approximately \$3.64 per unit for washers, dryers, and ranges, and approximately \$5.71 for refrigerators when full cross-border transaction costs are in effect. These values represent approximately one percent of the price of the finished product. Development and justification of the cross-border transaction costs used in this study are presented in the "Cross-Border Transaction Cost" section of Chapter 4. In all simulations, with the exception of simulation B4A, manufacturing plants are In simulations B3E and B3F changes in the level of cross-border transaction costs variable of twenty-five and fifty percent are examined. Like the tariff reductions, cross-

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border transaction costs reductions have no effect on the supply chain structure. However, the reductions in cross-border transaction costs examined decrease total systems costs by approximately \$26.7 million and \$53.5 million, respectively.

Therefore, any changes in the source location are

The most likely case simulation (B2A) is characterized by the complete removal of tariffs, a fifty percent reduction in cross-border transaction costs, a five percent increase in Canadian and fifty percent increase in Mexican demand, and Mexican distribution centers located in Nuevo Laredo and Ciudad Juarez being allowed to service market areas in the United States. The distribution centers utilized and market areas serviced by distribution centers change significantly from the initial integration network. The total systems cost on a per unit variable cost basis is reduced by \$6.24 per unit when compared to simulation B1B.

are first allowed to service their respective supplier.

Simulations B4A - B4H were conducted to examine the effects of the changes in the economic environment on the source of purchased items. In these simulations the manufacturing plants and distribution centers service only their respective domestic markets. In all simulations, with the exception of simulation B4A, manufacturing plants are instructed to source purchased items from the lowest total cost supplier. 2.0 million. These changes in source location

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The results of simulations B4A-B4H indicated that at no time did the Mexican manufacturing plant use any suppliers other than the Mexican suppliers located in Reynosa. The Canadian plant never uses the United States suppliers and the United States manufacturing plant never uses Canadian suppliers. Therefore, any changes in purchase item source location are shifts for Canadian and United States sources to Mexican sources. In order for a change in source location to occur, the total cost (i.e., the sum of purchased item price, transportation cost, tariff and cross-border transaction costs) of using the Mexican supplier, from the perspective of the Canadian and United States plant locations, must be lower than the domestic supplier option.

the greatest effect on the total cost of the system from

In the separate country simulation B4A total purchase expenditure was \$5,092.3 million and total systems cost was \$8,703.4 million. In simulation B4B manufacturing plants are first allowed to use the lowest cost supplier, regardless of country. Full tariffs and cross-border transaction costs are in effect. In this initial integration case the Canadian manufacturing plant sources three purchased items in Mexico and the United States manufacturing plant sources ten purchased items in Mexico, despite full tariff and cross-border transaction costs. Purchase expenditure was \$4,533.9 million and total systems cost was \$7,452.0 million. These changes in source location United States manufacturing plant sources sixteen purchased

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resulted in a \$2.01 reduction in average variable cost per finished product unit. Sources seven purchased items and the United States manufacturing plant sources nineteen purchased items. In simulations B4C and B4D tariff reductions of fifty and one hundred percent are examined. In simulation B4C the Canadian manufacturing plant sources six purchased items and the United States manufacturing plant sources eleven purchased items in Mexico. In simulation B4D the Canadian manufacturing plant sources ten purchased items and the United States manufacturing plant sources eleven purchased items in Mexico. These changes in source location resulted in \$0.05 and \$0.21 reductions in average variable cost per finished product unit, respectively. Tariff reductions have the greatest effect on purchased items entering Canada from Mexico. All but one of the purchased items are subject to Canadian tariffs. Only two of the twenty-five purchased items are subject to United States' tariffs when entering from Mexico.

In simulations B4E and B4F changes in the level of cross-border transaction costs of twenty-five and fifty percent are examined. The initial cross-border transaction costs examined for purchased items moving between the United States or Canada and Mexico were estimated at ten percent of the purchased item price. In simulation B4E the Canadian manufacturing plant sources five purchased items and the United States manufacturing plant sources sixteen purchased

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items in Mexico. In simulation B4F the Canadian manufacturing plant sources seven purchased items and the United States manufacturing plant sources nineteen purchased items in Mexico. These changes in source location resulted in \$2.44 and \$5.76 reductions in average variable cost per finished product unit, respectively. Cross-border transaction costs reductions have the greatest effect on purchased items entering the United States from Mexico as full Canadian tariffs are still in effect and prohibit any additional sourcing on the part of the Canadian plant. price, high labor content, and low wages. The B4F group and The partial implementation simulation B4G is characterized by a fifty percent tariff reduction and a twenty-five percent reduction in cross-border transaction costs. In simulation B4G the Canadian manufacturing plant sources nine purchased items and the United States manufacturing plant sources sixteen purchased items in Mexico. These changes in source location resulted in \$2.56 reduction in average variable cost per finished product unit.

The most likely case simulation B4H is characterized by the complete removal of tariffs, a fifty percent reduction in cross-border transaction costs, and a five percent increase in Canadian and twenty-five percent increase in Mexican demand. In simulation B4H the Canadian and United States manufacturing plant both source nineteen purchased items in Mexico. These changes in source location resulted in a

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\$6.47 reduction in average variable cost per finished product unit.

The research conclusions are presented in two sections. The results of the simulations conducted for research question 4 were analyzed from the perspective of purchased items at groups which were established on the basis of purchased item price, labor content, and transportation cost. This analysis showed that there is a relationship between changes in source location and the purchased item groups. Purchased items that are members of the high price, high labor content, and low transportation cost group and purchased items in the high price, high labor content, and high transportation cost group were most likely to be sourced in Mexico. Only one purchased item of the low price, low labor content, and low transportation cost was ever sourced in Mexico by the United States and Canadian plants.

Throughout the study, the environment encountered by the industry in terms of the United States-Mexican Free Trade Agreements, is assumed to be of a generic nature. For example, the data are based on industry averages as presented by the United States Department of Commerce sources. The data are representative of overall industry experience, but may not be representative of any individual firm within the industry. The research was conducted and is presented in Table 53.

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Efforts to gather comprehensive cost data were largely unsuccessful. Industry representatives were generally

The research conclusions are presented in two sections. The first section presents the conclusions for each research question addressed in the study. The second section presents general conclusions that are based on the overall research effort.

The conclusions are based on the simulation results which are presented in Chapter 5. The reader is reminded that the results are highly data specific. Changes in data used to define the hypothetical firm and its environment could alter the results and in turn the conclusions. Therefore it is very important that the reader have a thorough understanding of the data and assumptions employed in this study.

The intent throughout the study has been to approximate the environment encountered by the household appliance industry in terms of the United States-Canada and North American Free Trade Agreements. The data employed tends to be of a generic nature. For example, product cost data are based on industry averages as presented in various United States Department of Commerce sources. The data are representative of overall industry experience, but may not be representative of any individual firm within the industry.

American research question conclusions are summarized in Table 52.

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Efforts to gather company specific cost data were largely unsuccessful. Industry representatives were generally willing to indicate if cost estimates used in this research were reasonable or representative of industry experience, but would not share actual data. The industry representatives were also quick to point out that significant differences exist within the industry and between different divisions of individual firms.

The conclusion is that given these qualifications one should be extremely cautious in generalizing the conclusions of this research. The conclusions are beneficial in terms of presenting general directions or trends that may occur in the household appliance industry as a result of the United States-Canada and North American Free Trade Agreements. The study should not be used as a basis for specific location decisions or as an indicator of the magnitude of changes in total systems costs that a firm in the household appliance industry is likely to experience.

CONCLUSIONS BY RESEARCH QUESTION

The conclusion is that the research has a limited effect on facilities. In this section the conclusions are presented by individual research question. The United States-Canada research question conclusions are summarized in Table 51. The North American research question conclusions are summarized in Table 52.

United States-Canada Research Questions Conclusions

Cross-border Transaction Costs

Research Question A1-Initial Integration

The conclusion is that integration of the firm's operations to address the United States and Canada as a single entity, with no changes in tariffs, cross-border transaction costs, or Canadian demand, has a very limited effect on facilities utilized and costs when compared to the separate country approach.

Research Question A2-Most Likely Case

The conclusion is that an environment that includes zero tariffs, a fifty percent reduction in cross-border transaction costs, and a five percent increase in Canadian demand leads to 1) changes in facilities utilized, 2) market areas being serviced by foreign distribution centers, 3) changes in the manufacturing source of finished products for some Canadian distribution centers, and 4) a minor reduction in total systems cost when compared to the initial integration results.

Research Question A3-Changes In Independent Variables

Non-United States Finished Product Demand

The conclusion is that increases in Canadian demand of the magnitude examined in this research have no effect on the facilities utilized and an insignificant impact on the variable cost per unit to manufacture and distribute the finished products when compared to the initial integration results.

Tariffs

The conclusion is that decreases in tariffs have a limited effect on facilities utilized and total systems cost. The decrease in tariffs does, however, increase the number of market areas that are serviced by foreign distribution centers and, when all tariffs are removed, affects the manufacturing source of finished products for some Canadian distribution centers when compared to the initial integration results.

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Table 51 (cont'd.)

North American Research Questions Conclusions

Cross-border Transaction Costs

The conclusion is that decreases in cross-border transaction costs of the magnitude examined in this study have no effect on facilities utilized and an insignificant effect on total systems costs when compared to the initial integration results.

Research Question A4-Sourcing Series /**Research Question A5-Purchased Item Characteristics**

The conclusion is that changes in the levels of the independent variables have no effect on the suppliers utilized. In all cases the manufacturing plants use domestic suppliers exclusively.

Research Question B1-Cross-borderNon-United States

The conclusion is that changes in the levels of the independent variables have no effect on the facilities utilized and a limited effect on total systems costs when compared to the initial integration results.

Tariffs

The conclusion is that changes in the levels of the independent variables have no effect on facilities utilized and a limited effect on total systems cost when compared to the initial integration results.

Cross-border Transaction Costs

The conclusion is that decreases in cross-border transaction costs of the magnitude examined in this study have no effect on facilities utilized and a limited effect on total systems cost when compared to the initial integration results.

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Table 52 (4.)

North American Research Questions Conclusions

Research Question B1-Sourcing Series

Research Question B1-Initial Integration

The conclusion is that integration of the firm's operations to address the United States, Canada, and Mexico as a single entity, with no changes in tariffs, cross-border transaction costs, or non-United States demand, has a significant effect on facilities utilized and total systems cost.

Research Question B2-Most Likely Case

The conclusion is that an environment that includes zero tariffs, a fifty percent reduction in cross-border transaction costs, a five percent increase in Canadian demand along with a twenty-five percent increase in Mexican demand, and allowing selected Mexican distribution centers to service United States market areas leads to changes in facilities utilized, an increase in the number of market areas serviced by foreign distribution centers, and a reduction in total systems cost when compared to the initial integration results.

Research Question B3-Changes In Independent Variables

Non-United States Finished Product Demand

The conclusion is that increases in Canadian and Mexican demand of the magnitude examined in this study have no effect on the facilities utilized and cost to serve finished product demand in the individual countries when compared to the initial integration results.

Tariffs

The conclusion is that decreases in tariffs have no effect on facilities utilized and limited effect on total systems cost when compared to the initial integration results.

Cross-border Transaction Costs

The conclusion is that decreases in cross-border transaction costs of the magnitude examined in this study have no effect on facilities utilized and a limited effect on total systems cost when compared to the initial integration results.

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Table 52 (cont'd.)

Research Question B4-Sourcing SeriesInitial Integration

The conclusion is that allowing the manufacturing plants in Canada, the United States, and Mexico to source purchased items from the lowest total cost supplier with no changes in tariffs and cross-border transaction costs, leads to Mexican sourcing of several purchased items by the United States and Canadian manufacturing plants and a slight reduction in the total systems cost.

Tariffs

The conclusion is that decreases in tariffs increases the number of items purchased in Mexico, particularly by the Canadian plant, and results in a slight reduction in total systems cost when compared to the initial integration results.

Cross-border Transaction Costs

The conclusion is that decreases in cross-border transaction costs of the magnitude examined in this study increases the number of items purchased in Mexico, particularly by the United States plant, and results in a reduction in total systems cost when compared to the initial integration results.

Partial Implementation

The conclusion is that an environment that includes a fifty percent reduction in tariffs and a twenty-five percent reduction in cross-border transaction costs leads to increases the number of items purchased in Mexico, particularly by the United States plant, and results in a reduction in total systems cost.

Changes in source locations of the various purchased items may not always be statistically significant, but changes of the magnitude found are all significant from a practical business perspective.

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Table 52 (cont'd.)

Research Question A1 - Initial Integration
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The conclusion is that an environment that includes zero tariffs, a fifty percent reduction in cross-border transaction costs, a five percent increase in Canadian demand and a twenty-five percent increase in Mexican demand leads to the majority of the purchased items used in the Canadian and United States manufacturing plants being purchased in Mexico and a reduction in total systems cost.

Research Question B5-Purchased Item Characteristics

There is a relationship between purchased item characteristics examined of price, labor content, and transportation cost and likelihood of Mexican sourcing by United States and Canadian manufacturing plants.

Purchased items that incorporate high price, high labor content, and low transportation cost characteristics are likely to be sourced in Mexico regardless of tariff level or cross-border transaction costs treatment.

Purchased items that incorporate high labor content and low transportation costs characteristics are most likely to be sourced in Mexico, regardless of the purchased item's price.

Purchased items that incorporate high labor content and high transportation costs characteristics are the second most likely to be sourced in Mexico.

Purchased items that incorporate low price, low labor content, and low transportation cost characteristics are unlikely to be sourced in Mexico.

Purchased items that incorporate low price, low labor content, and high transportation cost characteristics will not be sourced in Mexico.

Changes in source locations of the various purchased items may not always be statistically significant, but changes of the magnitude found are all significant from a practical business perspective.

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Research Question A2 - Most Likely Case

Research Question A1 - Initial Integration

Research question A1 asks what is the least total cost supplier, manufacturing plant, and distribution center system, given the specified service constraints, for an integrated United States-Canada system and how does it differ from a separate country design when the other independent variables are held at the initial levels. The conclusion is that initial integration of the firm's operations has a discernable, but very limited effect on facilities utilized and total systems costs.

The only change in distribution center facilities utilized is that the Montreal distribution center is replaced by a Moncton distribution center. There is a change in the manufacturing plant source of dryers for the Canadian distribution centers other than Toronto. The Moncton and Edmonton facilities source dryers, which enter Canada duty-free, from the Indianapolis manufacturing plant. Tariffs and cross-border transaction costs prohibit any additional foreign sourcing of other finished products by distribution centers and also prohibit servicing market areas by foreign distribution centers. The reduction in cross-border transaction costs results in the elimination of the Moncton distribution center. The closing of the Moncton distribution center allows the firm to add a facility in

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Research Question A2 - Most Likely Case the firms cost to service the market areas located in the mid-Atlantic states.

Research question A2 asks what is the least total cost supplier, manufacturing plant, and distribution center system, given specified service constraints, for an integrated United States-Canada system under the "most likely" levels of independent variables and how does it differ from the initial integrated United States-Canada system developed in research question A1. Simulation A2A independent variable settings are as follows, a five percent increase in Canadian demand, zero tariffs, and a fifty percent reduction in cross-border transaction costs. The conclusion is that the "most likely" case leads to several changes in facilities utilized and a reduction in total systems cost.

The most likely case results in the Worcester distribution center servicing market areas in eastern Canada and the Regina distribution center servicing the United States market areas in North Dakota. The Regina facility receives all of its finished products from the United States plant in Indianapolis.

Research Question A3 - Changes in Independent Variables

The removal of tariffs and reduction in cross-border transaction costs results in the elimination of the Moncton distribution center. The closing of the Moncton distribution center allows the firm to add a facility in

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Raleigh, North Carolina which reduces the firms cost to service the market areas located in the mid-Atlantic states. The changes in facilities utilized and source of finished products leads to a \$0.42 reduction in total systems variable cost per unit.

Increases in Canadian Imports

The most likely case simulation (A2A) is used to approximate economic conditions that are "most likely" to exist in the United States and Canada upon full implementation of the United States-Canada Free Trade Agreement. The results of this simulation lead to the conclusion firms that review their United States-Canada operations will make changes to their operations relative to their initial integration approach that will allow the firm to maintain customer service levels and reduce total systems cost. The magnitude of these changes is likely to be of an incremental nature, rather than requiring a complete redesign of existing production and distribution systems. Changes are likely to include a few changes in distribution center locations and an increase the number of market areas being serviced by foreign distribution centers.

provided the most likely case simulation supply chain

Research Question A3 - Changes In Independent Variables independent variables when considered individually.

Research question A3 asks how changes in the levels of the independent variables for tariffs, cross-border transaction costs, and non-United States finished product demand affect

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the supplier, manufacturing plant, and distribution center system in terms of locations utilized and total systems cost when compared to least cost system developed in research question A1B. Costs have no effect on facilities utilized and total systems cost. The per unit cost reduction associated Increases in Canadian Demand by tariff reductions in cross-border transaction costs are not large enough to result in. The conclusion is that changes in Canadian demand of the magnitude examined in this research have virtually no effect on facilities used and total systems cost, when viewed on a variable cost per unit basis. These increases are not great enough to "pull" distribution centers from their initial integration locations. The United States finished product demand dominates the overall system.

Tariffs question A1C. The effect of the independent variable of tariff reductions on the cross-border. The conclusion is that tariff reductions will lead to several changes in facilities utilized and increases in the number of market areas serviced by foreign distribution centers. Changes in the independent variable for tariffs provided the most significant changes in supply chain structure and total systems costs of any of the independent variables when considered individually. Groups which were established on the basis of purchased item price, labor content, and transportation cost characteristics. Results of the various simulations of tariff reductions on tariff and

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Cross-border Transaction Costs sourcing pattern under any of the simulations conducted. In all cases the Canadian and the conclusion is that reductions in cross-border transaction costs have no effect on facilities utilized and total systems cost. The per unit cost reduction associated with the twenty-five and fifty percent reductions in cross-border transaction costs are not large enough to result in any additional cross-border transactions over and above the level that occurs under initial integration. Therefore, no changes in facilities utilized occurs and the effect of total systems cost is negligible.

Research Question A4 - Sourcing Series /

Research Question A5 - Purchased Item Characteristics

Research question A4 asks how do changes in the levels of the independent variables for tariffs and cross-border transaction costs affect the supplier locations utilized and the total systems cost when the United States and Canadian manufacturing plant and distribution center locations service only their respective domestic market areas. Research question 5 ask how do changes in the levels of the independent variables for tariffs and cross-border transaction costs affect purchased item groups which were established on the basis of purchased item price, labor content, and transportation cost characteristics. shifts to the Mexican manufacturing plant despite full tariff and

No changes take place in the sourcing pattern under any of the simulations conducted. In all cases the Canadian and United States manufacturing plants use their domestic suppliers exclusively. The conclusion is that changes in the United States-Canada economic environment associated with the United States-Canada Free Trade Agreement will reduce tariff and non-tariff barrier encountered in foreign sourcing. However, given that United States and Canadian supplier prices for purchased items are not significantly different, use of Canadian (United States) suppliers by a United States (Canadian) manufacturer is unlikely if a qualified domestic supplier is available locally.

Research Question B1 - Initial Integration

Research question B1 asks what is the least total cost supplier, manufacturing plant, and distribution center system, given the specified service constraints, for an integrated United States-Canada-Mexico system and how does it differ from a separate country design. The conclusion is that integration of the firm's North American operations provides an opportunity to reduce total systems cost regardless of the level of implementation of a North American Free Trade Agreement. cross-border transaction costs. The most likely case also permitted selected Mexican In the initial integration case all manufacturing shifts to the Mexican manufacturing plant despite full tariff and

cross-border transaction cost levels. The shift to Mexican production also results in major changes in the location of United States distribution centers.

The most likely case simulation (B2) is used to approximate the shift to Mexican manufacturing causes changes in the percentage of total systems costs represented by manufacturing and transportation cost factors. Mexican manufacturing leads to a decrease in manufacturing costs which is partially offset by increases in transportation costs. The location of distribution centers in the United States and Mexican distribution centers will change to serve the United States market.

Research Question B2 - Most Likely Case

Research question B2 asks what is the least total cost supplier, manufacturing plant, and distribution center system, given specified service constraints, for an integrated United States-Canada-Mexico system under the "most likely" levels of independent variables and how does it differ from the initial integrated United States-Canada-Mexico system developed in research question A1. Simulation B2A independent variable settings are as follows, a five percent increase in Canadian demand and a twenty-five percent increase in Mexican demand, zero tariffs, and a fifty percent reduction in cross-border transaction costs. The most likely case also permitted selected Mexican distribution centers to service market areas in the United States. The demand of the magnitude examined in this study have no

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States and United States distribution center to service Mexican market areas. When compared to the initial integration results, however, from the perspective of the most likely case simulation (B2A) is used to approximate economic conditions that are "most likely" to exist in the United States, Canada, and Mexico upon full implementation of the North American Free Trade Agreement. The conclusion is that the most likely case environment presents firms with opportunities to reduce total systems cost through a redesign of distribution networks to include Mexican distribution centers which service United States market areas.

Research Question B3 - Changes In Independent Variables

Research question B3 asks how changes in the levels of the independent variables for tariffs, cross-border transaction costs, and non-United States finished product demand affect the supplier, manufacturing plant, and distribution center system in terms of locations utilized and total systems cost when compared to the least cost system developed in research question B1B.

Non-United States Finished Product Demand Finished products entering the United States from Mexico are not subject to The conclusion is that increases in Canadian and Mexican demand of the magnitude examined in this study have no

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effect on the facilities utilized and cost to serve the demand in the individual countries when compared to the initial integration results. However, from the perspective of average variable cost per unit for the entire system, the increase in Canadian demand increases cost. This is due to increased tariffs, cross-border transaction costs, and relatively higher internal transfer transportation cost associated with servicing Canadian distribution centers with finished products manufactured in Mexico.

Research question: Is the increase in the levels of demand in the United States and Mexico sufficient to justify the increase in Canadian and Mexican demand is not of a significant magnitude to "pull" distribution center locations from the initial integration locations. The finished product demand associated with the United States market area dominates the overall system.

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Tariffs

Initial Integration

The conclusion is that decreases in tariffs have no effect on facilities utilized and a limited effect on total systems cost when compared to the initial integration results. The reason for the relatively low reduction in total systems cost is that only the finished products entering Canada benefit from the tariff reduction. Finished products entering the United States from Mexico are not subject to tariffs. changes in tariffs and cross-border transaction costs, leads to Mexican sourcing by both the Canadian and

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Cross-border Transaction Costs

The conclusion is that decreases in cross-border transaction costs of the magnitude examined in this study have no effect on facilities utilized and a limited effect on total systems cost when compared to the initial integration results.

Research Question B4 - Sourcing Series

Research question B4 asks how do changes in the levels of the independent variables for tariffs and cross-border transaction costs affect the supplier locations utilized and the total systems cost when the United States, Canadian, Mexican manufacturing plant and distribution center locations service only their respective domestic distribution centers and market areas.

Initial Integration

The conclusion is that allowing the manufacturing plants in Canada, the United States, and Mexico to source purchased items from the lowest total cost supplier (i.e. the supplier option that provides the lowest total cost for a purchased item based on the sum of purchase price, tariffs, cross-border transaction costs, and inbound transportation cost) with no changes in tariffs and cross-border transaction costs, leads to Mexican sourcing by both the Canadian and

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United States manufacturing plants, particularly, by the United States plant. This level of Mexican sourcing results in a slight reduction in the total systems variable cost per unit when compared to the separate country approach.

Tariffs

The conclusion is that decreases in tariffs increases the number of items purchased in Mexico, particularly by the Canadian plant and results in a slight reduction in total systems cost when compared to the initial integration results.

Only two of the purchased items included in this research are subject to United States tariffs when entering from Mexico. Therefore, tariff reduction only reduces the total cost of sourcing the purchased items in Mexico for these two items from the perspective of the United States manufacturing plant. As for the Canadian situation, all but one of the purchased items are subject to tariff when entering Canada from Mexico. This explains why the tariff reduction significantly increases the number of purchased items sourced in Mexico by the Canadian plant while only one additional purchased item is sourced in Mexico by the United States manufacturing plant.

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Cross-border Transaction Costs

The conclusion is that decreases in cross-border transaction costs increases the number of items purchased in Mexico, particularly by the United States plant and results in a reduction in total systems cost when compared to the initial integration results. The effect of the reduction in cross-border transaction costs is more pronounced for the United States manufacturing plant than the Canadian plant. The reason for this situation is that even though cross-border transaction costs are reduced, all but one of the purchased items entering Canada from Mexico are subject to full tariff levels.

Partial Implementation

The conclusion is that an environment that includes a fifty percent reduction in tariffs and a twenty-five percent reduction in cross-border transaction costs leads to increases in the number of items purchased in Mexico, particularly by the United States plant, and results in a reduction in total systems cost when compared to the initial integration results. The reason for the greater effect on the United States manufacturing plant's sourcing is the same as discussed earlier for cross-border transaction costs

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Most Likely Case

The conclusion is that an environment that includes zero tariffs, a fifty percent reduction in cross-border transaction costs, and a five percent increase in Canadian demand along with a twenty-five percent increase in Mexican demand leads to nineteen of the twenty-five purchased items being purchased in Mexico by the United States and Canadian manufacturing plants.

Research Question B5 - Purchased Item Characteristics

Research question B5 asks how do changes in the levels of the independent variables for tariffs and cross-border transaction costs affect purchased item groups which were established on the basis of purchased item price, labor content, and transportation cost characteristics. The conclusions are as follows.

1. There is a relationship between purchased item characteristics and effects of changes in the independent variables for tariffs and cross-border transaction costs.

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2. Purchased items that incorporate high price, high labor content, and low transportation cost characteristics are likely to be sourced in Mexico regardless of tariff level or cross-border transaction costs treatment.
3. Purchased items that incorporate high labor content and low transportation costs characteristics are most likely to be sourced in Mexico, regardless of the price of the purchased item.
4. Purchased items that incorporate high direct labor content and high transportation costs characteristics are the second most likely to be sourced in Mexico, regardless of the purchased item price.
5. Purchased items that incorporate low price, low labor content, and low transportation cost are not likely to be sourced in Mexico.
6. Purchased items that incorporate low price, low labor content, and high transportation cost characteristics are not sourced in Mexico.
7. Changes in source locations of the various purchased items may not always be statistically significant, but changes of the magnitude found in this study are all significant from a practical business perspective.

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GENERAL CONCLUSIONS

In this section general conclusions that are drawn from the research are discussed. These general conclusions which are presented in Table 53 are not specific to any one research question, but rather are based on the overall research effort.

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Table 53**General Conclusions****Conclusion 1:**

Integrating United States and Canadian production and distribution operations presents opportunities for firms to make changes to the supply chain structure that will result in relatively small reductions in total systems costs.

Conclusion 2:

Complete North American integration of operations will lead to significant shifts in manufacturing to Mexico. The shift to Mexican manufacturing will require changes in distribution center locations. These changes offer the potential for significant cost reductions.

Conclusion 3:

Increases in Canadian and Mexican demand of the magnitude addressed in this research have virtually no effect on the firm's operations. The demand for finished product in these markets is dwarfed by the United States demand. Therefore it is not large enough to "draw" distribution center facilities to locations closer to or in Canada or Mexico.

Conclusion 4:

Reductions in tariff levels in the United States-Canada case leads to increases in the number of market areas that are serviced by foreign distribution centers, but have a limited effect on facilities utilized and total systems costs.

Conclusion 5:

Reductions in tariff levels in the North American case have no effect on the supply chain structure and a limited effect on total systems costs.

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Table 53 (cont'd.)

Conclusion 6:

Reductions in cross-border transaction costs for finished products of the magnitude examined in this study have no effect on the supply chain structure and total systems costs for the United States-Canada case.

Conclusion 7:

Reductions in cross-border transaction costs for finished products of the magnitude examined in this study have no effect on the supply chain structure and a limited effect on total systems costs for the North American case.

Conclusion 8:

Mexican distribution centers located along the United States border have the potential to service United States market areas in a cost effective manner if adequate infrastructure is available and border-crossings procedures are established.

Conclusion 9:

Increases in Mexican manufacturing and use of Mexican suppliers will increase transportation cost relative to total product cost.

Conclusion 10:

General conclusions based on purchased item characteristics from the perspective of Canadian and United States manufacturing plants are as follows:

1. The higher the cost of the purchased item the greater the likelihood of using a Mexican supplier.
2. The higher the labor content of the purchased item the greater the likelihood of using a Mexican supplier.
3. The lower the transportation cost of the purchased item the greater the likelihood of using a Mexican supplier.

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The final conclusion presented is based on the author's experience in conducting this research rather than on the research findings. The conclusion is that firms considering expansion of business activities into Mexico should secure the services of consultants or businesses that have significant experience and a demonstrated performance record in Mexico. Based on the author's efforts to secure various data including, but not limited to, freight rates, tariffs, finished product demand, compensation rates, industry-level manufacturing costs, and population from an assortment of Mexican governmental agencies, businesses, and trade associations it was seen that the level of assistance and cooperation provided by these organizations is extremely variable. A few of these organizations were extremely responsive. Others were not at all cooperative.

This is not to say that these various governmental agencies, businesses, and trade associations should be expected to respond to every request for information or assistance. However, in the case of governmental agencies and trade associations a simple reply indicating their inability to comply with a request for information does not seem unreasonable. Worse yet, is the situation where the organization agrees to provide the requested data, but fails to deliver.

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Given, this situation use of an experienced consulting group, third party service provider, or establishing a partnership with an established Mexican firm would be a prudent approach for any organization entering the Mexican market.

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IMPLICATIONS

This research addresses an important current topic of interest to academic, management, and governmental policy-making groups. Implications of this research for each of these groups and future research opportunities are presented in this section.

ACADEMIC IMPLICATIONS

The research has several implications for the academic community. First, the research presents a viable means to conduct an examination of North American economic integration from the perspective of a hypothetical firm that is representative of a specific industry. This examination focuses on the firm's purchasing, manufacturing and distribution operations. The research is unique in that there has been very little research of this type, the notable exception being Taylor's 1991 study.

The research presents the effects of integrating the firm's operations across the North American countries and illustrates the potential changes and benefits associated with this approach. The research also indicates the effects of tariff, cross-border transaction costs, and changes in non-United States demand on the facilities utilized and total systems costs. The research also indicates for a

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variety of purchased items the relationship between price, labor content, and transportation cost on sourcing patterns. These are all factors that should be addressed in the development of international logistics or purchasing theory.

MANAGERIAL IMPLICATIONS

Management and labor interests are addressed through research questions which examine the supplier, manufacturing, and distribution center locations and associated costs at different levels of integration. Business and labor interests are concerned with similar questions, but for different reasons. Both are concerned with which suppliers, manufacturing plants, and distribution center locations are likely to be used under different levels of integration. Business interests are concerned with this issue from the perspective of competitiveness and the development of supplier, manufacturing, and distribution networks that can support future business strategies at lowest total systems cost. Labor interests are concerned with this issue from the perspective of protecting the jobs of its membership.

Business interests are also addressed through the examination of purchased items each of which possess a unique combination of characteristics, namely, price, labor content, and transportation cost. The research provides

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insights as to which characteristics increase the likelihood of purchased items being sourced in different countries within North America under the free trade scenarios and which purchased items are likely to remain in their current home countries.

The research provides an indication of the opportunities that are available from the development and effective use of Mexican manufacturing locations. It also indicates the potential that exists for the development of a competitive Mexican supply base to support manufacturing activities. On the other hand, this research can be viewed as an indication of level of challenges that face Canadian and United States industries if changes are not made.

The research indicates that integration of United States and Canadian operations allows for a small reduction in total systems cost. Integration of the United States, Canada, and Mexico leads to significant reductions in total systems cost.

A key implication of the research is that the development of Mexican manufacturing and supplier capabilities has the potential to significantly reduce costs regardless of a North American Free Trade Agreement. Despite the level of attention that has been provided the North American Free Trade Agreement it is not required to benefit from the use

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of Mexican suppliers and manufacturing operations. This does not imply that the North American Free Trade Agreement does not provide benefits, but it is not an absolute requirement for successfully incorporating Mexico into the firm's operations.

A research implication that emerges for both United States-Canada and North American integration is need for a review of distribution center networks in light of changes in the economic environment. Relatively few changes accompanied the United States-Canada integration. However, North American integration and the shift of all manufacturing activities to Mexico resulted in significant changes to the distribution center network. Firms should examine their current distribution network in terms of anticipated future changes. Minor changes are likely to be required for United States-Canada operations. However, if all of North America is considered, particularly if Mexican manufacturing is included in the firm's plans, significant changes in the distribution network may be required.

The shift to Mexican manufacturing also increased the percentage of total systems cost represented by transportation costs. Practitioners must be aware of this situation and develop strategies to ensure that transportation costs are minimized. A review of current transportation practices is recommended. The firm must

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determine if current carriers are providing required level of service at the best available price. It is also necessary to determine if carriers currently being used have the facilities, equipment, and personnel to operate effectively on an international basis. Examination of intermodal options from the Mexican manufacturing plant to United States and Canadian distribution centers is appropriate. Development of strategic alliances with carriers may also be warranted.

Firms must be certain that their own internal operations are capable of operating effectively in an international environment. Developing a logistics staff that includes individuals with international logistics experience is required. Development of information systems suited for international operations is also needed.

The firm should also review its inventory policies in light of using Mexican manufacturing plants. Given the likelihood of delays associated with current infrastructure and border-crossing procedures the firm may consider increasing safety-stock levels in order to protect against variabilities in delivery performance that may accompany the use of Mexican manufacturing operations.

The implication for firms providing transportation and logistical services is that the increased demand for quality

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international services is likely. Firms that are currently making investment in facilities, equipment, and establishing partnerships with Mexican carriers will be well positioned to take full advantage of opportunities related to shifts in manufacturing activity to Mexico as well as development of the Mexican market for finished goods.

The research has several implications for purchasing management. Most importantly it demonstrates the potential offered by the development of a competitive Mexican supply base. Purchasers will need to be aware of the supplier activities regarding Mexico. Identifying which suppliers of a specific purchased items have or are planning Mexican operations may provide opportunities for cost reductions. This is important information both from the perspective of supporting manufacturing activities domestically and for future support of the firm's Mexican manufacturing activities.

Purchasing management will also want to develop the internal capabilities required to operate effectively with the Mexican supply base. Personnel with international purchasing experience and Spanish language skills are needed. Purchasing management should also focus on identifying and eliminating any internal obstacles or practices that effectively increase the cost associated with using foreign sources in general, Mexican in particular.

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Purchasing management must also recognize that currently the Mexican supply-base is not highly developed. However, there is potential to develop low-cost supply base in Mexico. In determining the types of purchased items that are likely to be best suited to the Mexico, the research results regarding purchased item characteristics are pertinent. Purchased items with high price, high labor content, and low transportation cost are prime candidates. Furthermore, formally analyzing purchased item characteristics when making supplier develop decisions of this nature would be beneficial.

POLICY IMPLICATIONS

The research indicates the shift in manufacturing from the United States and Canada to Mexico that could occur regardless of implementation of a North American Free Trade Agreement. It also indicates the effect of increased economic integration on key supplier industries. The implications of this research for policy makers depends upon the group's perspective on free trade.

Policy makers with a protectionist perspective can view this research as an indication of the level of tariff and non-tariff barriers that must be maintained or established to avoid major shifts in manufacturing and sourcing activity to Mexico. Determination of the current location of

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manufacturing and supplier facilities can assist in the determination of geographic areas within the United States and Canada that are most likely to loose industries and jobs as a result of the possible shifts to Mexico. This approach may lead to the timely development of incentive programs to attract new business interests to areas that are loosing businesses to Mexico. Planning for job retraining programs may also be appropriate.

For policy makers with a free trade orientation the research indicates the magnitude of changes that are possible and level of savings that could result from shifting manufacturing activities to Mexico. Policy makers can see the volume of cross-border activity that could occur. The research indicates the level of additional savings that are available from reduction in cross-border transaction costs. Policy makers must focus efforts at making cross-border transactions as similar to domestic transactions as possible. Efforts here should include providing adequate infrastructure within and between countries to support increased levels of cross-border activity. Allowing transportation providers to operate throughout North America is also very important. Simplification of all border crossing procedures is also required.

FUTURE RESEARCH OPPORTUNITIES

The research presents a number of opportunities for future research endeavors. Research opportunities discussed include three broad areas, specifically 1) additional simulation studies that address North American economic integration, 2) application of different modeling tools to these studies, and 3) research that addresses North American integration across a broad range of areas.

In the area of additional simulation studies a number of opportunities exist. These potential opportunities include, but are not limited to studies that:

1. Address different industries
2. Address different and/or additional independent variables. Other variables that warrant consideration include currency exchange rates, productivity differences, and expected changes in wage rates.
3. Incorporate modes of transportation other than truck
4. Incorporate different customer service constraints
5. Incorporate more detailed cost data
6. Specifically addressed Mexican manufacturing with the purchased items being sourced in the United States and Canada.

7. Conduct sensitivity analyses on key purchased items characteristics. For example, from the perspective of the United States manufacturing plant, while holding all other variables constant, examine labor content values to determine at what level the shift to Mexican sourcing occurs.

Another opportunity for future research is found in the application of different modeling techniques to address North American economic integration issues. Development and application of a large scale optimization model to address North American facility location decisions at a the level of detail required by practitioners to make "real world" decisions would make a significant contribution.

There are a number of research opportunities in the area North American economic integration that have the potential to make a significant contribution to academic and business groups. First, there is a general lack of publicly available English language information regarding the conduct of business in Mexico. Information that is readily available for the United States and Canada, is either non-existent, difficult to obtain, or presented in Spanish in the case of Mexico. Information such as current wage rates by industry and geographic area, manufacturing costs, freight rates, and warehousing costs are required to conduct research of the type presented here. Research efforts to

collect and maintain information of this nature as well as others related to Mexican business are needed.

Research that addresses border-crossing procedures and practices is needed. An examination of current North American border-crossing procedures and practices with an orientation towards identification of various means to minimize border-crossing delays is needed.

Research in the areas of international logistics and international purchasing present a number of research opportunities. Examination of different means to reduce logistics costs and improve service performance in an international setting is needed. Along this line, identification of industry best practices among firms conducting logistical and purchasing activities across North America would be appropriate.

Research is also required in the area of general organizational practices. Research efforts that examine and identify practices that appear to serve their respective firm well in an integrated North American economic environment as well as identify practices that impede organizations from taking full advantage of opportunities that may accompany an integrated North American market.

RESEARCH LIMITATIONS

The scope of this research has limitations in several areas. The research is of an exploratory nature given the recency of the United States-Canada Free Trade Agreement and the fact that North American Free Trade Agreement has not yet been implemented. In addition, there has been very little research to date on the effects of the United States-Canada Free Trade Agreement and the North American Free Trade Agreement on an integrated supplier, manufacturing, distribution network.

The results are applicable to the purchased items, finished products, and industry studied, subject to the data and assumptions. The results are extremely data specific. Therefore, conclusions should be viewed as providing directional trends, but not specific location recommendations or cost benchmarks.

The scope is further limited by addressing the firm's purchasing and manufacturing activities from a strictly cost perspective. Supplier and manufacturing plant performance in areas such as quality, delivery, responsiveness, and technology although important considerations are not addressed. An assumption is made that all suppliers of a specific item can produce an item that is identical on all

performance criteria with the exception of the total cost to produce the item and the cost structure.

It is further assumed that there are no costs associated with moving the firm's business between different suppliers, manufacturing plants, and distribution centers. This assumption maybe somewhat unrealistic from the perspective of a short-term time horizon of one year or less, given contractual obligations with suppliers and warehouse facilities, as well as, time required to add capacity at the supplier or the firm's manufacturing plant locations. However, this assumption is quite viable, if viewed from a longer-term perspective.

The research findings are limited by the somewhat generic nature of the data. The data used in developing the simulation model are based on information collected in interviews with household appliance industry representatives and from secondary data sources. The data are intended to be representative of actual industry conditions. However, the data may not be representative of any individual firm.

Several variables that have the potential to affect the study results were not addressed. These variables include currency exchange rates and productivity. Significant changes in the currency exchange rates could alter the research results. This is particularly true in the case of

United States and Canada. Overall, the cost of conducting business in these two countries is comparable. Shifts in currency exchange rates could potentially affect facility locations and costs.

The research assumed productivity levels are equal regardless of country location. If significant differences in productivity do exist between facilities in different countries results may overstate or understate the benefits associated with shifting activities from one country to another.

The research assumes that viable suppliers for all purchased items are available in each of the North American countries. If a longer-term perspective is taken this assumption is realistic. In the near-term it is unlikely that a firm could meet all of its purchase requirements by sourcing exclusively in Mexico.

The research is limited by determining differences between purchased item and finished product prices on the basis of hourly compensation rate differentials that exist between the North American countries. An approach that included differences in materials, overhead costs, and sales, general, and administrative costs would assist in efforts to approximate actual cost differentials between countries.

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The research is limited by the use of a specified number of distribution facilities as a service constraint. This approach may result in retaining more distribution center facilities than are necessary to meet a predetermined customer service level. It may be possible to identify a distribution network that has fewer distribution center facilities that is capable of providing the same level of customer service without increasing total systems cost.

In this study, under the separate country simulations (simulations A1A and B1A) approximately ninety-five percent of the customer market areas were serviced within a two day period. All integrated simulations resulted in approximately ninety-eight percent of the customer market areas being serviced within a two day period.

An additional analysis of the simulation results indicated that the use of the fixed number of facilities approach resulted in the retention of one to two more distribution centers than was actually required to maintain a ninety-eight percent service level. However, this analysis also indicated that the removal of these "unnecessary" facilities would have virtually no effect on the total systems costs. Differences in total systems cost between the distribution network using fewer than the specified number of facilities and the specified number network were, in all cases, less than one-half of one percent. The reason for this situation

is that the savings associated with the removal of the distribution center facility were nearly offset by the increase in transportation costs required to service customer market areas using the revised distribution center network.

The service constraint distance between market areas and distribution centers of eight hundred miles with the assumption being that trucks carrying the finished products travel four hundred miles per day was applied to all market areas. The research could benefit from efforts to more accurately assess distance traveled between distribution center and market areas on a location by location basis. The four hundred mile per day assumption has the potential to understate the number of miles traveled per day in some parts of North America and overstate distance traveled in other parts.

The freight rate data utilized provides an approximation of the costs experienced by firms in the household appliance industry. Actual transportation costs could differ significantly from those used in this research. Factors such as shipping volume, source and destinations of shipments, and backhaul opportunities all impact the firm's actual transportation costs.

Mexican freight rate data is particularly limited given that it had to be developed through a linear regression approach. Actual point to point freight costs would improve the research.

In general, more specific data regarding the cost associated with doing business in Mexico are needed. Detailed labor rates by major cities and regions, freight rates, and manufacturing costs are required.

The final limitation of the research are those related to the simulation modeling approach. Results generated by the simulation model that are described as being the "least cost solution" for the system modeled are the least cost solution generated by heuristic rules incorporated within the simulation model. There is no guarantee, however, that this solution is globally optimum for the specified supplier, manufacturing, and distribution network. Furthermore, there is no indication as to how close the results of the simulation are to the globally optimum solution.

APPENDIX A

SOLUTION APPROACH

APPENDIX A

SOLUTION APPROACH

The term "least total cost" system is based on the service\least cost solution approach contained within the Netsim II model. This solution approach allows the user to specify a service constraint based on the maximum number of miles that are allowed between distribution centers and the markets that they serve. If more than one distribution center is available to service a market within the specified mileage, then the distribution center capable of providing service to the market at the lowest cost serves the market. If no distribution center is available to serve a market within the specified service constraint distance, then the lowest cost distribution center facility serves the market, regardless of distance.

Two additional algorithms are used in conjunction to the service\least cost solution. These algorithms are the bundling and sort-down algorithms and are discussed in the following section.

The bundling algorithm instructs the simulation model to service a specific market area with all finished products and weight groups from the single distribution center location that can do so at the lowest cost. This approach may represent a departure from the degree of flexibility that the distribution operations of major household appliance firms would like to provide, but is not a significant departure from actual practice. This is particularly true for less-than-truckload (LTL) shipments (A.T. Kearney 1992, The Lyte Group 1992).

A complete set of simulation runs were performed for the United States-Canada research questions using bundling of LTL shipments, with truckload shipments free to be sourced in a different location. A second set of United States-Canada simulation runs were performed with all shipment sizes bundled. This completely bundled series differed from the initial series by less than two tenths of one percent in terms of total cost. However, this approach did significantly simplify the determination of market areas serviced by distribution center locations. Given this situation, the completely bundled approach was used for all research questions.

The sort-down algorithm reduces the number of distribution center facilities in the firm's distribution network one facility at a time. This algorithm consists of a series of

service/least cost solutions, each of which determines the removal of the facility that will reduce total systems cost by the greatest amount or increase total systems cost the least. The decision to remove a distribution center facility is based on the increase in cost associated with using a different distribution center to serve the markets currently served by the facility under consideration for removal. The increased cost of serving these markets from a new facility is then offset by the savings from the reduction in fixed costs at the facility to be removed. This procedure is performed for all distribution center facilities that are candidates for removal (A.T. Kearney 1991).

The solution approach utilized in this study does not guarantee that the results are the globally optimum lowest cost system. Once facilities are removed during the sort-down process they are not considered in any later iterations. Therefore, it is possible for a facility that may be part of the globally optimum network to be unavailable for the final network solution.

APPENDIX B

MARKET AREAS AND PERCENT OF COUNTRY DEMAND BY MARKET AREA

APPENDIX B

MARKET AREAS AND PERCENT OF COUNTRY DEMAND BY MARKET AREA

Appendix B contains detailed information regarding the geocoding approaches used to define market areas. This information is presented by country in Tables B-1 through B-3.

Table B-1

United States Market Areas And Percent Of Country Demand By Market Area

Market Code	Location	Zip Codes Included In Market Area	Percent
011	Springfield, MA	011, 010, 012, 013	0.34
016	Worcester, MA	016, 014, 015	0.28
021	Boston, MA	021, 017, 018, 019, 020, 022, 023, 024	1.52
029	Providence, RI	029, 025, 027, 028, 206	0.70
031	Manchester, NH	031, 030, 032, 033, 034, 038, 039	0.42
041	Portland, ME	041, 040, 042, 043, 045	0.27
047	Caribou, ME	047, 044, 046, 049, 048	0.21
054	Burlington, VT	054, 035, 036, 037, 050, 051, 053, 055, 056, 057, 058, 059	0.27
061	Hartford, CT	061, 060, 062, 067	0.55
065	New Haven, CT	065, 063, 064, 066	0.59
069	Stamford, CT	069, 068	0.19
071	Newark, NJ	071, 070, 072, 073, 074, 075, 076, 078, 079	1.57
081	Camden, NJ	081, 080, 082, 083, 084	0.67
089	New Brunswick, NJ	089, 077, 087, 088, 085, 086	0.89
106	White Plains, NY	106, 105, 107, 108, 109	0.57
112	Brooklyn, NY	112, 100, 101, 102, 103, 104, 110, 111, 113, 114, 115, 116, 117, 118, 119	4.01

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Note: Percent refers to percent of total country demand represented by market area (i.e. percent of population)

Source:

Market Areas, Dialog Systems Division of A.T. Kearney, Inc., NETSIM II Documentation Manual, East Lansing, MI: 1991. Population percentages based on National Planning Data Corporation, 1991 Population Reported for All Zip Code Sectional Centers, Claritas/NPDC, Ithica, NY, 1992.

Table B-1 (cont'd.)

<u>Market Code</u>	<u>Location</u>	<u>Zip Codes Included In Market Area</u>	<u>Percent</u>
122	Albany, NY	122, 052, 120, 121, 123, 128	0.45
126	Poughkeepsie, NY	126, 124, 125, 127	0.28
132	Syracuse, NY	132, 129, 130, 131, 133, 134, 135, 136	0.65
139	Binghamton, NY	139, 137, 138, 148, 149	0.28
141	Silver Creek, NY	141, 140, 142, 143, 147	0.61
146	Rochester, NY	146, 144, 145	0.42
152	Pittsburgh, PA	152, 150, 151, 153, 154, 156, 160, 162, 161	1.11
158	Du Bois, PA	158, 163, 167, 168, 169	0.21
159	Johnstown, PA	159, 155, 157, 166	0.23
165	Erie, PA	165, 164	0.12
171	Harrisburg, PA	171, 170, 172, 173, 174, 175, 176, 178	0.76
181	Allentown, PA	181, 180, 182, 183	0.33
187	Wilkes-Barre, PA	187, 177, 184, 185, 186, 188	0.34
194	Pottstown, PA	194, 189, 190, 191, 192, 193	1.49
196	Reading, PA	196, 179, 195	0.19
198	Wilmingon, DE	198, 197, 199, 219	0.30
200	Washington, DC	200, 201, 202, 203, 204, 205, 206, 207, 208,	1.72
		209, 220, 221, 222, 223, 224, 225, 227	
212	Baltimore, MD	212, 210, 211, 213, 214, 216, 217, 218	1.14
215	Cumberland, MD	215, 226, 254, 267	0.15
229	Charlottesville, VA	229, 228, 268	0.14
232	Richmond, VA	232, 230, 231, 238, 239	0.49
235	Norfolk, VA	235, 233, 234, 236, 237, 279	0.63
240	Roanoke, VA	240, 241, 243, 244, 245	0.46
253	Charleston, WV	253, 246, 247, 248, 249, 250, 251, 252,	0.40
		255, 256, 257, 258, 259, 266	
265	Fairmont, WV	265, 260, 261, 262, 263, 264	0.27
274	Greensboro, NC	274, 270, 271, 272, 273	0.55
276	Raleigh, NC	276, 275, 277, 278	0.61
282	Charlotte, NC	282, 280, 281, 297	0.61

Table B-1 (cont'd.)

Market Code	Location	Zip Codes Included In Market Area	Percent
283	Fayetteville, NC	283, 284, 285	0.54
288	Asheville, NC	288, 286, 287, 289	0.41
292	Columbia, SC	292, 290, 291, 295	0.55
294	Charleston, SC	294	0.23
296	Greenville, SC	296, 293	0.43
303	Atlanta, GA	303, 300, 301, 302	1.31
306	Athens, GA	306, 305	0.24
309	Augusta, GA	309, 298, 308	0.20
312	Macon, GA	312, 304, 310, 311	0.30
314	Savannah, GA	314, 299, 313	0.18
317	Albany, GA	317	0.17
319	Columbus, GA	319, 318, 368	0.18
322	Jacksonville, FL	322, 315, 316, 320, 321	0.74
323	Tallahassee, FL	323, 324, 325	0.31
328	Orlando, FL	328, 326, 327, 329, 347	0.97
331	Miami, FL	331, 330, 332, 333	1.32
334	W. Palm Beach, FL	334, 349	0.51
336	Tampa, FL	336, 335, 337, 338, 342, 346	1.28
339	Ft. Myers, FL	339	0.25
352	Birmingham, AL	352, 350, 351, 353, 355	0.49
354	Tuscaloosa, AL	354, 367	0.13
356	Florence, AL	356, 357, 358	0.25
359	Gadsden, AL	359, 362	0.16
361	Montgomery, AL	361, 360, 363	0.26
366	Mobile, AL	366, 364, 365	0.26
372	Nashville, TN	372, 370, 371, 384, 385	0.65
374	Chattanooga, TN	374, 307, 373	0.36
376	Johnson City, TN	376, 242	0.22
379	Knoxville, TN	379, 377, 378	0.39
381	Memphis, TN	381, 380, 386, 723, 724	0.67

Table B-1 (cont'd.)

<u>Market Code</u>	<u>Location</u>	<u>Zip Codes Included In Market Area</u>	<u>Percent</u>
383	Jackson, TN	383, 382	0.14
387	Greenville, MS	387, 389	0.11
388	Tupelo, MS	388, 397	0.16
392	Jackson, MS	392, 390, 391	0.28
393	Meridian, MS	393, 369, 394	0.21
402	Louisville, KY	402, 400, 401, 427, 471	0.53
405	Lexington, KY	405, 403, 404, 406, 407, 408, 409, 411, 412	0.57
		413, 414, 415, 416, 417, 418, 425, 426	
		421, 422	
421	Bowling Green, KY	421, 422	0.12
432	Columbus, OH	432, 430, 431, 437, 438, 456, 457, 433	0.97
436	Toledo, OH	436, 434, 435	0.33
441	Cleveland, OH	441, 440	0.85
442	Ravenna, OH	442, 439, 443, 446, 447	0.63
445	Youngstown, OH	445, 444	0.22
449	Mansfield, OH	449, 448	0.17
452	Cincinnati, OH	452, 410, 450, 451, 470	0.82
454	Dayton, OH	454, 453, 455	0.44
458	Lima, OH	458	0.15
462	Indianapolis, IN	462, 460, 461, 478, 479	0.78
466	South Bend, IN	466, 465	0.22
468	Ft. Wayne, IN	468, 467	0.22
473	Muncie, IN	473, 469	0.26
474	Bloomington, IN	474, 472	0.16
477	Evansville, IN	477, 423, 424, 475, 476	0.29
482	Detroit, MI	482, 480, 481	1.82
485	Flint, MI	485, 484	0.25
486	Saginaw, MI	486, 487	0.24
489	Lansing, MI	489, 488, 492	0.41
495	Grand Rapids, MI	495, 490, 491, 493, 494	0.75
497	Sault Ste. Marie, MI	497, 496, 498, 499	0.28

Table B-1 (cont'd.)

<u>Market Code</u>	<u>Location</u>	<u>Zip Codes Included In Market Area</u>	<u>Percent</u>
503	Des Moines, IA	503, 500, 501, 502, 505, 508, 509, 514	0.38
511	Sioux City, IA	511, 510, 512, 513, 687	0.16
520	Dubuque, IA	520, 504, 506, 507, 521	0.22
528	Davenport, IA	528, 522, 523, 524, 525, 526, 527	0.34
532	Milwaukee, WI	532, 530, 531, 533, 534	0.82
537	Madison, WI	537, 535, 536, 538, 539	0.35
543	Green Bay, WI	543, 541, 542, 544, 545, 549	0.53
546	La Crosse, WI	546, 547	0.17
554	Minneapolis, MN	554, 540, 550, 551, 553, 562, 563	1.29
558	Duluth, MN	558, 548, 556, 557, 564, 566	0.26
559	Rochester, MN	559, 560, 561	0.25
571	Sioux Falls, SD	571, 570, 572, 573, 574, 576	0.20
577	Rapid City, SD	577, 575, 827	0.10
581	Fargo, ND	581, 565, 567, 580, 582, 583, 584	0.24
587	Minot, ND	587, 585, 586, 588	0.11
591	Billings, MT	591, 590, 592, 593, 824	0.12
594	Great Falls, MT	594, 595	0.06
596	Helena, MT	596, 597	0.07
598	Missoula, MT	598, 599	0.09
606	Chicago, IL	606, 463, 464, 600, 601, 602, 603, 604, 605	3.30
611	Rockford, IL	611, 610, 613	0.25
612	Rock Island, IL	612	0.09
616	Peoria, IL	616, 614, 615, 617	0.29
618	Champaign, IL	618, 609, 619	0.21
627	Springfield, IL	627, 624, 625, 626, 628	0.34
631	St. Louis, MO	631, 620, 622, 630, 633, 636	1.13
634	Hannibal, MO	634, 623, 635, 652	0.18
638	Sikeston, MO	638, 420, 629, 637, 639	0.22
641	Kansas City, MO	641, 640, 653, 660, 661, 662	0.74
645	St. Joseph, MO	645, 644, 646	0.10

Table B-1 (cont'd.)

<u>Market Code</u>	<u>Location</u>	<u>Zip Codes Included In Market Area</u>	<u>Percent</u>
648	Joplin, MO	648, 647, 667	0.15
658	Springfield, MO	658, 650, 651, 654, 655, 656, 657	0.35
666	Topeka, KS	666, 664, 665, 668	0.16
672	Wichita, KS	672, 669, 670, 671, 673, 674, 675, 676, 677	0.43
678	Dodge City, KS	678, 679, 739	0.06
681	Omaha, NE	681, 515, 516, 680	0.32
685	Lincoln, NE	685, 683, 684, 686, 689	0.20
691	No. Platte, NE	691, 688, 690, 692, 693	0.06
701	New Orleans, LA	701, 395, 700, 703, 704	0.80
708	Baton Rouge, LA	708, 396, 705, 707	0.51
711	Shreveport, LA	711, 710	0.18
712	Monroe, LA	712	0.13
713	Alexandria, LA	713, 714	0.16
722	Little Rock, AR	722, 716, 719, 720, 721	0.42
727	Fayetteville, AR	727, 725, 726	0.17
729	Fort Smith, AR	729, 728, 749	0.15
731	Oklahoma City, OK	731, 730, 734, 735, 736, 737, 738	0.61
741	Tulsa, OK	741, 740, 743, 746	0.39
745	McAlester, OK	745, 744, 747, 748	0.21
752	Dallas, TX	752, 750, 751, 758	1.11
755	Texarkana, TX	755, 717, 718	0.14
757	Tyler, TX	757, 754, 756, 759	0.40
761	Ft. Worth, TX	761, 760, 762, 764	0.70
763	Wichita Falls, TX	763, 792	0.08
767	Waco, TX	767, 765, 766	0.24
769	San Angelo, TX	769, 768, 797	0.22
770	Houston, TX	770, 771, 772, 773, 774, 775	1.59
777	Beaumont, TX	777, 706, 776	0.25
782	San Antonio, TX	782, 780, 781, 788	0.73
784	Corpus Christi, TX	784, 779, 783, 785	0.54

Table B-1 (cont'd.)

Market Code	Location	Zip Codes Included In Market Area	Percent
787	Austin, TX	787, 778, 786, 789	0.47
791	Amarillo, TX	791, 790, 884	0.16
794	Lubbock, TX	794, 793	0.14
796	Abilene, TX	796, 795	0.08
799	El Paso, TX	799, 798, 879, 880, 883	0.36
802	Denver, CO	802, 800, 801, 803, 804, 805, 806, 807	0.93
810	Pueblo, CO	810, 808, 809, 811, 812	0.29
815	Grand Junction, CO	815, 813, 814, 816	0.11
820	Cheyenne, WY	820, 821, 822, 823, 825, 826, 828, 829, 830, 831	0.15
832	Pocatello, ID	832, 833, 834	0.17
837	Boise, ID	837, 836, 979	0.16
841	Salt Lake City, UT	841, 840, 842, 843, 844, 893, 898	0.59
846	Provo, UT	846, 845, 847	0.13
850	Phoenix, AZ	850, 851, 852, 853, 863	1.02
857	Tucson, AZ	857, 855, 856, 859, 860	0.43
871	Albuquerque, NM	871, 872, 865, 870, 873, 874, 875, 877, 878	0.43
881	Clovis, NM	881, 882	0.09
891	Las Vegas, NV	891, 864, 889, 890	0.36
895	Reno, NV	895, 894, 896, 897, 961	0.18
900	Los Angeles, CA	900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 926, 927, 928	4.21
921	San Diego, CA	921, 920	0.86
924	San Bernardino, CA	924, 922, 923, 925	0.88
933	Bakersfield, CA	933, 930, 931, 932, 934, 935	0.97
937	Fresno, CA	937, 936, 938	0.33
946	Oakland, CA	946, 940, 941, 942, 943, 944, 945, 947, 948, 949, 954	1.99
952	Stockton, CA	952, 939, 950, 951, 953	1.20

Table B-1 (cont'd.)

<u>Market Code</u>	<u>Location</u>	<u>Zip Codes Included In Market Area</u>	<u>Percent</u>
958	Sacramento, CA	958, 956, 957	0.66
960	Redding, CA	960, 955, 959	0.34
968	Honolulu, HI	968, 967	0.45
972	Portland, OR	972, 970, 971, 986	0.71
973	Salem, OR	973, 974, 977	0.42
975	Grant Pass, OR	975, 976	0.11
981	Seattle, WA	981, 980	0.71
982	Everett, WA	982	0.23
984	Tacoma, WA	984, 983, 985	0.48
989	Yakima, WA	989, 988	0.15
992	Spokane, WA	992, 838, 990, 991, 994	0.26
993	Walla Walla, WA	993, 835, 978	0.16
996	Anchorage, AL	995, 996, 997, 998, 999	0.22

Table B-2

Canadian Market Areas And Percent Of Country Demand By Market Area

Market Code	Location	FSA Codes Included										Percent
		In Market Areas										
A1B	St. Johns, NFL	A1A, A1B, A1C, A1E, A1G, A1N, A1V, A2A, A2H, A2N, A2V										1.02
B2V	Halifax, NS	B1A, B1H, B1N, B1P, B1R, B1S, B1V, B2A, B2G, B2H, B2N, B2V, B2W, B2X, B2Y, B3A, B3B, B3H, B3J, B3K, B3L, B3M, B3N, B3P, B3R, B4A, B4B, B4C, B4E, B4H, B4N, B4V, B5A										2.59
C1A	Charlottetowne, PEI	C1A, C1B, C1C, C1E, C1N, C1N										0.29
E1C	Moncton, NB	E1A, E1B, E1C, E1E, E1G, E1N, E1V, E2A, E3N, E3V										0.88
E2H	Saint John, NB	E2H, E2J, E2K, E2L, E2M, E2N, E2P, E2V, E3A, E3B, E3L										0.92
G1A	Quebec, PQ	G1A, G1B, G1C, G1E, G1G, G1H, G1J, G1K, G1L, G1M, G1N, G1P, G1R, G1S, G1T, G1V, G1W, G1X, G1Y, G2A, G2B, G2C, G2E, G2G, G2H, G2K, G2L, G2M, G2N, G3A, G3V, G5V, G6W, G6Z, G7B, G7G, G7H, G7J, G7K, G7S, G7X, G8A, G8B, G8C, G8H, G8L										3.89
G5H	Rimouski, PQ	G4R, G4S, G4W, G4Z, G5B, G5C, G5H, G5L, G5N, G5R,										0.71
G6G	Thetford Mines, PQ	G5Y, G6B, G6E, G6G, G6L, G6P, G6T										0.60
G8V	Trois-Rivieres, PQ	G8P, G8T, G8V, G8W, G8Y, G8Z, G9A, G9B, G9C, G9N, G9P, G9T, G9X										1.03

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Source: Market Areas, Canadian FSA Markets, The Lyte Group, Inc., East Lansing, MI, 1992. Population percentage based on Statistics Canada, 1986 Census of Canada, Urban Forward Sortation Area Profiles - Part I - Regions 1-4, Ottawa, Canada.

Table B-2 (cont'd.)

Market Code	Location	FSA Codes Included In Market Areas	Percent
H9P	Montreal, PQ	H1A, H1B, H1C, H1E, H1G, H1H, H1J, H1K, H1L, H1M, H1N, H1P, H1R, H1S, H1T, H1V, H1W, H1X, H1Y, H1Z, H2A, H2B, H2C, H2E, H2G, H2H, H2J, H2K, H2L, H2M, H2N, H2P, H2S, H2T, H2V, H2W, H2X, H2Y, H2Z, H3A, H3B, H3C, H3E, H3G, H3H, H3J, H3K, H3L, H3M, H3N, H3P, H3R, H3S, H3T, H3V, H3W, H3X, H3Y, H3Z, H4A, H4B, H4C, H4E, H4G, H4H, H4J, H4K, H4L, H4M, H4N, H4P, H4R, H4S, H4V, H4W, H4X, H7A, H7C, H7E, H7G, H7H, H7K, H7L, H7M, H7N, H7P, H7R, H7S, H7T, H7V, H7W, H7X, H7Y, H8N, H8P, H8R, H8S, H8T, H8Y, H8Z, H9A, H9B, H9C, H9E, H9G, H9H, H9J, H9K, H9P, H9R, H9S, H9W, H9X, J2A, J2B, J3G, J3H, J3L, J3P, J3R, J3V, J3Y, J3Z, J4B, J4G, J4H, J4J, J4K, J4L, J4M, J4N, J4P, J4R, J4S, J4T, J4V, J4W, J4X, J4Y, J4Z, J5R, J5V, J5Y, J5Z, J6A, J6E, J6K, J6N, J6S, J6T, J6W, J6Z, J7A, J7B, J7C, J7E, J7G, J7H, J7K, J7L, J7P, J7R, J7V, J7W, J7Y, J7Z, J8C, J8H, J1A, J1E, J1G, J1H, J1J, J1K, J1L, J1M, J1N, J1S, J1T, J1X, J2G, J2H, J2J, J2K, J2N, J8L, J8P, J8R, J8T, J8V, J8X, J8Y, J8Z, J9A, J9E, J9H, J9J, J9L, J9M, J9N, J9P, J9Q, J9R, K1J, K1K, K1L, K1M, K1N, K1O, K1P, K1Q, K1R, K1S, K1T, K1U, K1V, K1W, K1X, K1Y, K1Z, K2A, K2B, K2C, K2D, K2E, K2F, K2G, K2H, K2I, K2J, K2K, K2L, K2M, K2N, K2O, K2P, K2Q, K2R, K2S, K2T, K2U, K2V, K2W, K2X, K2Y, K2Z, K3A, K3B, K3C, K3D, K3E, K3F, K3G, K3H, K3I, K3J, K3K, K3L, K3M, K3N, K3O, K3P, K3Q, K3R, K3S, K3T, K3U, K3V, K3W, K3X, K3Y, K3Z, K4A, K4B, K4C, K4D, K4E, K4F, K4G, K4H, K4I, K4J, K4K, K4L, K4M, K4N, K4O, K4P, K4Q, K4R, K4S, K4T, K4U, K4V, K4W, K4X, K4Y, K4Z, K5A, K5B, K5C, K5D, K5E, K5F, K5G, K5H, K5I, K5J, K5K, K5L, K5M, K5N, K5O, K5P, K5Q, K5R, K5S, K5T, K5U, K5V, K5W, K5X, K5Y, K5Z, K6A, K6B, K6C, K6D, K6E, K6F, K6G, K6H, K6I, K6J, K6K, K6L, K6M, K6N, K6O, K6P, K6Q, K6R, K6S, K6T, K6U, K6V, K6W, K6X, K6Y, K6Z, K7A, K7B, K7C, K7D, K7E, K7F, K7G, K7H, K7I, K7J, K7K, K7L, K7M, K7N, K7O, K7P, K7Q, K7R, K7S, K7T, K7U, K7V, K7W, K7X, K7Y, K7Z, K8A, K8B, K8C, K8D, K8E, K8F, K8G, K8H, K8I, K8J, K8K, K8L, K8M, K8N, K8O, K8P, K8Q, K8R, K8S, K8T, 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K3K, K3L, K3M, K3N, K3O, K3P, K3Q, K3R, K3S, K3T, K3U, K3V, K3W, K3X, K3Y, K3Z, K4A, K4B, K4C, K4D, K4E, K4F, K4G, K4H, K4I, K4J, K4K, K4L, K4M, K4N, K4O, K4P, K4Q, K4R, K4S, K4T, K4U, K4V, K4W, K4X, K4Y, K4Z, K5A, K5B, K5C, K5D, K5E, K5F, K5G, K5H, K5I, K5J, K5K, K5L, K5M, K5N, K5O, K5P, K5Q, K5R, K5S, K5T, K5U, K5V, K5W, K5X, K5Y, K5Z, K6A, K6B, K6C, K6D, K6E, K6F, K6G, K6H, K6I, K6J, K6K, K6L, K6M, K6N, K6O, K6P, K6Q, K6R, K6S, K6T, K6U, K6V, K6W, K6X, K6Y, K6Z, K7A, K7B, K7C, K7D, K7E, K7F, K7G, K7H, K7I, K7J, K7K, K7L, K7M, K7N, K7O, K7P, K7Q, K7R, K7S, K7T, K7U, K7V, K7W, K7X, K7Y, K7Z, K8A, K8B, K8C, K8D, K8E, K8F, K8G, K8H, K8I, K8J, K8K, K8L, K8M, K8N, K8O, K8P, K8Q, K8R, K8S, K8T, K8U, K8V, K8W, K8X, K8Y, K8Z, K9A, K9B, K9C, K9D, K9E, K9F, K9G, K9H, K9I, K9J, K9K, K9L, K9M, K9N, K9O, K9P, K9Q, K9R, K9S, K9T, K9U, K9V, K9W, K9X, K9Y, K9Z, K0A, K0B, K0C, K0D, K0E, K0F, K0G, K0H, K0I, K0J, K0K, K0L, K0M, K0N, K0O, K0P, K0Q, K0R, K0S, K0T, K0U, K0V, K0W, K0X, K0Y, K0Z, K1A, K1B, K1C, K1D, K1E, K1F, K1G, K1H, K1I, K1J, K1K, K1L, K1M, K1N, K1O, K1P, K1Q, K1R, K1S, K1T, K1U, K1V, K1W, K1X, K1Y, K1Z, K2A, K2B, K2C, K2D, K2E, K2F, K2G, K2H, K2I, K2J, K2K, K2L, K2M, K2N, K2O, K2P, K2Q, K2R, K2S, K2T, K2U, K2V, K2W, K2X, K2Y, K2Z, K3A, K3B, K3C, K3D, K3E, K3F, K3G, K3H, K3I, K3J, K3K, K3L, K3M, K3N, K3O, K3P, K3Q, K3R, K3S, K3T, K3U, K3V, K3W, K3X, K3Y, K3Z, K4A, K4B, K4C, K4D, K4E, K4F, K4G, K4H, K4I, K4J, K4K, K4L, K4M, K4N, K4O, K4P, K4Q, K4R, K4S, K4T, K4U, K4V, K4W, K4X, K4Y, K4Z, K5A, K5B, K5C, K5D, K5E, K5F, K5G, K5H, K5I, K5J, K5K, K5L, K5M, K5N, K5O, K5P, K5Q, K5R, K5S, K5T, K5U, K5V, K5W, K5X, K5Y, K5Z, K6A, K6B, K6C, K6D, K6E, K6F, K6G, K6H, K6I, K6J, K6K, K6L, K6M, K6N, K6O, K6P, K6Q, K6R, K6S, K6T, K6U, K6V, K6W, K6X, K6Y, K6Z, K7A, K7B, K7C, K7D, K7E, K7F, K7G, K7H, K7I, K7J, K7K, K7L, K7M, K7N, K7O, K7P, K7Q, K7R, K7S, K7T, K7U, K7V, K7W, K7X, K7Y, K7Z, K8A, K8B, K8C, K8D, K8E, K8F, K8G, K8H, K8I, K8J, K8K, K8L, K8M, K8N, K8O, K8P, K8Q, K8R, K8S, K8T, K8U, K8V, K8W, K8X, K8Y, K8Z, K9A, K9B, K9C, K9D, K9E, K9F, K9G, K9H, K9I, K9J, K9K, K9L, K9M, K9N, K9O, K9P, K9Q, K9R, K9S, K9T, K9U, K9V, K9W, K9X, K9Y, K9Z, K0A, K0B, K0C, K0D, K0E, K0F, K0G, K0H, K0I, K0J, K0K, K0L, K0M, K0N, K0O, K0P, K0Q, K0R, K0S, K0T, K0U, K0V, K0W, K0X, K0Y, K0Z, K1A, K1B, K1C, K1D, K1E, K1F, K1G, K1H, K1I, K1J, K1K, K1L, K1M, K1N, K1O, K1P, K1Q, K1R, K1S, K1T, K1U, K1V, K1W, K1X, K1Y, K1Z, K2A, K2B	

Table B-2 (cont'd.)

<u>Market Code</u>	<u>Location</u>	<u>FSA Codes Included In Market Areas</u>	<u>Percent</u>
K7K	Kingston, ON	K7G, K7H, K7K, K7L, K7M, K7N, K7P, K7R, K8N, K8P, K8R, K8V	1.08
L2M	St. Catharines, ON	L2A, L2E, L2G, L2H, L2J, L2M, L2P, L2R, L2S, L2T, L2V, L3B, L3C, L3K	1.61
L4N	Barrie, ON	L3V, L4M, L4N, L4P, L4R, L9Y	0.69
L4V	Toronto, ON	K9A, K9H, K9J, K9K, K9L, K9V, L1A, L1C, L1G, L1H, L1J, L1K, L1N, L1P, L1R, L1S, L1T, L1V, L1W, L1X, L3Y, L3Z, L4A, L4C, L4E, L4G, L4J, L4K, L4L, L4T, L4W, L4X, L4Y, L4Z, L5A, L5B, L5C, L5E, L5G, L5H, L5J, L5K, L5L, L5M, L5N, L5R, L6H, L6J, L6K, L6L, L6M, L6S, L6T, L6V, L6W, L6X, L6Y, L6Z, L7E, L7G, L7L, L7M, L7N, L7P, L7R, L7S, L7T, L8E, L8G, L8H, L8J, L8K, L8L, L8M, L8N, L8P, L8R, L8S, L8T, L8V, L8W, L9A, L9B, L9C, L9G, L9H, L9J, L9K, L9T, L9W, M1B, M1C, M1E, M1G, M1H, M1J, M1K, M1L, M1M, M1N, M1P, M1R, M1S, M1T, M1V, M2H, M2J, M2K, M2L, M2M, M2N, M2P, M2R, M3A, M3B, M3C, M3H, M3J, M3K, M3L, M3M, M3N, M4A, M4B, M4C, M4E, M4G, M4H, M4J, M4K, M4L, M4M, M4N, M4P, M4R, M4S, M4T, M4V, M4W, M4X, M5A, M5B, M5C, M5E, M5G, M5H, M5J, M5M, M5P, M5R, M5S, M5T, M5V, M6A, M6B, M6C, M6E, M6H, M6J, M6K, M6L, M6M, M6N, M6P, M6S, M8V, M8W, M8X, M8Y, M8Z, M9A, M9B, M9C, M9L, M9M, M9N, M9P, M9R, M9S, M9V, M9W, N1A, N1E, N1G, N1H, N1K	22.58

Table B-2 (cont'd.)

<u>Market Code</u>	<u>Location</u>	<u>FSA Codes Included In Market Areas</u>	<u>Percent</u>
N2B	Kitchner, ON	L7J, N1M, N1R, N1S, N2A, N2B, N2C, N2E, N2G, N2H, N2J, N2K, N2L, N2M, N2N, N2P, N2T, N2V, N2Z, N3B, N3C, N3H, N3L, N3P, N3R, N3S, N3T, N3V, N3Y, N4B, N4G, N4K, N4N, N4S, N4T, N4W, N4Z, N5A	3.11
N5Y	London, ON	N5C, N5H, N5P, N5R, N5V, N5W, N5X, N5Y, N5Z, N6A, N6B, N6C, N6E, N6G, N6H, N6J, N6K, N7A, N7G	1.95
N8N	Windsor, ON	N7L, N7M, N7S, N7T, N7V, N8A, N8H, N8M, N8N, N8P, N8R, N8S, N8T, N8W, N8X, N8Y, N9A, N9B, N9C, N9E, N9G, N9H, N9J, N9V, N9Y	2.29
P3A	Sudbury, ON	P1A, P1B, P1C, P2A, P2N, P3A, P3B, P3C, P3E, P3G, P4N, P4P, P4R, P5A, P5N, P6A, P6B, P6C	1.70
P7A	Thunder Bay, ON	P7A, P7B, P7C, P7E	0.32
P9N	Kenora, ON	P8N, P9A, P9N	0.20
R2X	Winnipeg, MN	R1A, R1N, R2C, R2E, R2G, R2H, R2J, R2K, R2L, R2M, R2N, R2P, R2R, R2V, R2W, R2X, R2Y, R3A, R3B, R3C, R3E, R3G, R3J, R3K, R3L, R3M, R3N, R3P, R3R, R3S, R3T, R3V, R3X, R6W, R7A, R7B, R7N, R8A, R8N	3.95
S4P	Regina, SK	R9A, S3N, S4A, S4H, S4N, S4P, S4R, S4S, S4T, S4V, S4X, S4Y, S6H, S6J, S6K	1.47
S7K	Saskatoon, SK	S6V, S7H, S7J, S7K, S7L, S7M, S7N, S7P, S9A, S9H, S9V	1.49
T2H	Calgary, AL	T1A, T1B, T1C, T1H, T1J, T1K, T1Y, T2A, T2B, T2C, T2E, T2G, T2H, T2J, T2K, T2L, T2M, T2N, T2P, T2R, T2S, T2T, T2V, T2W, T2X, T2Y, T2Z, T3A, T3B, T3C, T3E, T3G, T3H, T3J, T3K, T3L	4.16

Table B-2 (cont'd.)

<u>Market Code</u>	<u>Location</u>	<u>FSA Codes Included In Market Areas</u>	<u>Percent</u>
T5J	Edmonton, AL	T4N, T4P, T4R, T4V, T5A, T5B, T5C, T5E, T5G, T5H, T5J, T5K, T5L, T5M, T5N, T5P, T5R, T5T, T5W, T5X, T5Y, T5Z, T6A, T6B, T6C, T6E, T6G, T6H, T6J, T6K, T6L, T6M, T6P, T6R, T6A, T6B, T8C, T8E, T8G, T8H, T8L, T8N, T8V, T8W, T8A, T9E, T9H, T9J, T9K, T9V V1G, V1H, V2G, V2J, V2K, V2L, V2M, V2N, V8C, V8G, V8J, X1A	4.70
V1H	Prince George, BC	V1A, V1B, V1C, V1E, V1J, V1L, V1M, V1N, V1R, V1S, V1T, V1V, V1W, V1X, V1Y, V1Z, V2A, V2B, V3M, V2C, V2E, V2P, V2R, V2S, V2T, V2V, V2X, V2Y, V3A, V3B, V3C, V3E, V3G, V3H, V3J, V3K, V3L, V3M, V3N, V3R, V3S, V3T, V3V, V3W, V3Z, V4A, V4B, V4C, V4E, V4K, V4L, V4M, V4A, V5B, V5C, V5E, V5G, V5H, V5J, V5L, V5M, V5N, V5P, V5R, V5S, V5T, V5V, V5W, V5X, V5Y, V5Z, V6A, V6B, V6C, V6E, V6G, V6H, V6J, V6K, V6L, V6M, V6N, V6P, V6R, V6S, V6T, V6V, V6W, V6X, V6Y, V6Z, V7A, V7B, V7C, V7E, V7G, V7H, V7J, V7K, V7L, V7M, V7N, V7P, V7R, V7S, V7T, V7V, V7W, V8A, V8L, V8N, V8P, V8R, V8S, V8T, V8V, V8W, V8X, V8Y, V8Z, V9A, V9B, V9C, V9L, V9N, V9R, V9S, V9T, V9W, V9Y, Y1A	1.05
V3M	Vancouver, BC	V1A, V1B, V1C, V1E, V1J, V1L, V1M, V1N, V1R, V1S, V1T, V1V, V1W, V1X, V1Y, V1Z, V2A, V2B, V3M, V2C, V2E, V2P, V2R, V2S, V2T, V2V, V2X, V2Y, V3A, V3B, V3C, V3E, V3G, V3H, V3J, V3K, V3L, V3M, V3N, V3R, V3S, V3T, V3V, V3W, V3Z, V4A, V4B, V4C, V4E, V4K, V4L, V4M, V4A, V5B, V5C, V5E, V5G, V5H, V5J, V5L, V5M, V5N, V5P, V5R, V5S, V5T, V5V, V5W, V5X, V5Y, V5Z, V6A, V6B, V6C, V6E, V6G, V6H, V6J, V6K, V6L, V6M, V6N, V6P, V6R, V6S, V6T, V6V, V6W, V6X, V6Y, V6Z, V7A, V7B, V7C, V7E, V7G, V7H, V7J, V7K, V7L, V7M, V7N, V7P, V7R, V7S, V7T, V7V, V7W, V8A, V8L, V8N, V8P, V8R, V8S, V8T, V8V, V8W, V8X, V8Y, V8Z, V9A, V9B, V9C, V9L, V9N, V9R, V9S, V9T, V9W, V9Y, Y1A	11.99

Table B-3

**Mexican Market Areas And Percent Of Country
Demand By Market Area**

<u>Market Code</u>	<u>Location</u>	<u>Percent</u>
XX1001	Tijuana	0.92
XX1002	Mexicali	0.74
XX1003	Ensenada	0.32
XX1004	Baja California Balance	0.03
XX1005	Baja California Sur	0.39
XX1006	Sonora Balance	0.46
XX1007	Hermosillo	1.02
XX1008	Navojoa	0.77
XX1009	Ciudad Juarez	1.33
XX1010	North Chihuahua Balance	0.34
XX1011	Chihuahua	1.00
XX1012	South Chihuahua Balance	0.28
XX1013	North Coahuila	0.42
XX1014	Monclova	0.37
XX1015	Saltillo	0.69
XX1016	Torreon Area	1.36
XX1017	North Nuevo Leon	0.43
XX1018	Monterrey	2.95
XX1019	South Nuevo Leon	0.43
XX1020	Nuevo Laredo Area	0.39
XX1021	Reynosa Area	0.59
XX1022	Matamoros Area	0.50
XX1023	Ciudad Obregon Area	0.38
XX1024	South Tamaulipas Tampico	0.90
XX1025	San Luis Potosi State	2.47

Note: Percent refers to percent of total country demand represented by market area (i.e. percent of population)

Source: Market Areas, Taylor, John, C. "The United States-Canada-Mexico Free Trade Area: A Logistics Perspective On Distribution Center Location Implications In An Integrated North American Market." Ph.D. dissertation, Michigan State University, 1991. Population percentages based on Instituto Nacional de Estadística, Geografía e Informática, Estados Unidos Mexicanos Resumen General XI Censo General de Población y Vivienda, 1990, Aguascalientes, Mexico, 1992.

Table B-3 (cont'd.)

<u>Market Code</u>	<u>Location</u>	<u>Percent</u>
XX1026	North Zacatecas	0.63
XX1027	South Zacatecas	0.94
XX1028	North Durango State	0.35
XX1029	Durango Area	0.90
XX1030	Los Mochis	0.79
XX1031	Culican	1.33
XX1032	Mazatlan	0.59
XX1033	Nayarit	1.02
XX1034	South Jalisco	1.12
XX1035	Guadalajara Area	4.39
XX1036	North Jalisco	1.02
XX1037	Aguascalientes	0.89
XX1038	Leon	2.16
XX1039	Irapuato	1.40
XX1040	Celeya	1.35
XX1041	Queretaro	1.30
XX1042	Hidalgo	2.33
XX1043	North Veracruz and Poza Rica de Hidalgo	1.40
XX1044	Jalapa	1.54
XX1045	Orizaba	1.35
XX1046	Veracruz	1.76
XX1047	Coatzacoalcos	1.62
XX1048	Puebla State	5.08
XX1049	Tlaxcala State	0.94
XX1050	Mexico City	18.48
XX1051	Mexico State Balance	3.76
XX1052	Morelos State	1.47
XX1053	East Michoacan	2.49
XX1054	West Michoacan	1.88
XX1055	Colima State	0.53
XX1056	Guerrero State	3.23
XX1057	Oaxaca State	3.72
XX1058	Chiapas State	3.96
XX1059	Tabasco State	1.85
XX1060	Campeche State	0.66
XX1061	Yucatan State	1.68
XX1062	Quintana Roo State	0.61

APPENDIX C

COST STRUCTURE AND PRICE DEVELOPMENT

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APPENDIX C

COST STRUCTURE AND PRICE DEVELOPMENT

COST STRUCTURE DEVELOPMENT PROCEDURE

Introduction

In this section the procedure used to develop the product cost structure information for purchased items and finished products for the United States supplier and manufacturing facilities is presented. The objective of the procedure is to determine the producer's dollar expenditure related to each of the following cost categories associated with the manufacture and sale of the purchased items and finished products. The cost categories included are 1) materials, 2) labor, 3) manufacturing overhead and sales, general, and administrative expense (SG&A), and 4) profit. All cost structure calculations are based on data presented in the 1990 Annual Survey Of Manufactures (U.S. Department of Commerce 1992) and RMA Annual Statement Studies (Robert Morris Associates 1991) at the four digit Standard Industrial Classification (SIC) code level. Purchased item cost structure information for the United States supplier is presented in Table C-1. Finished product cost structure information for the United States manufacturer is presented in Table C-2.

Procedure-Purchased Items

1. Four digit standard industrial classification (SIC) codes items were identified for the purchased items.
2. The following information was gathered for each of the purchased items at the four digit SIC code level:
 - a. Value of product shipments
 - b. Cost of materials
 - c. Production worker wages
 - d. Production worker hours
 - e. Payroll
 - f. Social security and other legally required payments
 - g. Employer payments and other programs

- h. Purchased fuels and electric energy used for heat and power
- i. Pre-tax profit stated as a percentage of sales

Source: Items a-h, 1990 Annual Survey of Manufactures, U.S. Department of Commerce 1992, pp. 1-14 - 1-44. Item i, RMA Annual Statement Studies 1991, Robert Morris Associates, Philadelphia, PA 1991.

3. Materials cost is estimated by subtracting the "purchased fuels and electric energy used for heat and power" amount from "cost of materials". The materials cost is then divided by the "value of product shipments" to determine the percentage of "value of product shipments" represented by the materials cost.
4. "Production worker wages" are divided by "payroll" to determine the percentage of "payroll" represented by "production worker wages". The "social security and other legally required payments" and "employer payments and other programs" values are then multiplied by this percentage to determine the approximate amounts of these two categories that are related to production workers.
5. "Production worker wages" are added to the production worker portions of "social security and other legally required payments" and "employer payments and other programs" calculated in the preceding step to determine the total production worker compensation. This amount is used as the estimate for labor cost.
6. The labor cost is divided by the "value of product shipments" to determine the percentage represented by labor cost.
7. Labor cost is divided by "production worker hours" to determine the average hourly labor rate for the specific industry.
8. The pre-tax profit percentage for the industry is determined and used as the basis for the percentage of the "value of product shipments" represented by profits.
9. The sum of the percentages for materials cost, labor cost, and profit are then subtracted from one, the remainder is the percentage of the "value of product shipments" represented by manufacturing overhead and sales, general and administrative expense.

Purchased item cost structure information for the United States supplier is presented in Table C-1.

Table C-1

Purchased Item Cost Structure - United States Supplier

Item No.	Description	Materials	Labor	Overhead/ SG&A	Profit
101	Aluminum Components	64.0	14.1	17.9	4.0
102	Belts	45.4	19.1	33.6	1.9
103	Compressors*	53.0	10.0	27.0	10.0
104	Copper Components	73.5	8.8	9.7	8.0
105	Cord Sets	38.3	16.6	41.3	3.8
106	Corrugated Packaging*	65.0	20.0	12.1	2.9
107	Fasteners	46.5	17.3	32.7	3.5
108	Door Gaskets*	30.0	10.0	50.0	10.0
109	Knobs	46.6	5.0	44.6	3.8
110	1 Speed Motors*	45.0	10.0	35.0	10.0
111	2 Speed Motors*	45.0	10.0	35.0	10.0
112	Paint (Powder)	51.6	5.7	40.4	2.3
113	Plastic Components	45.0	17.3	33.9	3.8
114	Polypropylene Resin*	61.0	8.3	28.5	2.2
115	Pumps	46.7	13.9	35.6	3.8
116	Relays	39.3	12.3	44.6	3.8
117	Steel	69.2	8.5	18.0	4.3
118	Switches	47.0	9.0	40.1	3.9
119	Timers/Motors*	52.0	8.0	31.0	9.0
120	Wiring Harnesses*	45.2	20.4	30.3	4.2
121	Misc. Electronics*	47.0	9.0	41.0	3.0
122	Washer MP	52.4	14.2	31.5	1.9
123	Dryer MP	52.4	14.2	31.5	1.9
124	Range MP	59.7	13.2	25.2	1.9
125	Refrigerator MP	56.8	15.7	25.6	1.9

Source: Cost structure information for purchased items indicated by "*" was provided by suppliers. This information was provided on the condition that the firms would not be identified. Cost structure information for all other purchased items developed using procedure presented in Appendix C.

Procedure-Finished Products

1. The finished products cost structure development procedure is the same for materials and labor costs as the one presented for purchased items. (See Steps 1-7 in Appendix C, Procedure-Purchased Items.)
2. A cost of goods sold value of eighty percent is assumed for the finished products. The sum of the materials and labor cost percentages are subtracted from 0.80. The resulting percentage represents the finished product's overhead cost.
3. Sales, general, and administrative expense are assumed to be seven percent of the selling price for all finished products.
4. The sum of the percentages of the finished product price represented by materials, labor, and overhead costs and SG&A is subtracted from one. The result is the percentage of finished product price represented by other expenses and profit.

Table C-2

Finished Product Cost Structure - United States Manufacturing Location

Cost Category	Finished Products			
	Washer (Percent) \$	Dryer (Percent) \$	Range (Percent) \$	Refrigerator (Percent) \$
Materials	(52.4) 157.00	(52.4) 131.00	(59.7) 242.00	(56.8) 269.00
Labor	(14.2) 42.60	(14.2) 35.50	(13.2) 53.00	(15.7) 74.42
Overhead	(13.4) 40.20	(13.4) 33.50	(7.1) 28.76	(7.5) 35.55
SG&A	(7.0) 21.00	(7.0) 17.50	(7.0) 28.35	(7.0) 33.18
Other expenses/				
Profit	(13.0) 39.20	(13.0) 32.50	(13.0) 52.89	(13.0) 61.85
Price	300.00	250.00	405.00	474.00

Note: Percent value is the percentage of the finished product price of represented by the cost category. Dollar value is dollar amount represented by the cost category.

PRICE DEVELOPMENT PROCEDURE FOR CANADIAN AND MEXICAN SUPPLIERS AND MANUFACTURERS

Purchased Items

The prices for purchased items produced at Canadian and Mexican supplier locations are based on the purchased item cost structure developed for the United States supplier option and adjusted for differences in production worker compensation in these countries. The procedure used is described in the following section.

The supplier's expenditure for labor is based on its hourly compensation cost multiplied by the hours worked. To account for differences in hourly compensation rates between the United States and the other North American countries, an index for comparative hourly compensation costs is used to adjust the United States hourly compensation rate for each industry to those found in Canada and Mexico. The Canadian index value used is 1.08, which indicates that total hourly compensation rates in Canada for 1990 were, on average, eight percent higher than in the United States. The Mexican index value used is 0.12 which indicates that total hourly compensation costs in Mexico for 1990 were, on average, eighty-eight percent lower than in the United States (U.S. Department of Labor 1991).

United States supplier hourly compensation rates were multiplied by the index values with the results being used as the compensation rate for the given non-United States supplier option. All other cost structure amounts remain the same. Therefore, differences in the North American purchased items prices are based solely on differences in labor compensation costs.

Finished Products

The prices of the finished products manufactured in Canada and Mexico were established in the following manner. Overhead, sales, general, and administrative costs, and profit dollar amounts were held constant at all manufacturing locations. The labor cost was adjusted to reflect differences in hourly compensation rates. The materials cost is based on the assumption that each manufacturing location uses domestically produced purchased items.

APPENDIX D

FACILITIES COST DEVELOPMENT

APPENDIX D

FACILITIES COST DEVELOPMENT

Appendix D presents the cost development procedures for four types of cost data used in the simulation model. The costs addressed here include, manufacturing facilities fixed costs, manufacturing facilities variable costs, distribution center facilities fixed costs, and distribution center facilities variable costs.

Manufacturing Facilities Fixed Cost

Total finished product fixed costs are the sum of overhead and SG&A costs developed in Appendix C. This value is defined as the total fixed costs associated with the manufacture and sale of the finished product. The development of total fixed costs and fixed costs for individual manufacturing facilities is discussed in this section. Fixed costs by manufacturing location are presented in Table D-1.

1. Overhead and SG&A values are determined for each finished product. These values are added to provide the finished product fixed costs per unit value.
2. The finished product fixed costs per unit value is then multiplied by the production quantity for each finished product at each manufacturing facility under the separate country scenario. This provides the finished product total fixed costs.
3. The sum of finished product total fixed costs for each manufacturing facility is calculated. This value is the country fixed costs total.
4. The distribution center facility fixed costs are determined for each country. The distribution center fixed costs values were established during preliminary separate country simulation runs. Distribution center fixed costs are addressed separately in the simulation model.
5. The distribution center fixed costs values for each country are subtracted from the country facility total fixed costs for the respective country. The result is the manufacturing facility fixed cost total.

Table D-1
Manufacturing Facilities Fixed Cost

<u>Location/ Finished Product</u>	<u>FC/ Unit (\$)</u>	<u>Production Quantity (units)</u>	<u>Product Total FC (\$ 000)</u>	<u>Country Total FC (\$ 000)</u>	<u>DC FC (\$ 000)</u>	<u>Mfg. Facility Total FC (\$ 000)</u>
Indianapolis						
Washer	61.20	6,072,200	371,619.0			
Dryer	51.00	4,265,500	217,540.5			
Range	57.11	5,556,500	317,331.7			
Refrigerator	68.73	7,038,400	483,749.2	1,390,240.4	9,570.0	1,380,670.4
Toronto						
Washer	61.20	552,050	31,949.5			
Dryer	51.00	437,000	22,287.0			
Range	57.11	452,100	25,819.4			
Refrigerator	68.73	543,050	37,323.8	117,379.7	5,140.0	112,239.7
Monterrey						
Washer	61.20	20,700	1,266.8			
Dryer	51.00	8,250	420.8			
Range	57.11	40,850	2,332.9			
Refrigerator	68.73	36,200	2,488.0	6,508.5	120.0	6,388.5

Notes:

FC/Unit (fixed cost per unit) is the sum of overhead and SG&A amounts developed in Appendix C. Production quantity is the total volume by product under the separate country scenario. U.S. volumes differ from initial total demand amounts presented in Table 4-1 due to the removal of volumes associated with markets not considered in this study. DC FC (distribution center fixed costs) based on distribution center fixed costs addressed separately in the simulation model. Mfg. Facility Total FC is the initial fixed cost value used at each manufacturing facility.

Manufacturing Facilities Variable Cost

The variable labor costs by manufacturing location are presented in Table D-2. Variable manufacturing labor cost values were established using the procedure discussed in the following section.

1. The labor cost values developed in Appendix C were identified for each finished product.
2. The transfer handling costs and average customer handling charges were subtracted from the labor cost as these costs are addressed separately in the simulation model. The result is defined as the variable manufacturing labor cost per unit.
3. This variable manufacturing labor cost per unit is the value used at the United States manufacturing plant location. These values were then adjusted by the comparative cost index values (U.S. Department of Labor 1991) to determine the labor cost for the Canadian and Mexican manufacturing locations.

Table D-2
Manufacturing Variable Cost

Finished Product	Total Labor Cost/Unit (\$)	Average Handling Cost/Unit (\$)	United States		Canadian		Mexican	
			Manufacturing Labor Cost/Unit (\$)	Manufacturing Labor Cost/Unit (\$)	Manufacturing Labor Cost/Unit (\$)	Manufacturing Labor Cost/Unit (\$)	Manufacturing Labor Cost/Unit (\$)	Manufacturing Labor Cost/Unit (\$)
Washer	42.60	7.28	35.32	38.15	4.24			
Dryer	35.50	7.28	28.22	30.48	3.89			
Range	53.00	7.28	45.72	49.38	5.49			
Refrigerator	74.42	7.28	68.73	72.52	8.06			

Notes: The total labor cost per unit is based on product cost structure data presented in Appendix C. Average handling cost per unit is based on the average labor cost associated with transfer and customer handling activities. These costs are addressed separately in the simulation model. United States Manufacturing Cost/Unit is the result of total labor cost per unit less the average handling cost. Canadian and Mexican Manufacturing Labor Cost/Unit values are the product of United States Manufacturing Cost/Unit and the comparative compensation cost index discussed previously (U.S. Department of Labor 1991). The 1990 index values for Canada and Mexico are 1.08 and 0.12, respectively.

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Distribution Center Facilities Fixed Cost

The distribution center fixed costs are a function of two components, a base value and space-related amount. The base amount of \$750,000 is applied to all distribution center facilities in the United States and Canada. The space-related component is a function of the warehouse space costs found in the specific distribution center location. An initial value of \$1 million is used to establish the space-related fixed cost component. The procedure used to develop distribution center fixed costs is discussed in the following section. The fixed costs by distribution center location are presented in Table D-3.

1. The base fixed cost value for United States and Canadian distribution center facilities is assumed to be \$750,000. This value is applied to the fixed costs at all United States and Canadian distribution center facilities.
2. A space cost index was developed from data relating to the net market lease rate per square foot per annum for warehouse space (Exel Logistics 1992, National Association of Realtors, 1992). The index value was calculated using the Indianapolis market as the base value. Values for other distribution facility locations were divided by the Indianapolis value.
3. The space-related fixed cost component is the product the space cost index and the \$1 million space cost initial value (e.g. Moncton index value is 0.69 multiplied by \$1 million results in a space-related fixed cost value of \$690,000.) This amount varies according to the warehouse space costs in the specific geographic location.
4. The base fixed cost and space-related fixed cost components are added to provide the distribution center total fixed cost amount.

Mexican distribution center facility fixed costs were established in the following manner. All Mexican distribution center facility fixed costs were set at \$20,000 with the exception of Monterrey, Nuevo Laredo, and Ciudad Juarez. The Monterrey distribution center carries the highest volume of finished product in the Mexican market. The Monterrey distribution center fixed costs were set at \$100,000. The Nuevo Laredo and Ciudad Juarez facilities are allowed to directly service the United States markets under the most likely levels of integration. Under this level of integration the distribution center fixed costs are set at \$1.3 million to more accurately reflect the costs

associated with a facility capable of accommodating the expected higher product volumes.

Table D-3

Distribution Center Fixed Cost Development

<u>Facility Location</u>	<u>Base FC (\$ millions)</u>	<u>Space FC (\$ millions)</u>	<u>Total FC (\$ millions)</u>
Moncton, NB	0.75	0.69	1.44
Montreal, PQ	0.75	0.92	1.67
Toronto, ON	0.75	1.08	1.83
Niagara Falls, ON	0.75	1.00	1.75
Windsor, ON	0.75	1.23	1.98
Winnipeg, MB	0.75	0.77	1.52
Regina, SK	0.75	0.77	1.52
Calgary, AL	0.75	0.89	1.64
Edmonton, AL	0.75	0.89	1.64
Vancouver, BC	0.75	1.00	1.75
Worcester, MA	0.75	0.92	1.67
Newark, NJ	0.75	1.08	1.83
Buffalo, NY	0.75	1.00	1.75
Cleveland, OH	0.75	0.77	1.52
Detroit, MI	0.75	1.31	2.06
Chicago, IL	0.75	1.15	1.90
Minneapolis, MN	0.75	1.08	1.83
Kansas City, MO	0.75	0.89	1.64
Indianapolis, IN	0.75	1.00	1.75
Raleigh, NC	0.75	0.67	1.42
Atlanta, GA	0.75	0.55	1.30
Memphis, TN	0.75	0.85	1.60
Dallas, TX	0.75	0.85	1.60
Denver, CO	0.75	0.62	1.37
Phoenix, AZ	0.75	0.85	1.60
Los Angeles, CA	0.75	1.08	1.83
San Francisco, CA	0.75	1.38	2.13
Salt Lake City, UT	0.75	0.92	1.67
Reno, NV	0.75	0.70	1.45
Seattle, WA	0.75	1.08	1.83
Nuevo Laredo, COAH			1.30
Cuidad Juarez, CHIH			1.30
Hermosillo, SON			0.02
Chihuahua, CHIH			0.02
Monterrey, N.L.			1.00
Tampico, TAMPS			0.02
San Lois Potosi, S.L.P.			0.02
Guadalajara, JAL.			0.02
Mexico City, D.F.			0.02
Merida, YUC			0.02

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Distribution Center Facilities Variable Cost

The distribution center variable costs are a function of two components, a base value and labor-related amount. The base amount of \$2.00 per unit is applied to all distribution center facilities in the United States and Canada. The labor-related component is a function of the labor costs in the specific distribution center location. An initial value of \$3.00 per unit is used to establish the labor cost component. The procedure used to develop distribution center variable costs is discussed in the following section. The variable costs by distribution center location are presented in Table D-4.

1. The base variable cost value for United States and Canadian distribution center facilities is assumed to be \$2.00. This value is applied to all United States and Canadian distribution center facilities.
2. A labor cost index was developed from data relating to the average wage rates for warehouse labor (Exel Logistics 1992, Statistics Canada 1992). The index value was calculated using the Indianapolis labor rates as the base value. Values for other distribution facility locations were divided by the Indianapolis value.
3. The labor cost component is the product the labor cost index and the \$3.00 initial value. This amount varies according to the labor costs in the specific geographic location.
4. The base cost and labor cost components are added to provide the distribution center total variable cost amount.

Data were not available for the Mexican distribution facilities. A variable cost per unit of \$2.80 was assumed for all Mexican distribution center facilities. This amount was established by dividing the variable cost components equally between base and labor components (i.e. \$2.50 each). The labor component was then multiplied by the comparative compensation index to reflect Mexican labor costs (U.S. Department of Labor 1991).

Table D-4
Distribution Center Variable Cost Development

<u>Facility Location</u>	<u>Base Cost/ Unit (\$)</u>	<u>Unadjusted Labor Cost/ Unit (\$)</u>	<u>Labor Index</u>	<u>Adjusted Labor Cost/ Unit (\$)</u>	<u>Total VC/ Unit (\$)</u>
United States Facilities					
Worcester, MA	2.00	3.00	0.81	2.43	4.43
Newark, NJ	2.00	3.00	0.89	2.67	4.67
Buffalo, NY	2.00	3.00	1.04	3.12	5.12
Cleveland, OH	2.00	3.00	0.85	2.55	4.55
Detroit, MI	2.00	3.00	1.17	3.51	5.51
Chicago, IL	2.00	3.00	0.93	2.79	4.79
Minneapolis, MN	2.00	3.00	0.97	2.91	4.91
Kansas City, MO	2.00	3.00	0.77	2.31	4.31
Indianapolis, IN	2.00	3.00	1.00	5.00	5.00
Raleigh, NC	2.00	3.00	0.69	2.07	4.07
Atlanta, GA	2.00	3.00	0.79	2.37	4.37
Memphis, TN	2.00	3.00	0.73	2.19	4.19
Dallas, TX	2.00	3.00	0.72	2.16	4.16
Denver, CO	2.00	3.00	1.00	3.00	5.00
Phoenix, AZ	2.00	3.00	0.68	2.04	4.04
Los Angeles, CA	2.00	3.00	1.06	3.18	5.18
San Francisco, CA	2.00	3.00	1.06	3.18	5.18
Salt Lake City, UT	2.00	3.00	0.76	2.28	4.28
Reno, NV	2.00	3.00	0.83	2.49	4.49
Seattle, WA	2.00	3.00	0.99	4.97	4.97

Table D-4 (cont'd.)

<u>Facility Location</u>	<u>Base Cost/ Unit (\$)</u>	<u>Unadjusted Labor Cost/ Unit (\$)</u>	<u>Labor Index</u>	<u>Adjusted Labor Cost/ Unit (\$)</u>	<u>Total VC/ Unit (\$)</u>
Canadian Facilities					
Moncton, NB	2.00	3.00	0.80	2.40	4.40
Montreal, PQ	2.00	3.00	0.90	2.71	4.71
Toronto, ON	2.00	3.00	0.90	2.70	4.70
Niagara Falls, ON	2.00	3.00	0.83	2.50	4.50
Windsor, ON	2.00	3.00	1.00	3.00	5.00
Winnipeg, MB	2.00	3.00	0.81	2.43	4.43
Regina, SK	2.00	3.00	0.75	2.26	4.26
Calgary, AL	2.00	3.00	0.85	2.55	4.55
Edmonton, AL	2.00	3.00	0.89	2.68	4.68
Vancouver, BC	2.00	3.00	1.00	3.00	5.00
Mexican Facilities					
Nuevo Laredo, COAH	2.50	2.50	0.12	0.30	2.80
Cuidad Juarez, CHIH	2.50	2.50	0.12	0.30	2.80
Hermosillo, SON	2.50	2.50	0.12	0.30	2.80
Chihuahua, CHIH	2.50	2.50	0.12	0.30	2.80
Monterrey, N.L.	2.50	2.50	0.12	0.30	2.80
Tampico, TAMPS	2.50	2.50	0.12	0.30	2.80
San Luis Potosi, S.L.P	2.50	2.50	0.12	0.30	2.80
Guadalajara, JAL.	2.50	2.50	0.12	0.30	2.80
Mexico City, D.F.	2.50	2.50	0.12	0.30	2.80
Merida, YUC	2.50	2.50	0.12	0.30	2.80

APPENDIX E

MEXICAN FREIGHT RATE REGRESSION

APPENDIX E

MEXICAN FREIGHT RATE REGRESSION

Table E-1

Mexican Freight Rate Regression

<u>Source</u>	<u>Destination</u>	<u>Distance (miles)</u>	<u>LTL Rate (\$)</u>	<u>TL Rate (\$)</u>
Mexico City	Acapulco	259	662.40	1,083.93
Mexico City	Chihuahua	1394	956.72	1,435.08
Mexico City	Guadalajara	423	592.05	781.51
Mexico City	Merida	972	1,201.37	2,002.28
Mexico City	Monterrey	618	650.41	975.61
Mexico City	Oaxaca	341	726.54	1,188.88
Mexico City	San Lois Potosi	258	395.90	593.86
Mexico City	Tijuana	1885	1,750.74	2,626.12
Mexico City	Torreon	620	701.30	1,051.95
Mexico City	Veracruz	264	481.75	802.91
Mexico City	Villahermosa	565	788.25	1,313.76
Monterrey	Acapulco	878	1,505.29	2,463.20
Monterrey	Chihuahua	518	613.57	920.35
Monterrey	Guadalajara	485	722.54	2,563.02
Monterrey	Merida	1383	1,665.12	2,775.21
Monterrey	Oaxaca	959	1,593.25	2,607.13
Monterrey	San Lois Potosi	336	453.65	680.48
Monterrey	Tijuana	1728	1,674.67	2,512.01
Monterrey	Torreon	228	359.81	539.72
Monterrey	Veracruz	676	775.70	1,551.40
Monterrey	Villahermosa	979	1,034.46	2,068.91

Table E-1 (cont'd.)

Regression Output:	<u>LTL Rates</u>	<u>TL Rates</u>
Constant	305.193757	647.8460
Standard Error of Y Estimate	224.43281	526.4787
R Squared	0.77241986	0.570678
Number of Observations	21	21
Degrees of Freedom	19	19
X Coefficient	0.817814	1.200589
Standard Error of Y Coefficient	0.101840	0.238898

Source: Telephone interview with Transporta Nacional, S.A. de C.V. and fax from Mexico City office.

Note: LTL rate applies to shipments 30,000 pounds and below. TL rate applies to shipments over 30,000 pounds.

APPENDIX F

UNITED STATES - CANADA SIMULATION RESULTS

APPENDIX F

UNITED STATES - CANADA SIMULATION RESULTS

Table F-1

RQA1A Results: US-Canada Separate Countries

Summary

<u>Finished Product Demand</u>	(000)
Total Units	24,886.8

<u>Cost Information</u>	(\$000)
Total Purchase Cost	5,071,355.2
Total Manufacturing Cost	7,839,808.3
Total Distribution Center Cost	353,805.9
Total Transportation Cost	541,767.7
Total System Cost	8,678,143.8

<u>Transportation Cost Detail</u>	(\$000)
Inbound Freight:	57,238.1
Internal Transfer Freight:	140,698.1
Customer Freight:	343,831.6

Total Transportation Cost:	541,767.7
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<u>Facilities Utilized</u>	<u>Type</u>
Woodstock	S
Ft. Wayne	S
Toronto	M
Indianapolis	M
Montreal	DC
Toronto	DC
Edmonton	DC
Worcester	DC
Indianapolis	DC
Raleigh	DC
Atlanta	DC
Dallas	DC
Los Angeles	DC

Table F-1 (cont'd.)

Purchases By Manufacturing Plant Location / Purchases By Supplier Location

Manufacturing Plant Location: Toronto

Supplier Location: Woodstock

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.1630	5,073.2	5,900.1	87.8	5,987.9
102	Belts	2.4367	1,481.1	3,609.0	8.0	3,617.0
103	Compressors	50.4000	543.1	27,369.7	235.0	27,604.7
104	Copper Components	1.0574	1,583.7	1,674.6	27.4	1,702.0
105	Cord Sets	2.2799	1,065.1	2,428.3	14.8	2,443.1
106	Corrugated Packaging	2.2860	1,954.2	4,467.3	338.3	4,805.6
107	Fasteners	.0101	308,976.4	3,120.7	34.8	3,155.4
108	Door Gaskets	8.0640	543.1	4,379.2	188.0	4,567.2
109	Knobs	.2510	7,595.2	1,906.4	8.2	1,914.6
110	1 Speed Motors	18.4666	437.0	8,069.9	113.5	8,183.4
111	2 Speed Motors	24.9480	522.1	13,024.1	180.7	13,204.8
112	Paint (Powder)	3.2648	614.7	2,006.8	10.6	2,017.5
113	Plastic Components	3.5484	1,954.2	6,934.3	50.7	6,985.0
114	Polypropylene Resin	.3624	30,385.8	11,011.8	526.0	11,537.8
115	Pumps	6.0667	522.1	3,167.1	9.0	3,176.2
116	Relays	7.0689	1,065.1	7,529.1	11.5	7,540.6
117	Steel	.2829	162,405.4	45,944.5	2,811.3	48,755.8
118	Switches	.7554	8,961.0	6,769.1	15.5	6,784.6
119	Timers/Motors	7.2964	3,477.3	25,371.8	6.0	25,377.8
120	Wiring Harnesses	6.0776	1,954.2	11,876.8	67.7	11,944.5
121	Misc. Electronics	6.4461	1,954.2	12,597.0	10.2	12,607.1
122	Washer MP	46.0068	522.1	24,017.8	271.1	24,289.0
123	Dryer MP	39.2610	437.0	17,157.1	7.6	17,164.6
124	Range MP	177.6261	452.1	80,304.8	743.5	81,048.2
125	Refrigerator MP	114.1256	543.1	61,975.9	564.0	62,539.9
Total:				392,613.2	6,341.3	398,954.5

Manufacturing Plant Location: Indianapolis

Supplier Location: Fort Wayne

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	1.1500	65,082.0	74,844.3	968.4	75,812.7
102	Belts	2.4000	16,409.9	39,383.8	69.1	39,452.9
103	Compressors	50.0000	7,038.4	351,920.0	2,167.8	354,087.8
104	Copper Components	1.0500	20,374.3	21,393.0	215.2	21,608.1
105	Cord Sets	2.2500	13,110.6	29,498.9	120.0	29,618.8
106	Corrugated Packaging	2.2500	22,932.6	51,598.4	2,825.3	54,423.7
107	Fasteners	.0100	3,583,891.2	35,838.9	287.0	36,125.9
108	Door Gaskets	8.0000	7,038.4	56,307.2	1,734.3	58,041.5
109	Knobs	.2500	90,832.9	22,708.2	99.5	22,807.7
110	1 Speed Motors	18.3200	4,265.5	78,144.0	788.3	78,932.2
111	2 Speed Motors	24.7500	6,072.2	150,287.0	1,496.2	151,783.1
112	Paint (Powder)	3.2500	7,323.3	23,800.9	70.9	23,871.7
113	Plastic Components	3.5000	22,932.6	80,264.1	602.7	80,866.8
114	Polypropylene Resin	.3600	377,159.5	135,777.4	3,982.8	139,760.2
115	Pumps	6.0000	6,072.2	36,433.2	90.4	36,523.6
116	Relays	7.0000	13,110.6	91,774.2	110.5	91,884.7
117	Steel	.2810	1,874,393.0	526,704.4	16,494.7	543,199.1
118	Switches	.7500	102,854.1	77,140.6	138.7	77,279.2
119	Timers/Motors	7.2500	41,274.9	299,243.0	55.6	299,298.7
120	Wiring Harnesses	5.9800	22,932.6	137,136.9	524.7	137,661.6
121	Misc. Electronics	6.4000	22,932.6	146,768.6	92.7	146,861.4
122	Washer MP	45.4900	6,072.2	276,224.4	3,191.6	279,415.9
123	Dryer MP	38.8200	4,265.5	165,586.7	74.7	165,661.4
124	Range MP	175.7700	5,556.5	976,666.0	7,854.7	984,520.7
125	Refrigerator MP	112.7100	7,038.4	793,298.1	6,841.3	800,139.4
Total:				4,678,742.0	50,896.8	4,729,638.8

Table F-1 (cont'd.)

Total Purchase Expenditure For Each Purchased Item And Total Purchases For The Firm

Item No.	Description	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	70,155.2	80,744.4	1,056.2	81,800.6
102	Belts	17,891.0	42,992.8	77.1	43,069.9
103	Compressors	7,581.5	379,289.7	2,402.8	381,692.6
104	Copper Components	21,957.9	23,067.5	242.6	23,310.1
105	Cord Sets	14,175.7	31,927.2	134.7	32,061.9
106	Corrugated Packaging	24,886.8	56,065.7	3,163.6	59,229.2
107	Fasteners	3,892,867.6	38,959.6	321.8	39,281.3
108	Door Gaskets	7,581.5	60,686.4	1,922.3	62,608.6
109	Knobs	98,428.1	24,614.6	107.7	24,722.3
110	1 Speed Motors	4,702.5	86,213.9	901.7	87,115.6
111	2 Speed Motors	6,594.3	163,311.1	1,676.9	164,988.0
112	Paint (Powder)	7,938.0	25,807.7	81.5	25,889.2
113	Plastic Components	24,886.8	87,198.4	653.4	87,851.8
114	Polypropylene Resin	407,545.3	146,789.2	4,508.8	151,298.0
115	Pumps	6,594.3	39,600.3	99.4	39,699.7
116	Relays	14,175.7	99,303.3	122.0	99,425.3
117	Steel	2,036,798.4	572,648.9	19,306.0	591,954.9
118	Switches	111,815.1	83,909.7	154.2	84,063.9
119	Timers/Motors	44,752.2	324,614.8	61.7	324,676.5
120	Wiring Harnesses	24,886.8	149,013.8	592.4	149,606.2
121	Misc. Electronics	24,886.8	159,365.6	102.9	159,468.5
122	Washer MP	6,594.3	300,242.2	3,462.7	303,704.9
123	Dryer MP	4,702.5	182,743.8	82.3	182,826.1
124	Range MP	6,008.6	1,056,970.8	8,598.2	1,065,568.9
125	Refrigerator MP	7,581.5	855,274.0	7,405.4	862,679.3
Total:			5,071,355.2	57,238.1	5,128,593.3

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Toronto

Item	Quantity	Purchased	Mfg.	Transfer		Total	
No. Description	(000)	Materials/ Unit (\$)	Labor/ Unit (\$)	Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Mfg. VC (\$ 000)	
201 Washers	522.1	159.17	38.15	2.35	199.67	104,238.6	
202 Dryers	437.0	132.59	30.48	2.35	165.42	72,290.0	
203 Ranges	452.1	244.32	49.38	2.35	296.05	133,845.2	
204 Refrigerators	543.1	271.54	72.51	2.35	346.40	188,110.2	
Total:		1,954.2			VC Total:	498,484.0	
						FC Total:	112,239.7
						Plant Total:	610,723.7

Manufacturing Plant Location: Indianapolis

Item	Quantity	Purchased	Mfg.	Transfer		Total	
No. Description	(000)	Materials/ Unit (\$)	Labor/ Unit (\$)	Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Mfg. VC (\$ 000)	
201 Washers	6,072.2	156.63	35.32	2.50	194.45	1,180,765.7	
202 Dryers	4,265.5	130.36	28.22	2.50	161.08	687,093.5	
203 Ranges	5,556.5	240.83	45.72	2.50	289.05	1,606,120.2	
204 Refrigerators	7,038.4	267.71	67.14	2.50	337.35	2,374,434.7	
Total:		22,932.6			VC Total:	5,848,414.2	
						FC Total:	1,380,670.4
						Plant Total:	7,229,084.6
Firm Total:		24,886.8			Firm VC Total:	6,346,898.2	
						Firm FC Total:	1,492,910.1
						Firm MFG Total:	7,839,808.3

Table F-1 (cont'd.)

Source Of Finished Products By Distribution Center Location /
Total Cost For Distribution Center Operations

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Montreal	Washers	CAN	140.8	662.9	1,013.4		1,676.3
	Dryers	CAN	117.9	555.3	707.4		1,262.7
	Ranges	CAN	121.9	574.2	1,184.9		1,759.0
	Refrigerators	CAN	146.5	689.8	1,665.1		2,354.9
	Total:		527.0	2,482.2	4,570.8	1,670.0	7,053.0
						DC Total:	8,723.0
Toronto	Washers	CAN	251.5	1,182.1	1,810.8		2,992.9
	Dryers	CAN	210.5	989.4	1,263.0		2,252.4
	Ranges	CAN	217.8	1,023.4	2,116.5		3,140.0
	Refrigerators	CAN	261.7	1,229.8	2,975.0		4,204.7
	Total:		941.4	4,424.6	8,165.3	1,830.0	12,589.9
						DC Total:	14,419.9
Edmonton	Washers	CAN	129.8	607.5	934.6		1,542.0
	Dryers	CAN	108.6	508.3	651.6		1,159.9
	Ranges	CAN	112.5	526.3	1,093.0		1,619.3
	Refrigerators	CAN	135.0	631.6	1,534.4		2,166.0
	Total:		485.8	2,273.6	4,213.6	1,640.0	6,487.1
						DC Total:	8,127.1
Worcester	Washers	US	371.3	1,644.6	2,673.0		4,317.6
	Dryers	US	260.8	1,155.1	1,564.5		2,719.6
	Ranges	US	339.7	1,504.9	3,301.9		4,806.8
	Refrigerators	US	430.3	1,906.2	4,892.5		6,798.7
	Total:		1,402.0	6,210.9	12,431.9	1,670.0	18,642.8
						DC Total:	20,312.8
Indianapolis	Washers	US	3,166.1	15,830.5	22,795.9		38,626.4
	Dryers	US	2,224.1	11,120.3	13,344.3		24,464.6
	Ranges	US	2,897.3	14,486.5	28,161.8		42,648.3
	Refrigerators	US	3,670.0	18,349.8	41,727.3		60,077.1
	Total:		11,957.4	59,787.0	106,029.3	1,750.0	165,816.3
						DC Total:	167,566.3
Raleigh	Washers	US	365.4	1,487.0	2,630.5		4,117.5
	Dryers	US	256.7	1,044.8	1,540.2		2,585.0
	Ranges	US	334.3	1,360.4	3,248.9		4,609.3
	Refrigerators	US	423.5	1,723.7	4,815.2		6,538.9
	Total:		1,379.8	5,615.8	12,234.8	1,420.0	17,850.6
						DC Total:	19,270.6
Atlanta	Washers	US	674.8	2,948.7	4,858.2		7,806.9
	Dryers	US	473.9	2,070.9	2,843.4		4,914.3
	Ranges	US	617.3	2,697.6	6,000.2		8,697.8
	Refrigerators	US	781.9	3,416.9	8,890.2		12,307.1
	Total:		2,547.9	11,134.1	22,592.0	1,300.0	33,726.1
						DC Total:	35,026.1
Dallas	Washers	US	616.3	2,563.8	4,437.4		7,001.2
	Dryers	US	433.0	1,801.3	2,598.0		4,399.3
	Ranges	US	564.1	2,346.7	5,483.1		7,829.7
	Refrigerators	US	714.5	2,972.3	8,123.9		11,096.2
	Total:		2,327.9	9,684.1	20,642.3	1,600.0	30,326.3
						DC Total:	31,926.3

Table F-1 (cont'd.)

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Los Angeles	Washers	US	878.5	4,550.4	6,324.8		10,875.2
	Dryers	US	617.1	3,196.6	3,702.6		6,899.2
	Ranges	US	803.9	4,163.9	7,813.4		11,977.4
	Refrigerators	US	1,018.3	5,274.5	11,577.5		16,852.0
	Total:		3,317.7	17,185.4	29,418.4	1,830.0	46,603.8
							DC Total: 48,433.8
							Firm DC Total: 353,805.9

Market Areas Serviced By Distribution Center Location

Distribution Center: Montreal Market Areas (10):

C1A-Charl, E1C-Monct, E2H-Saint, G1A-Quebe, G5H-Rimou, G6G-Thetf, G8V-Trois, H9P-Montr, J1E-Sherb, J9X-Rouyn

Distribution Center: Toronto Market Areas (14):

A1B-St Jo, B2V-Halif, J8X-Ottaw, K7K-Kings, L2M-St. C, L4N-Barri, L4V-Toron, N2B-Kitch, N5Y-Londo, N8N-Winds, P3A-Sudbu, P7A-Thund, P9N-Kenor, R2X-Winni,

Distribution Center: Edmonton Market Areas (6):

S4P-Regin, S7K-Saska, T2H-Calga, T5J-Edmon, V1H-Princ, V3M-Vanco

Distribution Center: Worcester Market Areas (13):

011-Sprng, 016-Worch, 021-Bosto, 029-Provd, 031-Manch, 041-Portl, 047-Bango, 054-Burln, 061-Hartf, 065-NewHa, 069-Stamf, 122-Alban, 126-Pough

Distribution Center: Indianapolis Market Areas (112):

071-Newar, 081-Camde, 089-NewBr, 106-WhitP, 112-Brook, 132-Syrac, 139-Bingp, 141-Buffa, 146-Rochs, 152-Pitts, 158-Du Bo, 159-Johns, 165-Erie, 171-Harrs, 181-Allen, 187-Wlks-, 194-Phila, 196-Readi, 198-Wilmn, 212-Balti, 215-Cumbr, 253-Charl, 265-Clrks, 288-Ashev, 352-Birmg, 354-Tusca, 356-Hunts, 366-Mobil, 372-Nashv, 374-Chata, 376-Johns, 379-Knoxv, 381-Memph, 383-Jacks, 387-Grenv, 388-Tupel, 392-Jacks, 393-Merid, 402-Louis, 405-Lexin, 421-Bowln, 432-Colum, 436-Toled, 441-Clevl, 442-Akron, 445-Young, 449-Mansf, 452-Cncin, 454-Dayto, 458-Lima,, 462-Indan, 466-South, 468-Ft.Wa, 473-Munci, 474-Blomm, 477-Evans, 482-Detro, 485-Flint, 486-Sagin, 489-Lansi, 495-GrndR, 497-SStMa, 503-DesMo, 511-Sioux, 520-Dubuq, 528-Daven, 532-Milwa, 537-Madis, 543-Green, 546-EauCl, 554-Minea, 558-Dulut, 559-Rochs, 571-Sioux, 581-Fargo, 591-Billi, 594-Great, 596-Helen, 598-Misou, 606-Chica, 611-Rockf, 612-Rockl, 616-Peori, 618-Champ, 627-Sprin, 631-StLou, 634-Hanni, 638-CapeG, 641-Kanss, 645-St.Jo, 648-Jopli, 658-Sprin, 666-Topek, 672-Wichi, 681-Omaha, 685-Linco, 712-Monro, 722-Litle, 727-Fayet, 729-Ft.Sm, 741-Tulsa, 820-Cheye, 832-Pocat, 837-Boise, 972-Portl, 973-Salem, 981-Seatt, 982-Evere, 984-Tacom, 989-Yakim, 992-Spoka, 993-Walaw

Distribution Center: Raleigh Market Areas (10):

200-Washn, 229-Harsn, 232-Richm, 235-Norfo, 240-Roano, 274-Green, 276-Ralei, 282-Charl, 283-Fayet, 294-Charl

Distribution Center: Atlanta Market Areas (23):

292-Colmb, 296-Grenv, 303-Atlan, 306-Athen, 309-Augus, 312-Macon, 314-Savan, 317-Alban, 319-Colum, 322-Jacks, 323-Talla, 328-Orlan, 331-Miami, 334-W.Plm, 336-Tampa, 339-FtMye, 359-Gadsd, 361-Montg, 577-Rapid, 587-Minot, 701-NewOr, 708-BatnR, 713-Alexn

Distribution Center: Dallas Market Areas (25):

678-Dodge, 691-N.Pla, 711-Shrev, 731-OklaC, 745-Mcals, 752-Dalla, 755-Texar, 757-Tyler, 761-Ft.Wo, 763-Wicht, 767-Waco,, 769-SanAn, 770-Houst, 777-Beaum, 782-SanAn, 784-CorpC, 787-Austi, 791-Amari, 794-Lubbo, 796-Abile, 799-El Pa, 802-Denve, 810-Puebl, 871-Albuq 881-Roswe,

Distribution Center: Los Angeles Market Areas (17):

815-GrndJ, 841-SltLk, 846-Provo, 850-Phoen, 857-Tucso, 891-LasVe, 895-Reno,, 900-LosAn, 921-SanDi, 924-SanBe, 933-Bakrs, 937-Fresn, 946-Oakla, 952-Stock, 958-Sacra, 960-Reddi, 975-Medfo,

Table F-2

RQA1B Results: US-Canada Initial Integration

Summary

<u>Finished Product Demand</u>	<u>(000)</u>
Total Units	24,886.8

<u>Cost Information</u>	<u>(\$000)</u>
Total Purchase Cost	5,071,176.2
Total Manufacturing Cost	7,839,160.5
Total Distribution Center Cost	353,985.7
Total Transportation Cost	544,957.0
Total System Cost	8,681,019.2

<u>Transportation Cost Detail</u>	<u>(\$000)</u>
Inbound Freight:	57,084.1
Internal Transfer Freight:	137,575.6
Customer Freight:	350,297.3

Total Transportation Cost:	544,957.0
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<u>Facilities Utilized</u>	<u>Type</u>
Woodstock	S
Ft. Wayne	S
Toronto	M
Indianapolis	M
Moncton	DC
Toronto	DC
Edmonton	DC
Worcester	DC
Indianapolis	DC
Atlanta	DC
Dallas	DC
Los Angeles	DC
Salt Lake City	DC

Table F-2 (cont'd.)

Purchases By Manufacturing Plant Location / Purchases By Supplier Location

Manufacturing Plant Location: Toronto

Supplier Location: Woodstock

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.1630	5,073.2	5,900.1	87.8	5,987.9
102	Belts	2.4367	1,331.9	3,245.4	7.2	3,252.7
103	Compressors	50.4000	543.1	27,369.7	235.0	27,604.7
104	Copper Components	1.0574	1,583.7	1,674.6	27.4	1,702.0
105	Cord Sets	2.2799	1,065.1	2,428.3	14.8	2,443.1
106	Corrugated Packaging	2.2860	1,805.0	4,126.2	312.5	4,438.7
107	Fasteners	.0101	281,225.2	2,840.4	31.6	2,872.0
108	Door Gaskets	8.0640	543.1	4,379.2	188.0	4,567.2
109	Knobs	.2510	7,296.8	1,831.5	7.9	1,839.4
110	1 Speed Motors	18.4666	287.8	5,314.7	74.7	5,389.4
111	2 Speed Motors	24.9480	522.1	13,024.1	180.7	13,204.8
112	Paint (Powder)	3.2648	582.6	1,902.1	10.1	1,912.2
113	Plastic Components	3.5484	1,805.0	6,404.9	46.9	6,451.7
114	Polypropylene Resin	.3624	30,236.6	10,957.7	523.4	11,481.2
115	Pumps	6.0667	522.1	3,167.1	9.0	3,176.2
116	Relays	7.0689	1,065.1	7,529.1	11.5	7,540.6
117	Steel	.2829	147,037.8	41,597.0	2,545.3	44,142.3
118	Switches	.7554	8,065.8	6,092.9	14.0	6,106.9
119	Timers/Motors	7.2964	3,178.9	23,194.5	5.5	23,200.0
120	Wiring Harnesses	6.0776	1,805.0	10,970.1	62.5	11,032.6
121	Misc. Electronics	6.4461	1,805.0	11,635.2	9.4	11,644.6
122	Washer MP	46.0068	522.1	24,017.8	271.1	24,289.0
123	Dryer MP	39.2610	287.8	11,299.3	5.0	11,304.3
124	Range MP	177.6261	452.1	80,304.8	743.5	81,048.2
125	Refrigerator MP	114.1256	543.1	61,975.9	564.0	62,539.9
Total:				373,182.7	5,988.9	379,171.5

Manufacturing Plant Location: Indianapolis

Supplier Location: Fort Wayne

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	1.1500	65,082.0	74,844.3	968.4	75,812.7
102	Belts	2.4000	16,559.1	39,741.8	69.8	39,811.6
103	Compressors	50.0000	7,038.4	351,920.0	2,167.8	354,087.8
104	Copper Components	1.0500	20,374.3	21,393.0	215.2	21,608.1
105	Cord Sets	2.2500	13,110.6	29,498.9	120.0	29,618.8
106	Corrugated Packaging	2.2500	23,081.8	51,934.1	2,843.7	54,777.7
107	Fasteners	.0100	3,611,642.6	36,116.4	289.2	36,405.6
108	Door Gaskets	8.0000	7,038.4	56,307.2	1,734.3	58,041.5
109	Knobs	.2500	91,131.3	22,782.8	99.8	22,882.6
110	1 Speed Motors	18.3200	4,414.7	80,877.3	815.8	81,693.1
111	2 Speed Motors	24.7500	6,072.2	150,287.0	1,496.2	151,783.1
112	Paint (Powder)	3.2500	7,355.4	23,905.1	71.2	23,976.3
113	Plastic Components	3.5000	23,081.8	80,786.3	606.6	81,392.9
114	Polypropylene Resin	.3600	377,308.7	135,831.1	3,984.4	139,815.5
115	Pumps	6.0000	6,072.2	36,433.2	90.4	36,523.6
116	Relays	7.0000	13,110.6	91,774.2	110.5	91,884.7
117	Steel	.2810	1,889,760.6	531,022.7	16,629.9	547,652.6
118	Switches	.7500	103,749.3	77,812.0	139.9	77,951.8
119	Timers/Motors	7.2500	41,573.3	301,406.4	56.0	301,462.5
120	Wiring Harnesses	5.9800	23,081.8	138,029.2	528.1	138,557.3
121	Misc. Electronics	6.4000	23,081.8	147,723.5	93.3	147,816.9
122	Washer MP	45.4900	6,072.2	276,224.4	3,191.6	279,415.9
123	Dryer MP	38.8200	4,414.7	171,378.7	77.4	171,456.0
124	Range MP	175.7700	5,556.5	976,666.0	7,854.7	984,520.7
125	Refrigerator MP	112.7100	7,038.4	793,298.1	6,841.3	800,139.4
Total:				4,697,993.6	51,095.2	4,749,088.8

Table F-2 (cont'd.)

Total Purchase Expenditure For Each Purchased Item And Total Purchases For The Firm

Item No.	Description	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	70,155.2	80,744.4	1,056.2	81,800.6
102	Belts	17,891.0	42,987.3	77.0	43,064.3
103	Compressors	7,581.5	379,289.7	2,402.8	381,692.6
104	Copper Components	21,957.9	23,067.5	242.6	23,310.1
105	Cord Sets	14,175.7	31,927.2	134.7	32,061.9
106	Corrugated Packaging	24,886.8	56,060.3	3,156.1	59,216.4
107	Fasteners	3,892,867.8	38,956.8	320.9	39,277.7
108	Door Gaskets	7,581.5	60,686.4	1,922.3	62,608.6
109	Knobs	98,428.1	24,614.3	107.7	24,722.0
110	1 Speed Motors	4,702.5	86,192.0	890.6	87,082.6
111	2 Speed Motors	6,594.3	163,311.1	1,676.9	164,988.0
112	Paint (Powder)	7,938.0	25,807.2	81.3	25,888.5
113	Plastic Components	24,886.8	87,191.2	653.5	87,844.6
114	Polypropylene Resin	407,545.3	146,788.9	4,507.8	151,296.7
115	Pumps	6,594.3	39,600.3	99.4	39,699.7
116	Relays	14,175.7	99,303.3	122.0	99,425.3
117	Steel	2,036,798.4	572,619.7	19,175.2	591,794.9
118	Switches	111,815.1	83,904.9	153.8	84,058.7
119	Timers/Motors	44,752.2	324,601.0	61.5	324,662.5
120	Wiring Harnesses	24,886.8	148,999.2	590.6	149,589.8
121	Misc. Electronics	24,886.8	159,358.7	102.7	159,461.4
122	Washer MP	6,594.3	300,242.2	3,462.7	303,704.9
123	Dryer MP	4,702.5	182,678.0	82.3	182,760.3
124	Range MP	6,008.6	1,056,970.8	8,598.2	1,065,568.9
125	Refrigerator MP	7,581.5	855,274.0	7,405.4	862,679.3
Total:			5,071,176.2	57,084.1	5,128,260.3

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Toronto

Item No.	Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201	Washers	522.1	159.17	38.15	2.35	199.67	104,238.6
202	Dryers	287.8	132.59	30.48	2.35	165.42	47,608.9
203	Ranges	452.1	244.32	49.38	2.35	296.05	133,845.2
204	Refrigerators	543.1	271.54	72.51	2.35	346.40	188,110.2
Total:		1,805.0				VC Total:	473,802.9
						FC Total:	112,239.7
						Plant Total:	586,042.6

Manufacturing Plant Location: Indianapolis

Item No.	Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201	Washers	6,072.2	156.63	35.32	2.50	194.45	1,180,765.7
202	Dryers	4,414.7	130.36	28.22	2.50	161.08	711,126.9
203	Ranges	5,556.5	240.83	45.72	2.50	289.05	1,606,120.2
204	Refrigerators	7,038.4	267.71	67.14	2.50	337.35	2,374,434.7
Total:		23,081.8				VC Total:	5,872,447.5
						FC Total:	1,380,670.4
						Plant Total:	7,253,117.9
Firm Total:		24,886.8				Firm VC Total:	6,346,250.4
						Firm FC Total:	1,492,910.1
						Firm MFG Total:	7,839,160.5

Table F-2 (cont'd.)

Source Of Finished Products By Distribution Center Location /
Total Cost For Distribution Center Operations

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Moncton	Washers	CAN	48.5	213.4	349.2		562.6
	Dryers	US	40.6	178.6	243.6		422.2
	Ranges	CAN	42.0	184.6	407.8		592.3
	Refrigerators	CAN	50.4	221.8	573.1		794.8
	Total:		181.5	798.4	1,573.6	1,440.0	2,372.0
						DC Total:	3,812.0
Toronto	Washers	CAN	343.8	1,615.6	2,475.0		4,090.6
	Dryers	CAN	287.8	1,352.7	1,726.8		3,079.5
	Ranges	CAN	297.7	1,399.2	2,893.6		4,292.8
	Refrigerators	CAN	357.7	1,681.2	4,067.1		5,748.2
	Total:		1,287.0	6,048.7	11,162.5	1,830.0	17,211.2
						DC Total:	19,041.2
Edmonton	Washers	CAN	129.8	607.5	934.6		1,542.0
	Dryers	US	108.6	508.3	651.6		1,159.9
	Ranges	CAN	112.5	526.3	1,093.0		1,619.3
	Refrigerators	CAN	135.0	631.6	1,534.4		2,166.0
	Total:		485.8	2,273.6	4,213.6	1,640.0	6,487.1
						DC Total:	8,127.1
Worcester	Washers	US	371.3	1,644.6	2,673.0		4,317.6
	Dryers	US	260.8	1,155.1	1,564.5		2,719.6
	Ranges	US	339.7	1,504.9	3,301.9		4,806.8
	Refrigerators	US	430.3	1,906.2	4,892.5		6,798.7
	Total:		1,402.0	6,210.9	12,431.9	1,670.0	18,642.8
						DC Total:	20,312.8
Indianapolis	Washers	US	3,363.4	16,816.8	24,216.1		41,032.9
	Dryers	US	2,362.7	11,813.3	14,175.9		25,989.2
	Ranges	US	3,077.8	15,388.8	29,915.7		45,304.5
	Refrigerators	US	3,898.6	19,492.8	44,326.5		63,819.3
	Total:		12,702.3	63,511.5	112,634.3	1,750.0	176,145.8
						DC Total:	177,895.8
Atlanta	Washers	US	682.7	2,983.2	4,915.1		7,898.3
	Dryers	US	479.5	2,095.2	2,876.7		4,971.9
	Ranges	US	624.6	2,729.3	6,070.6		8,799.9
	Refrigerators	US	791.1	3,457.1	8,994.8		12,451.9
	Total:		2,577.8	11,264.8	22,857.2	1,300.0	34,122.0
						DC Total:	35,422.0
Dallas	Washers	US	612.8	2,549.0	4,411.8		6,960.8
	Dryers	US	430.5	1,790.9	2,583.0		4,373.9
	Ranges	US	560.9	2,333.1	5,451.5		7,784.6
	Refrigerators	US	710.4	2,955.3	8,077.3		11,032.5
	Total:		2,314.5	9,628.3	20,523.5	1,600.0	30,151.8
						DC Total:	31,751.8
Los Angeles	Washers	US	698.7	3,619.0	5,030.3		8,649.3
	Dryers	US	490.9	2,542.6	2,945.1		5,487.7
	Ranges	US	639.4	3,311.8	6,214.5		9,526.3
	Refrigerators	US	810.0	4,195.5	9,209.1		13,404.7
	Total:		2,638.8	13,669.0	23,399.0	1,830.0	37,068.0
						DC Total:	38,898.0

Table F-2 (cont'd.)

<u>DC Location</u>	<u>Description</u>	<u>Mfg.</u> <u>Source</u>	<u>Units</u> <u>(000)</u>	<u>Variable</u> <u>Labor</u> <u>(\$ 000)</u>	<u>Inv.</u> <u>CC.</u> <u>(\$ 000)</u>	<u>Fixed</u> <u>Cost</u> <u>(\$ 000)</u>	<u>Product</u> <u>DC Total</u> <u>(\$ 000)</u>
Salt Lake City	Washers	US	343.6	1,470.4	2,473.6		3,944.0
	Dryers	US	241.3	1,032.8	1,447.8		2,480.6
	Ranges	US	314.3	1,345.2	3,055.0		4,400.2
	Refrigerators	US	398.1	1,703.9	4,526.4		6,230.3
Total: 1,297.3				5,552.2	11,502.8	1,670.0	17,055.0
						DC Total:	18,725.0
						Firm DC Total:	353,985.7

Market Areas Served By Distribution Center Location

Distribution Center: Moncton Market Areas (6):

B2V-Halif, C1A-Charl, E1C-Monct, E2H-Saint, G1A-Quebe, G5H-Rimou

Distribution Center: Toronto Market Areas (18):

A1B-St Jo, G6G-Thetf, G8V-Trois, H9P-Montr, J1E-Sherb, J8X-Ottaw, J9X-Rouyn, K7K-Kings, L2M-St. C, L4N-Barri, L4V-Toron, N2B-Kitch, N5Y-Londo, N8W-Winds, P3A-Sudbu, P7A-Thund, P9N-Kenor, R2X-Winni,

Distribution Center: Edmonton Market Areas (6):

S4P-Regin, S7K-Saska, T2H-Calga, T5J-Edmon, V1H-Princ, V3M-Vanco

Distribution Center: Worcester Market Areas (13):

011-Sprng, 016-Worch, 021-Bosto, 029-Provd, 031-Manch, 041-Portl, 047-Bango, 054-Burln, 061-Hartf, 065-NewHa, 069-Stamf, 122-Alban, 126-Pough

Distribution Center: Indianapolis Market Areas (109):

071-Newar, 081-Camde, 089-NewBr, 106-WhitP, 112-Brook, 132-Syrac, 139-Bingp, 141-Buffa, 146-Rochs, 152-Pitts, 158-Du Bo, 159-Johns, 165-Erie, 171-Harrs, 181-Allen, 187-Wlks-, 194-Phila, 196-Readi, 198-Wilmn, 200-Washn, 212-Balti, 215-Cumbr, 229-Harsn, 232-Richm, 235-Norfo, 240-Roano, 253-Charl, 265-Clrks, 274-Green, 276-Ralei, 282-Charl, 283-Fayet, 288-Ashev, 352-Birmg, 354-Tusca, 356-Hunts, 366-Mobil, 372-Nashv, 374-Chata, 376-Johns, 379-Knoxv, 381-Memph, 383-Jacks, 387-Grenv, 388-Tupel, 392-Jacks, 393-Merid, 402-Louis, 405-Lexin, 421-Bowln, 432-Colum, 436-Toled, 441-Clevl, 442-Akron, 445-Young, 449-Mansf, 452-Cncin, 454-Dayto, 458-Lima, 462-Indan, 466-South, 468-Ft.Wa, 473-Munci, 474-Blomn, 477-Evans, 482-Detro, 485-Flint, 486-Sagin, 489-Lansi, 495-GrndR, 497-SstMa, 503-DesMo, 511-Sioux, 520-Dubuq, 528-Daven, 532-Milwa, 537-Madis, 543-Green, 546-EauCl, 554-Minea, 558-Dulut, 559-Rochs, 571-Sioux, 581-Fargo, 606-Chica, 611-Rockf, 612-Rockl, 616-Peori, 618-Champ, 627-Sprin, 631-StLou, 634-Hanni, 638-CapeG, 641-Kanss, 645-St.Jo, 648-Jopli, 658-Sprin, 666-Topek, 672-Wichi, 681-Omaha, 685-Linco, 712-Monro, 722-Litle, 727-Fayet, 729-Ft.Sm, 741-Tulsa, 981-Seatt, 982-Evere, 984-Tacom

Distribution Center: Atlanta Market Areas (23):

292-Colmb, 294-Charl, 296-Grenv, 303-Atlan, 306-Athen, 309-Augus, 312-Macon, 314-Savan, 317-Alban, 319-Colum, 322-Jacks, 323-Talla, 328-Orlan, 331-Miami, 334-W.Plm, 336-Tampa, 339-FtMye, 359-Gadsd, 361-Montg, 587-Minot, 701-NewOr, 708-BatnR, 713-Alexn

Distribution Center: Dallas Market Areas (24):

678-Dodge, 711-Shrev, 731-OklaC, 745-Mcals, 752-Dalla, 755-Texar, 757-Tyler, 761-Ft.Wo, 763-Wicht, 767-Waco,, 769-SanAn, 770-Houst, 777-Beaum, 782-SanAn, 784-CorpC, 787-Austi, 791-Amari, 794-Lubbo, 796-Abile, 799-El Pa, 802-Denve, 810-Puebl, 871-Albuq, 881-Roswe

Distribution Center: Los Angeles Market Areas (9):

900-LosAn, 921-SanDi, 924-SanBe, 933-Bakrs, 937-Fresn, 946-Oakla, 952-Stock, 958-Sacra, 960-Reddi

Distribution Center: Salt Lake City Market Areas (22):

577-Rapid, 591-Billi, 594-Great, 596-Helen, 598-Misou, 691-N.Pla, 815-GrndJ, 820-Cheye, 832-Pocat, 837-Boise, 841-Sltlk, 846-Provo, 850-Phoen, 857-Tucso, 891-LasVe, 895-Reno,, 972-Portl, 973-Salem, 975-Medfo, 989-Yakim, 992-Spoka, 993-WalaW

Table F-3

RQA2A Results: US-Canada Most Likely Case

Summary

<u>Finished Product Demand</u>	<u>(000)</u>
Total Units	24,984.6

<u>Cost Information</u>	<u>(\$000)</u>
Total Purchase Cost	5,089,388.2
Total Manufacturing Cost	7,859,384.8
Total Distribution Center Cost	353,599.0
Total Transportation Cost	542,120.0
Total System Cost	8,698,443.0

<u>Transportation Cost Detail</u>	<u>(\$000)</u>
Inbound Freight:	56,660.8
Internal Transfer Freight:	144,770.2
Customer Freight:	340,689.0
Total Transportation Cost:	542,120.0

<u>Facilities Utilized</u>	<u>Type</u>
Woodstock	S
Ft. Wayne	S
Toronto	M
Indianapolis	M
Toronto	DC
Regina	DC
Worcester	DC
Indianapolis	DC
Raleigh	DC
Atlanta	DC
Dallas	DC
Los Angeles	DC
Salt Lake City	DC

Table F-3 (cont'd.)

Purchases By Manufacturing Plant Location / Purchases By Supplier Location

Manufacturing Plant Location: Toronto

Supplier Location: Woodstock

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.1630	3,172.3	3,689.4	54.9	3,744.4
102	Belts	2.4367	925.8	2,255.9	5.0	2,260.9
103	Compressors	50.4000	339.6	17,115.8	147.0	17,262.8
104	Copper Components	1.0574	990.3	1,047.1	17.1	1,064.3
105	Cord Sets	2.2799	665.9	1,518.2	9.2	1,527.4
106	Corrugated Packaging	2.2860	1,221.7	2,792.8	211.5	3,004.3
107	Fasteners	.0101	193,157.0	1,950.9	21.7	1,972.6
108	Door Gaskets	8.0640	339.6	2,738.5	117.6	2,856.1
109	Knobs	.2510	4,747.9	1,191.7	5.1	1,196.9
110	1 Speed Motors	18.4666	273.2	5,045.1	70.9	5,116.0
111	2 Speed Motors	24.9480	326.3	8,140.5	113.0	8,253.5
112	Paint (Powder)	3.2648	384.3	1,254.7	6.7	1,261.3
113	Plastic Components	3.5484	1,221.7	4,335.1	31.7	4,366.8
114	Polypropylene Resi	.3624	18,998.2	6,884.9	328.9	7,213.8
115	Pumps	6.0667	326.3	1,979.6	5.7	1,985.2
116	Relays	7.0689	665.9	4,707.2	7.2	4,714.4
117	Steel	.2829	101,527.4	28,722.1	1,757.5	30,479.6
118	Switches	.7554	5,601.8	4,231.6	9.7	4,241.3
119	Timers/Motors	7.2964	2,174.1	15,863.1	3.8	15,866.9
120	Wiring Harnesses	6.0776	1,221.7	7,425.0	42.3	7,467.3
121	Misc. Electronics	6.4461	1,221.7	7,875.2	6.3	7,881.5
122	Washer MP	46.0068	326.3	15,012.0	169.5	15,181.5
123	Dryer MP	39.2610	273.2	10,726.1	4.7	10,730.8
124	Range MP	177.6261	282.6	50,197.1	464.7	50,661.9
125	Refrigerator MP	114.1256	339.6	38,757.1	352.7	39,109.8
Total:				245,456.8	3,964.4	249,421.2

Manufacturing Plant Location: Indianapolis

Supplier Location: Fort Wayne

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	1.1500	67,237.4	77,323.0	1,000.5	78,323.5
102	Belts	2.4000	17,039.2	40,894.1	71.8	40,965.9
103	Compressors	50.0000	7,269.1	363,455.0	2,238.9	365,693.9
104	Copper Components	1.0500	21,047.1	22,099.5	222.3	22,321.7
105	Cord Sets	2.2500	13,563.2	30,517.2	124.1	30,641.3
106	Corrugated Packaging	2.2500	23,762.9	53,466.5	2,927.6	56,394.1
107	Fasteners	.0100	3,715,168.3	37,151.7	297.5	37,449.2
108	Door Gaskets	8.0000	7,269.1	58,152.8	1,791.1	59,943.9
109	Knobs	.2500	94,060.8	23,515.2	103.0	23,618.2
110	1 Speed Motors	18.3200	4,451.0	81,542.3	822.5	82,364.9
111	2 Speed Motors	24.7500	6,294.1	155,779.0	1,550.9	157,329.8
112	Paint (Powder)	3.2500	7,584.5	24,649.6	73.4	24,723.0
113	Plastic Components	3.5000	23,762.9	83,170.2	624.5	83,794.6
114	Polypropylene Resin	.3600	390,070.6	140,425.4	4,119.2	144,544.6
115	Pumps	6.0000	6,294.1	37,764.6	93.7	37,858.3
116	Relays	7.0000	13,563.2	94,942.4	114.3	95,056.7
117	Steel	.2810	1,943,394.2	546,093.8	17,101.9	563,195.7
118	Switches	.7500	106,661.5	79,996.1	143.8	80,139.9
119	Timers/Motors	7.2500	42,752.1	309,952.7	57.6	310,010.4
120	Wiring Harnesses	5.9800	23,762.9	142,102.1	543.7	142,645.8
121	Misc. Electronics	6.4000	23,762.9	152,082.6	96.1	152,178.7
122	Washer MP	45.4900	6,294.1	286,318.6	3,308.2	289,626.8
123	Dryer MP	38.8200	4,451.0	172,787.8	78.0	172,865.8
124	Range MP	175.7700	5,748.7	1,010,449.0	8,126.4	1,018,575.4
125	Refrigerator MP	112.7100	7,269.1	819,300.3	7,065.6	826,365.8
Total:				4,843,931.4	52,696.3	4,896,627.7

Table F-3 (cont'd.)

Total Purchase Expenditure For Each Purchased Item And Total Purchases For The Firm

Item No.	Description	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	70,409.7	81,012.4	1,055.4	82,067.8
102	Belts	17,965.0	43,150.0	76.8	43,226.8
103	Compressors	7,608.7	380,570.8	2,385.9	382,956.7
104	Copper Components	22,037.4	23,146.6	239.4	23,386.0
105	Cord Sets	14,229.1	32,035.4	133.4	32,168.7
106	Corrugated Packaging	24,984.6	56,259.3	3,139.1	59,398.4
107	Fasteners	3,908,325.3	39,102.6	319.2	39,421.8
108	Door Gaskets	7,608.7	60,891.3	1,908.7	62,800.0
109	Knobs	98,808.7	24,706.9	108.1	24,815.1
110	1 Speed Motors	4,724.2	86,587.4	893.5	87,480.9
111	2 Speed Motors	6,620.4	163,919.5	1,663.8	165,583.3
112	Paint (Powder)	7,968.8	25,904.3	80.1	25,984.4
113	Plastic Components	24,984.6	87,505.2	656.2	88,161.4
114	Polypropylene Resin	409,068.8	147,310.4	4,448.0	151,758.4
115	Pumps	6,620.4	39,744.2	99.3	39,843.5
116	Relays	14,229.1	99,649.6	121.5	99,771.1
117	Steel	2,044,921.6	574,815.9	18,859.4	593,675.3
118	Switches	112,263.3	84,227.7	153.5	84,381.2
119	Timers/Motors	44,926.2	325,815.8	61.4	325,877.2
120	Wiring Harnesses	24,984.6	149,527.1	586.0	150,113.1
121	Misc. Electronics	24,984.6	159,957.8	102.4	160,060.2
122	Washer MP	6,620.4	301,330.6	3,477.6	304,808.3
123	Dryer MP	4,724.2	183,513.9	82.7	183,596.6
124	Range MP	6,031.3	1,060,646.1	8,591.1	1,069,237.2
125	Refrigerator MP	7,608.7	858,057.3	7,418.3	865,475.6
Total:			5,089,388.2	56,660.8	5,146,049.0

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Toronto

Item No.	Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201	Washers	326.3	159.17	38.15	2.35	199.67	65,152.8
202	Dryers	273.2	132.59	30.48	2.35	165.42	45,193.7
203	Ranges	282.6	244.32	49.38	2.35	296.05	83,664.4
204	Refrigerators	339.6	271.54	72.51	2.35	346.40	117,636.0
Total:		1,221.7				VC Total:	311,646.9
						FC Total:	112,239.7
						Plant Total:	423,886.6

Manufacturing Plant Location: Indianapolis

Item No.	Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201	Washers	6,294.1	156.63	35.32	2.50	194.45	1,223,915.1
202	Dryers	4,451.0	130.36	28.22	2.50	161.08	716,974.2
203	Ranges	5,748.7	240.83	45.72	2.50	289.05	1,661,676.1
204	Refrigerators	7,269.1	267.71	67.14	2.50	337.35	2,452,262.3
Total:		23,762.9				VC Total:	6,054,827.8
						FC Total:	1,380,670.4
						Plant Total:	7,435,498.2

Firm Total: 24,984.6

Firm VC Total: 6,366,474.7
Firm FC Total: 1,492,910.1
Firm MFG Total: 7,859,384.8

Table F-3 (cont'd.)

Source Of Finished Products By Distribution Center Location /
Total Cost For Distribution Center Operations

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Toronto	Washers	CAN	326.3	1,533.6	2,349.4		3,883.0
	Dryers	CAN	273.2	1,284.0	1,639.2		2,923.2
	Ranges	CAN	282.6	1,328.2	2,746.9		4,075.1
	Refrigerators	CAN	339.6	1,596.1	3,861.3		5,457.4
	Total:		1,221.7	5,742.0	10,596.7	1,830.0	16,338.7
						DC Total:	18,168.7
Regina	Washers	US	182.0	775.1	1,310.0		2,085.2
	Dryers	US	149.3	635.8	895.5		1,531.3
	Ranges	US	158.7	675.9	1,542.1		2,217.9
	Refrigerators	US	191.7	816.4	2,179.1		2,995.5
	Total:		681.5	2,903.2	5,926.7	1,520.0	8,829.9
						DC Total:	10,349.9
Worcester	Washers	US	432.3	1,915.1	3,112.6		5,027.7
	Dryers	US	311.9	1,381.5	1,871.1		3,252.6
	Ranges	US	392.6	1,739.2	3,816.1		5,555.3
	Refrigerators	US	493.9	2,187.8	5,615.1		7,802.8
	Total:		1,630.6	7,223.6	14,414.8	1,670.0	21,638.4
						DC Total:	23,308.4
Indianapolis	Washers	US	2,997.7	14,988.3	21,583.1		36,571.3
	Dryers	US	2,105.7	10,528.5	12,634.2		23,162.7
	Ranges	US	2,743.2	13,715.8	26,663.4		40,379.2
	Refrigerators	US	3,474.6	17,373.0	39,506.2		56,879.2
	Total:		11,321.1	56,605.5	100,386.9	1,750.0	156,992.4
						DC Total:	158,742.4
Raleigh	Washers	US	365.4	1,487.0	2,630.5		4,117.5
	Dryers	US	256.7	1,044.8	1,540.2		2,585.0
	Ranges	US	334.3	1,360.4	3,248.9		4,609.3
	Refrigerators	US	423.5	1,723.7	4,815.2		6,538.9
	Total:		1,379.8	5,615.8	12,234.8	1,420.0	17,850.6
						DC Total:	19,270.6
Atlanta	Washers	US	661.9	2,892.5	4,765.7		7,658.2
	Dryers	US	464.9	2,031.4	2,789.1		4,820.5
	Ranges	US	605.6	2,646.3	5,886.0		8,532.2
	Refrigerators	US	767.1	3,352.0	8,721.4		12,073.4
	Total:		2,499.4	10,922.2	22,162.1	1,300.0	33,084.2
						DC Total:	34,384.2
Dallas	Washers	US	612.8	2,549.0	4,411.8		6,960.8
	Dryers	US	430.5	1,790.9	2,583.0		4,373.9
	Ranges	US	560.9	2,333.1	5,451.5		7,784.6
	Refrigerators	US	710.4	2,955.3	8,077.3		11,032.5
	Total:		2,314.5	9,628.3	20,523.5	1,600.0	30,151.8
						DC Total:	31,751.8
Los Angeles	Washers	US	698.7	3,619.0	5,030.3		8,649.3
	Dryers	US	490.9	2,542.6	2,945.1		5,487.7
	Ranges	US	639.4	3,311.8	6,214.5		9,526.3
	Refrigerators	US	810.0	4,195.5	9,209.1		13,404.7
	Total:		2,638.8	13,669.0	23,399.0	1,830.0	37,068.0
						DC Total:	38,898.0

Table F-3 (cont'd.)

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Salt Lake City	Washers	US	343.6	1,470.4	2,473.6		3,944.0
	Dryers	US	241.3	1,032.8	1,447.8		2,480.6
	Ranges	US	314.3	1,345.2	3,055.0		4,400.2
	Refrigerators	US	398.1	1,703.9	4,526.4		6,230.3
Total: 1,297.3				5,552.2	11,502.8	1,670.0	17,055.0
						DC Total:	18,725.0
						Firm DC Total:	353,599.0

Market Areas Serviced By Distribution Center Location

Distribution Center: Toronto Market Areas (13):

A1B-St Jo, G8V-Trois, H9P-Montr, J8X-Ottaw, J9X-Rouyn, K7K-Kings, L2M-St. C, L4N-Barri, L4V-Toron, N2B-Kitch, N5Y-Londo, N8N-Winds, P3A-Sudbu

Distribution Center: Regina Market Areas (11):

S81-Fargo, S87-Minot, P7A-Thund, P9N-Kenor, R2X-Winni, S4P-Regin, S7K-Saska, T2H-Calga, T5J-Edmon, V1H-Princ, V3M-Vanco

Distribution Center: Worcester Market Areas (21):

011-Sprng, 016-Worch, 021-Bosto, 029-Provd, 031-Manch, 041-Portl, 047-Bango, 054-Burln, 061-Hartf, 065-NewHa, 069-Stamf, 122-Alban, 126-Pough, B2V-Halif, C1A-Charl, E1C-Monct, E2H-Saint, G1A-Quebe, G5H-Rimou, G6G-Thetf, J1E-Sherb

Distribution Center: Indianapolis Market Areas (99):

071-Newar, 081-Camde, 089-NewBr, 106-WhitP, 112-Brook, 132-Syrac, 139-Bingp, 141-Buffa, 146-Rochs, 152-Pitts, 158-Du Bo, 159-Johns, 165-Erie,, 171-Harrs, 181-Allen, 187-Wlks-, 194-Phila, 196-Readi, 198-Wilmn, 212-Balti, 215-Cumbr, 253-Charl, 265-Clrks, 288-Ashev, 352-Birmg, 354-Tusca, 356-Hunts, 366-Mobil, 372-Nashv, 374-Chata, 376-Johns, 379-Knoxv, 381-Memph, 383-Jacks, 387-Grenv, 388-Tupel, 392-Jacks, 393-Merid, 402-Loui, 405-Lexin, 421-Bowln, 432-Colum, 436-Toled, 441-Clevl, 442-Akron, 445-Young, 449-Mansf, 452-Cncin, 454-Dayto, 458-Lima, 462-Indan, 466-South, 468-Ft.Wa, 473-Munci, 474-Blomm, 477-Evans, 482-Detro, 485-Flint, 486-Sagin, 489-Lansi, 495-GrndR, 497-SStMa, 503-DesMo, 511-Sioux, 520-Dubuq, 528-Daven, 532-Milwa, 537-Madis, 543-Green, 546-EauCl, 554-Minea, 558-Dulut, 559-Rochs, 571-Sioux, 606-Chica, 611-Rockf, 612-RockI, 616-Peori, 618-Champ, 627-Sprin, 631-StLou, 634-Hanni, 638-CapeG, 641-Kanss, 645-St.Jo, 648-Jopli, 658-Sprin, 666-Topek, 672-Wichi, 681-Omaha, 685-Linco, 712-Monro, 722-Litle, 727-Fayet, 729-Ft.Sm, 741-Tulsa, 981-Seatt, 982-Evere, 984-Tacom

Distribution Center: Raleigh Market Areas (10):

200-Washn, 229-Harsn, 232-Richm, 235-Norfo, 240-Roano, 274-Green, 276-Ralei, 282-Charl, 283-Fayet, 294-Charl

Distribution Center: Atlanta Market Areas (21):

292-Colmb, 296-Grenv, 303-Atlan, 306-Athen, 309-Augus, 312-Macon, 314-Savan, 317-Alban, 319-Colum, 322-Jacks, 323-Talla, 328-Orlan, 331-Miami, 334-W.Plm, 336-Tampa, 339-FtMye, 359-Gadsd, 361-Montg, 701-NewOr, 708-BatnR, 713-Alexn

Distribution Center: Dallas Market Areas (24):

678-Dodge, 711-Shrev, 731-OklaC, 745-Mcals, 752-Dalla, 755-Texar, 757-Tyler, 761-Ft.Wo, 763-Wicht, 767-Waco,, 769-SanAn, 770-Houst, 777-Beaum, 782-SanAn, 784-CorpC, 787-Austi, 791-Amari, 794-Lubbo, 796-Abile, 799-El Pa, 802-Denve, 810-Puebl, 871-Albuq, 881-Roswe

Distribution Center: Los Angeles Market Areas (9):

900-LosAn, 921-SanDi, 924-SanBe, 933-Bakrs, 937-Fresn, 946-Oakla, 952-Stock, 958-Sacra, 960-Reddi

Distribution Center: Salt Lake City Market Areas (22):

577-Rapid, 591-Billi, 594-Great, 596-Helen, 598-Misou, 691-N.Pla, 815-GrndJ, 820-Cheye, 832-Pocat, 837-Boise, 841-SltLk, 846-Provo, 850-Phoen, 857-Tucso, 891-LasVe, 895-Reno,, 972-Portl, 973-Salem, 975-Medfo, 989-Yakim, 992-Spoka, 993-Walaw

Table F-4

RQA3A Results: US-Canada 5 Percent Increase in Canadian Demand

Summary

<u>Finished Product Demand</u>	<u>(000)</u>
Total Units	24,984.6

<u>Cost Information</u>	<u>(\$000)</u>
Total Purchase Cost	5,090,834.9
Total Manufacturing Cost	7,864,099.4
Total Distribution Center Cost	355,291.1
Total Transportation Cost	546,991.8
Total System Cost	8,708,988.2

<u>Transportation Cost Detail</u>	<u>(\$000)</u>
Inbound Freight:	57,394.1
Internal Transfer Freight:	138,236.6
Customer Freight:	351,361.1
Total Transportation Cost:	546,991.8

<u>Facilities Utilized</u>	<u>Type</u>
Woodstock	S
Ft. Wayne	S
Toronto	M
Indianapolis	M
Moncton	DC
Toronto	DC
Edmonton	DC
Worcester	DC
Indianapolis	DC
Atlanta	DC
Dallas	DC
Los Angeles	DC
Salt Lake City	DC

Table F-4 (cont'd.)

Purchases By Manufacturing Plant Location / Purchases By Supplier Location

Manufacturing Plant Location: Toronto

Supplier Location: Woodstock

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.1630	5,327.8	6,196.2	92.2	6,288.4
102	Belts	2.4367	1,398.6	3,407.8	7.6	3,415.4
103	Compressors	50.4000	570.3	28,743.1	246.8	28,989.9
104	Copper Components	1.0574	1,663.2	1,758.6	28.8	1,787.4
105	Cord Sets	2.2799	1,118.5	2,550.1	15.5	2,565.6
106	Corrugated Packaging	2.2860	1,895.5	4,333.0	328.1	4,661.1
107	Fasteners	.0101	295,315.7	2,982.7	33.2	3,015.9
108	Door Gaskets	8.0640	570.3	4,598.9	197.5	4,796.3
109	Knobs	.2510	7,662.7	1,923.3	8.3	1,931.6
110	1 Speed Motors	18.4666	302.2	5,579.7	78.5	5,658.1
111	2 Speed Motors	24.9480	548.2	13,676.5	189.8	13,866.3
112	Paint (Powder)	3.2648	611.8	1,997.4	10.6	2,008.0
113	Plastic Components	3.5484	1,895.5	6,725.8	49.2	6,775.0
114	Polypropylene Resin	.3624	31,752.8	11,507.2	549.7	12,056.9
115	Pumps	6.0667	548.2	3,325.8	9.5	3,335.3
116	Relays	7.0689	1,118.5	7,906.6	12.1	7,918.7
117	Steel	.2829	154,404.1	43,680.9	2,672.8	46,353.7
118	Switches	.7554	8,469.9	6,398.2	14.7	6,412.8
119	Timers/Motors	7.2964	3,338.2	24,356.8	5.8	24,362.6
120	Wiring Harnesses	6.0776	1,895.5	11,519.8	65.6	11,585.4
121	Misc. Electronics	6.4461	1,895.5	12,218.3	9.8	12,228.1
122	Washer MP	46.0068	548.2	25,220.9	284.7	25,505.6
123	Dryer MP	39.2610	302.2	11,862.7	5.2	11,867.9
124	Range MP	177.6261	474.8	84,336.9	780.8	85,117.7
125	Refrigerator MP	114.1256	570.3	65,085.8	592.3	65,678.2
Total:				391,893.0	6,289.1	398,182.1

Manufacturing Plant Location: Indianapolis

Supplier Location: Fort Wayne

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	1.1500	65,082.0	74,844.3	968.4	75,812.7
102	Belts	2.4000	16,566.5	39,759.5	69.8	39,829.3
103	Compressors	50.0000	7,038.4	351,920.0	2,167.8	354,087.8
104	Copper Components	1.0500	20,374.3	21,393.0	215.2	21,608.1
105	Cord Sets	2.2500	13,110.6	29,498.9	120.0	29,618.8
106	Corrugated Packaging	2.2500	23,089.2	51,950.6	2,844.6	54,795.2
107	Fasteners	.0100	3,613,009.6	36,130.1	289.3	36,419.4
108	Door Gaskets	8.0000	7,038.4	56,307.2	1,734.3	58,041.5
109	Knobs	.2500	91,146.0	22,786.5	99.8	22,886.3
110	1 Speed Motors	18.3200	4,422.1	81,012.0	817.2	81,829.1
111	2 Speed Motors	24.7500	6,072.2	150,287.0	1,496.2	151,783.1
112	Paint (Powder)	3.2500	7,357.0	23,910.3	71.2	23,981.5
113	Plastic Components	3.5000	23,089.2	80,812.0	606.8	81,418.8
114	Polypropylene Resin	.3600	377,316.0	135,833.8	3,984.5	139,818.2
115	Pumps	6.0000	6,072.2	36,433.2	90.4	36,523.6
116	Relays	7.0000	13,110.6	91,774.2	110.5	91,884.7
117	Steel	.2810	1,890,517.6	531,235.4	16,636.6	547,872.0
118	Switches	.7500	103,793.4	77,845.1	139.9	77,985.0
119	Timers/Motors	7.2500	41,588.0	301,513.0	56.1	301,569.1
120	Wiring Harnesses	5.9800	23,089.2	138,073.1	528.3	138,601.4
121	Misc. Electronics	6.4000	23,089.2	147,770.6	93.4	147,863.9
122	Washer MP	45.4900	6,072.2	276,224.4	3,191.6	279,415.9
123	Dryer MP	38.8200	4,422.1	171,664.0	77.5	171,741.5
124	Range MP	175.7700	5,556.5	976,666.0	7,854.7	984,520.7
125	Refrigerator MP	112.7100	7,038.4	793,298.1	6,841.3	800,139.4
Total:				4,698,941.9	51,105.0	4,750,046.9

Table F-4 (cont'd.)

Total Purchase Expenditure For Each Purchased Item And Total Purchases For The Firm

Item No.	Description	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	70,409.7	81,040.4	1,060.7	82,101.1
102	Belts	17,965.0	43,167.3	77.4	43,244.7
103	Compressors	7,608.7	380,663.1	2,414.6	383,077.8
104	Copper Components	22,037.4	23,151.6	243.9	23,395.5
105	Cord Sets	14,229.1	32,048.9	135.5	32,184.4
106	Corrugated Packaging	24,984.6	56,283.6	3,172.7	59,456.3
107	Fasteners	3,908,325.3	39,112.8	322.6	39,435.3
108	Door Gaskets	7,608.7	60,906.1	1,931.7	62,837.8
109	Knobs	98,808.7	24,709.8	108.1	24,817.9
110	1 Speed Motors	4,724.2	86,591.6	895.7	87,487.3
111	2 Speed Motors	6,620.4	163,963.4	1,686.0	165,649.4
112	Paint (Powder)	7,968.8	25,907.7	81.8	25,989.5
113	Plastic Components	24,984.6	87,537.8	656.0	88,193.8
114	Polypropylene Resin	409,068.8	147,341.0	4,534.1	151,875.1
115	Pumps	6,620.4	39,759.0	99.8	39,858.8
116	Relays	14,229.1	99,680.8	122.6	99,803.3
117	Steel	2,044,921.7	574,916.4	19,309.4	594,225.8
118	Switches	112,263.3	84,243.2	154.6	84,397.8
119	Timers/Motors	44,926.2	325,869.8	61.8	325,931.7
120	Wiring Harnesses	24,984.6	149,592.9	593.9	150,186.8
121	Misc. Electronics	24,984.6	159,988.8	103.2	160,092.0
122	Washer MP	6,620.4	301,445.3	3,476.2	304,921.5
123	Dryer MP	4,724.2	183,526.7	82.7	183,609.4
124	Range MP	6,031.3	1,061,002.9	8,635.5	1,069,638.4
125	Refrigerator MP	7,608.7	858,383.9	7,433.7	865,817.6
Total:			5,090,834.9	57,394.1	5,148,228.9

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Toronto

Item No.	Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201	Washers	548.2	159.17	38.15	2.35	199.67	109,460.0
202	Dryers	302.2	132.59	30.48	2.35	165.42	49,982.7
203	Ranges	474.8	244.32	49.38	2.35	296.05	140,565.6
204	Refrigerators	570.3	271.54	72.51	2.35	346.40	197,549.5
Total:		1,895.5				VC Total:	497,557.8
						FC Total:	112,239.7
						Plant Total:	609,797.5

Manufacturing Plant Location: Indianapolis

Item No.	Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201	Washers	6,072.2	156.63	35.32	2.50	194.45	1,180,765.7
202	Dryers	4,422.1	130.36	28.22	2.50	161.08	712,310.9
203	Ranges	5,556.5	240.83	45.72	2.50	289.05	1,606,120.2
204	Refrigerators	7,038.4	267.71	67.14	2.50	337.35	2,374,434.7
Total:		23,089.2				VC Total:	5,873,631.5
						FC Total:	1,380,670.4
						Plant Total:	7,254,301.9

Firm Total: 24,984.6

Firm VC Total: 6,371,189.3
 Firm FC Total: 1,492,910.1
 Firm MFG Total: 7,864,099.4

Table F-4 (cont'd.)

Source Of Finished Products By Distribution Center Location /
Total Cost For Distribution Center Operations

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Moncton	Washers	CAN	51.0	224.2	366.8		591.0
	Dryers	US	42.6	187.4	255.6		443.0
	Ranges	CAN	44.1	193.8	428.2		622.0
	Refrigerators	CAN	53.0	233.0	602.0		835.0
	Total:		190.6	838.4	1,652.7	1,440.0	2,491.1
						DC Total:	3,931.1
Toronto	Washers	CAN	361.0	1,696.5	2,598.8		4,295.3
	Dryers	CAN	302.2	1,420.1	1,812.9		3,233.0
	Ranges	CAN	312.7	1,469.5	3,039.0		4,508.4
	Refrigerators	CAN	375.7	1,765.6	4,271.1		6,036.7
	Total:		1,351.4	6,351.6	11,721.8	1,830.0	18,073.4
						DC Total:	19,903.4
Edmonton	Washers	CAN	136.3	637.9	981.4		1,619.2
	Dryers	US	114.0	533.3	683.7		1,217.0
	Ranges	CAN	118.1	552.7	1,147.9		1,700.6
	Refrigerators	CAN	141.7	663.2	1,611.1		2,274.3
	Total:		510.1	2,387.0	4,424.1	1,640.0	6,811.2
						DC Total:	8,451.2
Worcester	Washers	US	371.3	1,644.6	2,673.0		4,317.6
	Dryers	US	260.8	1,155.1	1,564.5		2,719.6
	Ranges	US	339.7	1,504.9	3,301.9		4,806.8
	Refrigerators	US	430.3	1,906.2	4,892.5		6,798.7
	Total:		1,402.0	6,210.9	12,431.9	1,670.0	18,642.8
						DC Total:	20,312.8
Indianapolis	Washers	US	3,363.4	16,816.8	24,216.1		41,032.9
	Dryers	US	2,362.7	11,813.3	14,175.9		25,989.2
	Ranges	US	3,077.8	15,388.8	29,915.7		45,304.5
	Refrigerators	US	3,898.6	19,492.8	44,326.5		63,819.3
	Total:		12,702.3	63,511.5	112,634.3	1,750.0	176,145.8
						DC Total:	177,895.8
Atlanta	Washers	US	682.7	2,983.2	4,915.1		7,898.3
	Dryers	US	479.5	2,095.2	2,876.7		4,971.9
	Ranges	US	624.6	2,729.3	6,070.6		8,799.9
	Refrigerators	US	791.1	3,457.1	8,994.8		12,451.9
	Total:		2,577.8	11,264.8	22,857.2	1,300.0	34,122.0
						DC Total:	35,422.0
Dallas	Washers	US	612.8	2,549.0	4,411.8		6,960.8
	Dryers	US	430.5	1,790.9	2,583.0		4,373.9
	Ranges	US	560.9	2,333.1	5,451.5		7,784.6
	Refrigerators	US	710.4	2,955.3	8,077.3		11,032.5
	Total:		2,314.5	9,628.3	20,523.5	1,600.0	30,151.8
						DC Total:	31,751.8
Los Angeles	Washers	US	698.7	3,619.0	5,030.3		8,649.3
	Dryers	US	490.9	2,542.6	2,945.1		5,487.7
	Ranges	US	639.4	3,311.8	6,214.5		9,526.3
	Refrigerators	US	810.0	4,195.5	9,209.1		13,404.7
	Total:		2,638.8	13,669.0	23,399.0	1,830.0	37,068.0
						DC Total:	38,898.0

Table F-4 (cont'd.)

<u>DC Location</u>	<u>Description</u>	<u>Mfg.</u> <u>Source</u>	<u>Units</u> <u>(000)</u>	<u>Variable</u> <u>Labor</u> <u>(\$ 000)</u>	<u>Inv.</u> <u>CC.</u> <u>(\$ 000)</u>	<u>Fixed</u> <u>Cost</u> <u>(\$ 000)</u>	<u>Product</u> <u>DC Total</u> <u>(\$ 000)</u>
Salt Lake City	Washers	US	343.6	1,470.4	2,473.6		3,944.0
	Dryers	US	241.3	1,032.8	1,447.8		2,480.6
	Ranges	US	314.3	1,345.2	3,055.0		4,400.2
	Refrigerators	US	398.1	1,703.9	4,526.4		6,230.3
Total: 1,297.3				5,552.2	11,502.8	1,670.0	17,055.0
						DC Total:	18,725.0
						Firm DC Total:	355,291.1

Market Areas Serviced By Distribution Center Location

Distribution Center: Moncton Market Areas (6):

B2V-Halif, C1A-Charl, E1C-Monct, E2H-Saint, G1A-Quebe, G5H-Rimou

Distribution Center: Toronto Market Areas (18):

A1B-St Jo, G6G-Thetf, G8V-Trois, H9P-Montr, J1E-Sherb, J8X-Ottaw, J9X-Rouyn, K7K-Kings, L2M-St. C, L4N-Barri, L4V-Toron, N2B-Kitch, N5Y-Londo, N8N-Winds, P3A-Sudbu, P7A-Thun, P9N-Kenor, R2X-Winni

Distribution Center: Edmonton Market Areas (6):

S4P-Regin, S7K-Saska, T2H-Calga, T5J-Edmon, V1H-Princ, V3M-Vanco

Distribution Center: Worcester Market Areas (13):

011-Sprng, 016-Worch, 021-Bosto, 029-Provd, 031-Manch, 041-Portl, 047-Bango, 054-Burln, 061-Hartf, 065-NewHa, 069-Stamf, 122-Alban, 126-Pough

Distribution Center: Indianapolis Market Areas (109):

071-Newar, 081-Camde, 089-NewBr, 106-WhitP, 112-Brook, 132-Syrac, 139-Bingp, 141-Buffa, 146-Rochs, 152-Pitts, 158-Du Bo, 159-Johns, 165-Erie,, 171-Harrs, 181-Allen, 187-Wlks-, 194-Phila, 196-Readi, 198-Wilnm, 200-Washn, 212-Balti, 215-Cumbr, 229-Harsn, 232-Richm, 235-Norfo, 240-Roano, 253-Charl, 265-Clrks, 274-Green, 276-Ralei, 282-Charl, 283-Fayet, 288-Ashev, 352-Birmg, 354-Tusca, 356-Hunts, 366-Mobil, 372-Nashv, 374-Chata, 376-Johns, 379-Knoxv, 381-Memph, 383-Jacks, 387-Grenv, 388-Tupel, 392-Jacks, 393-Merid, 402-Louis, 405-Lexin, 421-Bowln, 432-Colum, 436-Toled, 441-Clevl, 442-Akron, 445-Young, 449-Mansf, 452-Cncin, 454-Dayto, 458-Lima,, 462-Indan, 466-South, 468-Ft.Wa, 473-Munci, 474-Blomm, 477-Evans, 482-Detro, 485-Flint, 486-Sagin, 489-Lansi, 495-GrndR, 497-SStMa, 503-DesMo, 511-Sioux, 520-Dubuq, 528-Daven, 532-Milwa, 537-Madis, 543-Green, 546-EauCl, 554-Minea, 558-Dulut, 559-Rochs, 571-Sioux, 581-Fargo, 606-Chica, 611-Rockf, 612-Rockl, 616-Peori, 618-Champ, 627-Sprin, 631-StLou, 634-Hanni, 638-CapeG, 641-Kanss, 645-St.Jo, 648-Jopli, 658-Sprin, 666-Topek, 672-Wichi, 681-Omaha, 685-Linco, 712-Monro, 722-Litle, 727-Fayet, 729-Ft.Sm, 741-Tulsa, 981-Seatt, 982-Evere, 984-Tacom

Distribution Center: Atlanta Market Areas (23):

292-Colum, 294-Charl, 296-Grenv, 303-Atlan, 306-Athen, 309-Augus, 312-Macon, 314-Savan, 317-Alban, 319-Colum, 322-Jacks, 323-Talla, 328-Orlan, 331-Miami, 334-W.Plm, 336-Tampa, 339-FtMye, 359-Gadsd, 361-Montg, 587-Minot, 701-NewOr, 708-BatnR, 713-Alexn

Distribution Center: Dallas Market Areas (24):

678-Dodge, 711-Shrev, 731-OklaC, 745-Mcals, 752-Dalla, 755-Texar, 757-Tyler, 761-Ft.Wo, 763-Wicht, 767-Waco,, 769-SanAn, 770-Houst, 777-Beaum, 782-SanAn, 784-CorpC, 787-Austi, 791-Amari, 794-Lubbo, 796-Abile, 799-El Pa, 802-Denve, 810-Puebl, 871-Albuq, 881-Roswe

Distribution Center: Los Angeles Market Areas (9):

900-LosAn, 921-SanDi, 924-SanBe, 933-Bakrs, 937-Fresn, 946-Oakla, 952-Stock, 958-Sacra, 960-Reddi

Distribution Center: Salt Lake City Market Areas (22):

577-Rapid, 591-Billi, 594-Great, 596-Helen, 598-Misou, 691-N.Pla, 815-GrndJ, 820-Cheye, 832-Pocat, 837-Boise, 841-SltLk, 846-Provo, 850-Phoen, 857-Tucso, 891-LasVe, 895-Reno,, 972-Portl, 973-Salem, 975-Medfo, 989-Yakim, 992-Spoka, 993-WalaW

Table F-5

RQA3B Results: 10 Percent Increase In Canadian Demand

Summary

<u>Finished Product Demand</u>	(000)
Total Units	25,082.4

<u>Cost Information</u>	(000)
Total Purchase Cost	5,110,454.8
Total Manufacturing Cost	7,888,988.7
Total Distribution Center Cost	356,595.0
Total Transportation Cost	549,027.1
Total System Cost	8,736,907.4

<u>Transportation Cost Detail</u>	(000)
Inbound Freight:	57,703.4
Internal Transfer Freight:	138,898.2
Customer Freight:	352,425.5
Total Transportation Cost:	549,027.1

<u>Facilities Utilized</u>	<u>Type</u>
Woodstock	S
Ft. Wayne	S
Toronto	M
Indianapolis	M
Moncton	DC
Toronto	DC
Edmonton	DC
Worcester	DC
Indianapolis	DC
Atlanta	DC
Dallas	DC
Los Angeles	DC
Salt Lake City	DC

It
No
101
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111 2
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113 Pl
114 Pol
115 Pum
116 Rel
117 Stee
118 Swit
119 Time
120 Wirin
121 Misc.
122 Washe
123 Dryer
124 Range
125 Refrig

Table F-5 (cont'd.)

Purchases By Manufacturing Plant Location / Purchases By Supplier Location

Manufacturing Plant Location: Toronto

Supplier Location: Woodstock

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.1630	5,580.9	6,490.6	96.6	6,587.2
102	Belts	2.4367	1,465.2	3,570.3	7.9	3,578.2
103	Compressors	50.4000	597.4	30,109.0	258.5	30,367.5
104	Copper Components	1.0574	1,742.2	1,842.2	30.2	1,872.3
105	Cord Sets	2.2799	1,171.7	2,671.4	16.2	2,687.6
106	Corrugated Packaging	2.2860	1,985.7	4,539.2	343.7	4,882.9
107	Fasteners	.0101	309,371.0	3,124.6	34.8	3,159.5
108	Door Gaskets	8.0640	597.4	4,817.4	206.8	5,024.3
109	Knobs	.2510	8,027.1	2,014.8	8.7	2,023.5
110	1 Speed Motors	18.4666	316.6	5,846.5	82.2	5,928.7
111	2 Speed Motors	24.9480	574.3	14,327.6	198.8	14,526.5
112	Paint (Powder)	3.2648	640.9	2,092.4	11.1	2,103.5
113	Plastic Components	3.5484	1,985.7	7,045.9	51.6	7,097.4
114	Polypropylene Resin	.3624	33,262.8	12,054.4	575.8	12,630.2
115	Pumps	6.0667	574.3	3,484.1	9.9	3,494.0
116	Relays	7.0689	1,171.7	8,282.6	12.7	8,295.3
117	Steel	.2829	161,753.8	45,760.1	2,800.1	48,560.2
118	Switches	.7554	8,873.1	6,702.7	15.4	6,718.1
119	Timers/Motors	7.2964	3,497.1	25,515.9	6.1	25,521.9
120	Wiring Harnesses	6.0776	1,985.7	12,068.0	68.8	12,136.7
121	Misc. Electronics	6.4461	1,985.7	12,799.7	10.3	12,810.0
122	Washer MP	46.0068	574.3	26,421.7	298.3	26,720.0
123	Dryer MP	39.2610	316.6	12,430.0	5.5	12,435.5
124	Range MP	177.6261	497.4	88,342.3	817.9	89,160.2
125	Refrigerator MP	114.1256	597.4	68,178.6	620.5	68,799.1
Total:				410,532.2	6,588.3	417,120.5

Manufacturing Plant Location: Indianapolis

Supplier Location: Fort Wayne

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	1.1500	65,082.0	74,844.3	968.4	75,812.7
102	Belts	2.4000	16,574.1	39,777.7	69.8	39,847.5
103	Compressors	50.0000	7,038.4	351,920.0	2,167.8	354,087.8
104	Copper Components	1.0500	20,374.3	21,393.0	215.2	21,608.1
105	Cord Sets	2.2500	13,110.6	29,498.9	120.0	29,618.8
106	Corrugated Packaging	2.2500	23,096.8	51,967.7	2,845.5	54,813.2
107	Fasteners	.0100	3,614,423.0	36,144.2	289.4	36,433.7
108	Door Gaskets	8.0000	7,038.4	56,307.2	1,734.3	58,041.5
109	Knobs	.2500	91,161.2	22,790.3	99.8	22,890.1
110	1 Speed Motors	18.3200	4,429.7	81,151.2	818.6	81,969.8
111	2 Speed Motors	24.7500	6,072.2	150,287.0	1,496.2	151,783.1
112	Paint (Powder)	3.2500	7,358.6	23,915.5	71.2	23,986.8
113	Plastic Components	3.5000	23,096.8	80,838.6	607.0	81,445.6
114	Polypropylene Resin	.3600	377,323.6	135,836.5	3,984.5	139,821.1
115	Pumps	6.0000	6,072.2	36,433.2	90.4	36,523.6
116	Relays	7.0000	13,110.6	91,774.2	110.5	91,884.7
117	Steel	.2810	1,891,300.5	531,455.4	16,643.4	548,098.9
118	Switches	.7500	103,839.0	77,879.3	140.0	78,019.2
119	Timers/Motors	7.2500	41,603.2	301,623.2	56.1	301,679.3
120	Wiring Harnesses	5.9800	23,096.8	138,118.6	528.5	138,647.0
121	Misc. Electronics	6.4000	23,096.8	147,819.2	93.4	147,912.6
122	Washer MP	45.4900	6,072.2	276,224.4	3,191.6	279,415.9
123	Dryer MP	38.8200	4,429.7	171,959.0	77.6	172,036.6
124	Range MP	175.7700	5,556.5	976,666.0	7,854.7	984,520.7
125	Refrigerator MP	112.7100	7,038.4	793,298.1	6,841.3	800,139.4
Total:				4,699,922.5	51,115.1	4,751,037.6

Table F-5 (cont'd.)

Total Purchase Expenditure For Each Purchased Item And Total Purchases For The Firm

Item No.	Description	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	70,662.9	81,334.9	1,065.0	82,399.9
102	Belts	18,039.3	43,348.0	77.8	43,425.7
103	Compressors	7,635.8	382,029.0	2,426.4	384,455.3
104	Copper Components	22,116.4	23,235.1	245.3	23,480.5
105	Cord Sets	14,282.3	32,170.2	136.2	32,306.4
106	Corrugated Packaging	25,082.4	56,506.9	3,189.3	59,696.1
107	Fasteners	3,923,794.1	39,268.9	324.3	39,593.1
108	Door Gaskets	7,635.8	61,124.6	1,941.1	63,065.7
109	Knobs	99,188.3	24,805.1	108.5	24,913.6
110	1 Speed Motors	4,746.3	86,997.7	900.8	87,898.5
111	2 Speed Motors	6,646.5	164,614.6	1,695.0	166,309.6
112	Paint (Powder)	7,999.5	26,008.0	82.3	26,090.3
113	Plastic Components	25,082.4	87,884.5	658.5	88,543.0
114	Polypropylene Resin	410,586.4	147,890.9	4,560.3	152,451.3
115	Pumps	6,646.5	39,917.3	100.3	40,017.6
116	Relays	14,282.3	100,056.8	123.1	100,180.0
117	Steel	2,053,054.2	577,215.6	19,443.5	596,659.1
118	Switches	112,712.1	84,582.0	155.3	84,737.3
119	Timers/Motors	45,100.3	327,139.1	62.1	327,201.2
120	Wiring Harnesses	25,082.4	150,186.6	597.2	150,783.8
121	Misc. Electronics	25,082.4	160,618.9	103.7	160,722.6
122	Washer MP	6,646.5	302,646.1	3,489.8	306,135.9
123	Dryer MP	4,746.3	184,389.0	83.1	184,472.1
124	Range MP	6,053.9	1,065,008.3	8,672.6	1,073,680.9
125	Refrigerator MP	7,635.8	861,476.7	7,461.8	868,938.5
Total:			5,110,454.8	57,703.4	5,168,158.1

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Toronto

Item No.	Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201	Washers	574.3	159.17	38.15	2.35	199.67	114,671.4
202	Dryers	316.6	132.59	30.48	2.35	165.42	52,373.1
203	Ranges	497.4	244.32	49.38	2.35	296.05	147,241.6
204	Refrigerators	597.4	271.54	72.51	2.35	346.40	206,936.8
Total:		1,985.7				VC Total:	521,222.9
						FC Total:	112,239.7
						Plant Total:	633,462.6

Manufacturing Plant Location: Indianapolis

Item No.	Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201	Washers	6,072.2	156.63	35.32	2.50	194.45	1,180,765.7
202	Dryers	4,429.7	130.36	28.22	2.50	161.08	713,535.1
203	Ranges	5,556.5	240.83	45.72	2.50	289.05	1,606,120.2
204	Refrigerators	7,038.4	267.71	67.14	2.50	337.35	2,374,434.7
Total:		23,096.8				VC Total:	5,874,855.7
						FC Total:	1,380,670.4
						Plant Total:	7,255,526.1
Firm Total:		25,082.4				Firm VC Total:	6,396,078.6
						Firm FC Total:	1,492,910.1
						Firm MFG Total:	7,888,988.7

Table F-5 (cont'd.)

Source Of Finished Products By Distribution Center Location /
Total Cost For Distribution Center Operations

<u>DC Location</u>	<u>Description</u>	<u>Mfg.</u> <u>Source</u>	<u>Units</u> <u>(000)</u>	<u>Variable</u> <u>Labor</u> <u>(\$ 000)</u>	<u>Inv.</u> <u>CC.</u> <u>(\$ 000)</u>	<u>Fixed</u> <u>Cost</u> <u>(\$ 000)</u>	<u>Product</u> <u>DC Total</u> <u>(\$ 000)</u>
Moncton	Washers	CAN	53.4	234.7	384.1		618.9
	Dryers	US	44.7	196.7	268.2		464.9
	Ranges	CAN	46.1	202.8	448.1		650.9
	Refrigerators	CAN	55.5	244.0	630.5		874.5
	Total:		199.6	878.2	1,730.9	1,440.0	2,609.1
						DC Total:	4,049.1
Toronto	Washers	CAN	378.2	1,777.3	2,722.7		4,500.0
	Dryers	CAN	316.6	1,488.0	1,899.6		3,387.6
	Ranges	CAN	327.5	1,539.3	3,183.3		4,722.6
	Refrigerators	CAN	393.6	1,849.7	4,474.7		6,324.3
	Total:		1,415.8	6,654.3	12,280.2	1,830.0	18,934.5
						DC Total:	20,764.5
Edmonton	Washers	CAN	142.8	668.3	1,028.2		1,696.5
	Dryers	US	119.5	559.0	716.7		1,275.7
	Ranges	CAN	123.8	579.2	1,202.9		1,782.0
	Refrigerators	CAN	148.4	694.5	1,687.3		2,381.8
	Total:		534.4	2,501.0	4,635.0	1,640.0	7,136.0
						DC Total:	8,776.0
Worcester	Washers	US	371.3	1,644.6	2,673.0		4,317.6
	Dryers	US	260.8	1,155.1	1,564.5		2,719.6
	Ranges	US	339.7	1,504.9	3,301.9		4,806.8
	Refrigerators	US	430.3	1,906.2	4,892.5		6,798.7
	Total:		1,402.0	6,210.9	12,431.9	1,670.0	18,642.8
						DC Total:	20,312.8
Indianapolis	Washers	US	3,363.4	16,816.8	24,216.1		41,032.9
	Dryers	US	2,362.7	11,813.3	14,175.9		25,989.2
	Ranges	US	3,077.8	15,388.8	29,915.7		45,304.5
	Refrigerators	US	3,898.6	19,492.8	44,326.5		63,819.3
	Total:		12,702.3	63,511.5	112,634.3	1,750.0	176,145.8
						DC Total:	177,895.8
Atlanta	Washers	US	682.7	2,983.2	4,915.1		7,898.3
	Dryers	US	479.5	2,095.2	2,876.7		4,971.9
	Ranges	US	624.6	2,729.3	6,070.6		8,799.9
	Refrigerators	US	791.1	3,457.1	8,994.8		12,451.9
	Total:		2,577.8	11,264.8	22,857.2	1,300.0	34,122.0
						DC Total:	35,422.0
Dallas	Washers	US	612.8	2,549.0	4,411.8		6,960.8
	Dryers	US	430.5	1,790.9	2,583.0		4,373.9
	Ranges	US	560.9	2,333.1	5,451.5		7,784.6
	Refrigerators	US	710.4	2,955.3	8,077.3		11,032.5
	Total:		2,314.5	9,628.3	20,523.5	1,600.0	30,151.8
						DC Total:	31,751.8
Los Angeles	Washers	US	698.7	3,619.0	5,030.3		8,649.3
	Dryers	US	490.9	2,542.6	2,945.1		5,487.7
	Ranges	US	639.4	3,311.8	6,214.5		9,526.3
	Refrigerators	US	810.0	4,195.5	9,209.1		13,404.7
	Total:		2,638.8	13,669.0	23,399.0	1,830.0	37,068.0
						DC Total:	38,898.0

Table F-5 (cont'd.)

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Salt Lake City	Washers	US	343.6	1,470.4	2,473.6		3,944.0
	Dryers	US	241.3	1,032.8	1,447.8		2,480.6
	Ranges	US	314.3	1,345.2	3,055.0		4,400.2
	Refrigerators	US	398.1	1,703.9	4,526.4		6,230.3
Total: 1,297.3				5,552.2	11,502.8	1,670.0	17,055.0
				DC Total: 18,725.0			
				Firm DC Total: 356,595.0			

Market Areas Served By Distribution Center Location

Distribution Center: Moncton Market Areas (6):

B2V-Halif, C1A-Charl, E1C-Monct, E2H-Saint, G1A-Quebe, G5H-Rimou

Distribution Center: Toronto Market Areas (18):

A1B-St Jo, G6G-Thetf, G8V-Trois, H9P-Montr, J1E-Sherb, J8X-Ottaw, J9X-Rouyn, K7K-Kings, L2M-St. C, L4M-Barri, L4V-Toron, N2B-Kitch, N5Y-Londo, N8N-Winds, P3A-Sudbu, P7A-Thund, P9N-Kenor, R2X-Winni

Distribution Center: Edmonton Market Areas (6):

S4P-Regin, S7K-Saska, T2H-Calga, T5J-Edmon, V1H-Princ, V3M-Vanco

Distribution Center: Worcester Market Areas (13):

011-Sprng, 016-Worch, 021-Bosto, 029-Provd, 031-Manch, 041-Portl, 047-Bango, 054-Burln, 061-Hartf, 065-NewHa, 069-Stamf, 122-Alban, 126-Pough

Distribution Center: Indianapolis Market Areas (109):

071-Newar, 081-Camde, 089-NewBr, 106-WhitP, 112-Brook, 132-Syrac, 139-Bingp, 141-Buffa, 146-Rochs, 152-Pitts, 158-Du Bo, 159-Johns, 165-Erie, 171-Harrs, 181-Allen, 187-Wlks-, 194-Phila, 196-Readi, 198-Wilmn, 200-Washn, 212-Balti, 215-Cumbr, 229-Harsn, 232-Richm, 235-Norfo, 240-Roano, 253-Charl, 265-Clrks, 274-Green, 276-Ralei, 282-Charl, 283-Fayet, 288-Ashev, 352-Birmg, 354-Tusca, 356-Hunts, 366-Mobil, 372-Washv, 374-Chata, 376-Johns, 379-Knoxv, 381-Memph, 383-Jacks, 387-Grenv, 388-Tupel, 392-Jacks, 393-Merid, 402-Louis, 405-Lexin, 421-Bowln, 432-Colum, 436-Toled, 441-Clevl, 442-Akron, 445-Young, 449-Mansf, 452-Cncin, 454-Dayto, 458-Lima, 462-Indan, 466-South, 468-Ft.Wa, 473-Munci, 474-Blomn, 477-Evans, 482-Detro, 485-Flint, 486-Sagin, 489-Lansi, 495-GrndR, 497-SStMa, 503-DesMo, 511-Sioux, 520-Dubuq, 528-Daven, 532-Milwa, 537-Madis, 543-Green, 546-EauCl, 554-Minea, 558-Dulut, 559-Rochs, 571-Sioux, 581-Farg, 606-Chica, 611-Rockf, 612-RockI, 616-Peori, 618-Champ, 627-Sprin, 631-StLou, 634-Hanni, 638-CapeG, 641-Kanss, 645-St.Jo, 648-Jopli, 658-Sprin, 666-Topek, 672-Wichi, 681-Omaha, 685-Linco, 712-Monro, 722-Little, 727-Fayet, 729-Ft.Sm, 741-Tulsa, 981-Seatt, 982-Evere, 984-Tacom

Distribution Center: Atlanta Market Areas (23):

292-Colmb, 294-Charl, 296-Grenv, 303-Atlan, 306-Athen, 309-Augus, 312-Macon, 314-Savan, 317-Alban, 319-Colum, 322-Jacks, 323-Talla, 328-Orlan, 331-Miami, 334-W.Plm, 336-Tampa, 339-FtMye, 359-Gadsd, 361-Montg, 587-Minot, 701-NewOr, 708-BatnR, 713-Alexn

Distribution Center: Dallas Market Areas (24):

678-Dodge, 711-Shrev, 731-OklaC, 745-Mcals, 752-Dalla, 755-Texar, 757-Tyler, 761-Ft.Wo, 763-Wicht, 767-Waco,, 769-SanAn, 770-Houst, 777-Beaum, 782-SanAn, 784-CorpC, 787-Austi, 791-Amari, 794-Lubbo, 796-Abile, 799-El Pa, 802-Denve, 810-Puebl, 871-Albuq, 881-Roswe

Distribution Center: Los Angeles Market Areas (9):

900-LosAn, 921-SanDi, 924-SanBe, 933-Bakrs, 937-Fresn, 946-Oakla, 952-Stock, 958-Sacra, 960-Reddi

Distribution Center: Salt Lake City Market Areas (22):

577-Rapid, 591-Billi, 594-Great, 596-Helen, 598-Misou, 691-N.Pla, 815-GrndJ, 820-Cheye, 832-Pocat, 837-Boise, 841-SltLk, 846-Provo, 850-Phoen, 857-Tucso, 891-LasVe, 895-Reno, 972-Portl, 973-Salem, 975-Medfo, 989-Yakim, 992-Spoka, 993-Walaw

Table F-6

RQA3C Results: US-Canada 50 Percent Tariff Reduction

Summary

<u>Finished Product Demand</u>	(000)
Total Units	24,886.8

<u>Cost Information</u>	(\$000)
Total Purchase Cost	5,071,044.5
Total Manufacturing Cost	7,838,741.5
Total Distribution Center Cost	352,745.7
Total Transportation Cost	544,933.9
Total System Cost	8,679,393.9

<u>Transportation Cost Detail</u>	(\$000)
Inbound Freight:	57,027.2
Internal Transfer Freight:	146,021.1
Customer Freight:	341,885.7
Total Transportation Cost:	544,933.9

<u>Facilities Utilized</u>	Type
Woodstock	S
Ft. Wayne	S
Toronto	M
Indianapolis	M
Toronto	DC
Edmonton	DC
Worcester	DC
Indianapolis	DC
Raleigh	DC
Atlanta	DC
Dallas	DC
Los Angeles	DC
Salt Lake City	DC

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Table F-6 (cont'd.)

Purchases By Manufacturing Plant Location / Purchases By Supplier Location

Manufacturing Plant Location: Toronto

Supplier Location: Woodstock

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.1630	4,835.4	5,623.6	83.7	5,707.3
102	Belts	2.4367	1,303.0	3,175.0	7.1	3,182.1
103	Compressors	50.4000	517.6	26,087.0	224.0	26,311.0
104	Copper Components	1.0574	1,509.5	1,596.1	26.1	1,622.2
105	Cord Sets	2.2799	1,015.2	2,314.4	14.1	2,328.5
106	Corrugated Packaging	2.2860	1,754.0	4,009.5	303.6	4,313.1
107	Fasteners	.0101	274,285.5	2,770.3	30.9	2,801.1
108	Door Gaskets	8.0640	517.6	4,173.9	179.2	4,353.1
109	Knobs	.2510	7,021.8	1,762.5	7.6	1,770.1
110	1 Speed Motors	18.4666	307.9	5,685.9	80.0	5,765.8
111	2 Speed Motors	24.9480	497.6	12,412.9	172.3	12,585.1
112	Paint (Powder)	3.2648	562.5	1,836.5	9.7	1,846.2
113	Plastic Components	3.5484	1,754.0	6,223.7	45.5	6,269.3
114	Polypropylene Resin	.3624	28,852.4	10,456.1	499.5	10,955.6
115	Pumps	6.0667	497.6	3,018.5	8.6	3,027.1
116	Relays	7.0689	1,015.2	7,176.0	11.0	7,187.0
117	Steel	.2829	143,602.4	40,625.1	2,485.9	43,111.0
118	Switches	.7554	7,889.1	5,959.4	13.7	5,973.1
119	Timers/Motors	7.2964	3,097.1	22,597.3	5.4	22,602.7
120	Wiring Harnesses	6.0776	1,754.0	10,659.8	60.7	10,720.5
121	Misc. Electronics	6.4461	1,754.0	11,306.1	9.1	11,315.2
122	Washer MP	46.0068	497.6	22,890.7	258.4	23,149.1
123	Dryer MP	39.2610	307.9	12,088.5	5.3	12,093.8
124	Range MP	177.6261	430.9	76,539.1	708.6	77,247.7
125	Refrigerator MP	114.1256	517.6	59,071.4	537.6	59,609.0
Total:				360,059.3	5,787.4	365,846.7

Manufacturing Plant Location: Indianapolis

Supplier Location: Fort Wayne

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	1.1500	65,319.8	75,117.7	972.0	76,089.7
102	Belts	2.4000	16,588.0	39,811.2	69.9	39,881.1
103	Compressors	50.0000	7,063.9	353,192.5	2,175.7	355,368.2
104	Copper Components	1.0500	20,448.5	21,470.9	215.9	21,686.8
105	Cord Sets	2.2500	13,160.6	29,611.2	120.5	29,731.7
106	Corrugated Packaging	2.2500	23,132.9	52,048.9	2,850.0	54,898.9
107	Fasteners	.0100	3,618,582.1	36,185.8	289.8	36,475.6
108	Door Gaskets	8.0000	7,063.9	56,510.8	1,740.5	58,251.3
109	Knobs	.2500	91,406.3	22,851.6	100.1	22,951.7
110	1 Speed Motors	18.3200	4,394.6	80,509.1	812.1	81,321.2
111	2 Speed Motors	24.7500	6,096.7	150,893.3	1,502.2	152,395.6
112	Paint (Powder)	3.2500	7,375.5	23,970.4	71.4	24,041.8
113	Plastic Components	3.5000	23,132.9	80,965.0	607.9	81,572.9
114	Polypropylene Resin	.3600	378,692.9	136,329.4	3,999.0	140,328.4
115	Pumps	6.0000	6,096.7	36,580.2	90.7	36,670.9
116	Relays	7.0000	13,160.6	92,123.9	110.9	92,234.7
117	Steel	.2810	1,893,196.0	531,988.1	16,660.1	548,648.2
118	Switches	.7500	103,926.0	77,944.5	140.1	78,084.6
119	Timers/Motors	7.2500	41,655.2	301,999.8	56.2	302,056.0
120	Wiring Harnesses	5.9800	23,132.9	138,334.4	529.3	138,863.7
121	Misc. Electronics	6.4000	23,132.9	148,050.2	93.6	148,143.8
122	Washer MP	45.4900	6,096.7	277,338.9	3,204.4	280,543.3
123	Dryer MP	38.8200	4,394.6	170,598.4	77.0	170,675.4
124	Range MP	175.7700	5,577.7	980,392.3	7,884.6	988,277.0
125	Refrigerator MP	112.7100	7,063.9	796,166.5	6,866.1	803,032.6
Total:				4,710,985.1	51,239.9	4,762,225.0

Table F-6 (cont'd.)

Total Purchase Expenditure For Each Purchased Item And Total Purchases For The Firm

Item No.	Description	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	70,155.2	80,741.3	1,055.7	81,796.9
102	Belts	17,891.0	42,986.2	76.9	43,063.2
103	Compressors	7,581.5	379,279.5	2,399.7	381,679.2
104	Copper Components	21,957.9	23,067.0	242.1	23,309.1
105	Cord Sets	14,175.7	31,925.7	134.5	32,060.2
106	Corrugated Packaging	24,886.8	56,058.4	3,153.6	59,212.0
107	Fasteners	3,892,867.6	38,956.1	320.6	39,276.7
108	Door Gaskets	7,581.5	60,684.7	1,919.7	62,604.5
109	Knobs	98,428.1	24,614.0	107.7	24,721.7
110	1 Speed Motors	4,702.5	86,194.9	892.1	87,087.0
111	2 Speed Motors	6,594.3	163,306.2	1,674.5	164,980.7
112	Paint (Powder)	7,938.0	25,806.9	81.1	25,888.0
113	Plastic Components	24,886.8	87,188.7	653.5	87,842.2
114	Polypropylene Resin	407,545.3	146,785.5	4,498.5	151,284.0
115	Pumps	6,594.3	39,598.7	99.3	39,698.0
116	Relays	14,175.7	99,299.8	121.9	99,421.7
117	Steel	2,036,798.4	572,613.2	19,146.0	591,759.2
118	Switches	111,815.1	83,903.9	153.8	84,057.7
119	Timers/Motors	44,752.2	324,597.2	61.5	324,658.7
120	Wiring Harnesses	24,886.8	148,994.2	590.0	149,584.2
121	Misc. Electronics	24,886.8	159,356.4	102.7	159,459.0
122	Washer MP	6,594.3	300,229.6	3,462.8	303,692.4
123	Dryer MP	4,702.5	182,686.8	82.3	182,769.2
124	Range MP	6,008.6	1,056,931.4	8,593.3	1,065,524.7
125	Refrigerator MP	7,581.5	855,237.9	7,403.7	862,641.6
Total:			5,071,044.5	57,027.2	5,128,071.7

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Toronto

Item No.	Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201	Washers	497.6	159.17	38.15	2.35	199.67	99,346.6
202	Dryers	307.9	132.59	30.48	2.35	165.42	50,933.9
203	Ranges	430.9	244.32	49.38	2.35	296.05	127,568.9
204	Refrigerators	517.6	271.54	72.51	2.35	346.40	179,294.4
Total:		1,754.0				VC Total:	457,143.8
						FC Total:	112,239.7
						Plant Total:	569,383.5

Manufacturing Plant Location: Indianapolis

Item No.	Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201	Washers	6,096.7	156.63	35.32	2.50	194.45	1,185,529.9
202	Dryers	4,394.6	130.36	28.22	2.50	161.08	707,889.2
203	Ranges	5,577.7	240.83	45.72	2.50	289.05	1,612,248.1
204	Refrigerators	7,063.9	267.71	67.14	2.50	337.35	2,383,020.4
Total:		23,132.9				VC Total:	5,888,687.5
						FC Total:	1,380,670.4
						Plant Total:	7,269,357.9

Firm Total: 24,886.8

Firm VC Total: 6,345,831.4
Firm FC Total: 1,492,910.1
Firm MFG Total: 7,838,741.5

Table F-6 (cont'd.)

Source Of Finished Products By Distribution Center Location / Total Cost For Distribution Center Operations							
DC Location	Description	Mfg. Source	Units (000)	Variable Labor (\$ 000)	Inv. CC. (\$ 000)	Fixed Cost (\$ 000)	Product DC Total (\$ 000)
Toronto	Washers	CAN	367.8	1,728.4	2,647.8		4,376.2
	Dryers	CAN	307.9	1,447.1	1,847.4		3,294.5
	Ranges	CAN	318.5	1,496.7	3,095.3		4,592.0
	Refrigerators	CAN	382.7	1,798.5	4,350.7		6,149.2
	Total:		1,376.8	6,470.7	11,941.3	1,830.0	18,412.0
						DC Total:	20,242.0
Edmonton	Washers	CAN	129.8	607.5	934.6		1,542.0
	Dryers	US	108.6	508.3	651.6		1,159.9
	Ranges	CAN	112.5	526.3	1,093.0		1,619.3
	Refrigerators	CAN	135.0	631.6	1,534.4		2,166.0
	Total:		485.8	2,273.6	4,213.6	1,640.0	6,487.1
						DC Total:	8,127.1
Worcester	Washers	US	395.8	1,753.2	2,849.4		4,602.6
	Dryers	US	281.3	1,245.9	1,687.5		2,933.4
	Ranges	US	360.9	1,598.8	3,508.0		5,106.7
	Refrigerators	US	455.8	2,019.0	5,181.9		7,200.9
	Total:		1,493.7	6,616.9	13,226.7	1,670.0	19,843.6
						DC Total:	21,513.6
Indianapolis	Washers	US	3,012.2	15,060.8	21,687.5		36,748.2
	Dryers	US	2,115.9	10,579.5	12,695.4		23,274.9
	Ranges	US	2,756.5	13,782.3	26,792.7		40,575.0
	Refrigerators	US	3,491.5	17,457.3	39,697.8		57,155.0
	Total:		11,376.0	56,879.8	100,873.4	1,750.0	157,753.1
						DC Total:	159,503.1
Raleigh	Washers	US	365.4	1,487.0	2,630.5		4,117.5
	Dryers	US	256.7	1,044.8	1,540.2		2,585.0
	Ranges	US	334.3	1,360.4	3,248.9		4,609.3
	Refrigerators	US	423.5	1,723.7	4,815.2		6,538.9
	Total:		1,379.8	5,615.8	12,234.8	1,420.0	17,850.6
						DC Total:	19,270.6
Atlanta	Washers	US	668.5	2,921.3	4,813.2		7,734.5
	Dryers	US	469.5	2,051.7	2,817.0		4,868.7
	Ranges	US	611.6	2,672.7	5,944.8		8,617.4
	Refrigerators	US	774.7	3,385.4	8,808.3		12,193.8
	Total:		2,524.3	11,031.2	22,383.3	1,300.0	33,414.5
						DC Total:	34,714.5
Dallas	Washers	US	612.8	2,549.0	4,411.8		6,960.8
	Dryers	US	430.5	1,790.9	2,583.0		4,373.9
	Ranges	US	560.9	2,333.1	5,451.5		7,784.6
	Refrigerators	US	710.4	2,955.3	8,077.3		11,032.5
	Total:		2,314.5	9,628.3	20,523.5	1,600.0	30,151.8
						DC Total:	31,751.8
Los Angeles	Washers	US	698.7	3,619.0	5,030.3		8,649.3
	Dryers	US	490.9	2,542.6	2,945.1		5,487.7
	Ranges	US	639.4	3,311.8	6,214.5		9,526.3
	Refrigerators	US	810.0	4,195.5	9,209.1		13,404.7
	Total:		2,638.8	13,669.0	23,399.0	1,830.0	37,068.0
						DC Total:	38,898.0

Table F-6 (cont'd.)

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Salt Lake City	Washers	US	343.6	1,470.4	2,473.6		3,944.0
	Dryers	US	241.3	1,032.8	1,447.8		2,480.6
	Ranges	US	314.3	1,345.2	3,055.0		4,400.2
	Refrigerators	US	398.1	1,703.9	4,526.4		6,230.3
Total: 1,297.3				5,552.2	11,502.8	1,670.0	17,055.0
						DC Total:	18,725.0
						Firm DC Total:	352,745.7

Market Areas Serviced By Distribution Center Location

Distribution Center: Toronto Market Areas (20):

A1B-St Jo, G1A-Quebe, G5H-Rimou, G6G-Thetf, G8V-Trois, H9P, Montr, J1E-Sherb, J8X-Ottaw, J9X-Rouyn, K7K-Kings, L2M-St. C, L4N-Barri, L4V-Toron, N2B-Kitch, N5Y-Londo, N8N-Winds, P3A-Sudbu, P7A-Thund, P9N-Kenor, R2X-Winni

Distribution Center: Edmonton Market Areas (6):

S4P-Regin, S7K-Saska, T2H-Calga, T5J-Edmon, V1H-Princ, V3M-Vanco

Distribution Center: Worcester Market Areas (17):

011-Sprng, 016-Worch, 021-Bosto, 029-Provd, 031-Manch, 041-Portl, 047-Bango, 054-Burln, 061-Hartf, 065-NewHa, 069-Stamf, 122-Alban, 126-Pough, B2V-Halif, C1A-Charl, E1C-Monct, E2H-Saint

Distribution Center: Indianapolis Market Areas (100):

071-Newar, 081-Camde, 089-NewBr, 106-WhitP, 112-Brook, 132-Syrac, 139-Bingp, 141-Buffa, 146-Rochs, 152-Pitts, 158-Du Bo, 159-Johns, 165-Erie,, 171-Harrs, 181-Allen, 187-Wlks-, 194-Phila, 196-Read,, 198-Wilmn, 212-Balti, 215-Cumbr, 253-Charl, 265-Clrks, 288-Ashev, 352-Birmg, 354-Tusca, 356-Hunts, 366-Mobil, 372-Nashv, 374-Chata, 376-Johns, 379-Knoxv, 381-Memph, 383-Jacks, 387-Grenv, 388-Tupel, 392-Jacks, 393-Merid, 402-Louis, 405-Lexin, 421-Bowlm, 432-Colum, 436-Toled, 441-Clevl, 442-Akron, 445-Young, 449-Mansf, 452-Cncin, 454-Dayto, 458-Lima, 462-Indan, 466-South, 468-Ft.Wa, 473-Munci, 474-Blomn, 477-Evans, 482-Detro, 485-Flint, 486-Sagin, 489-Lansi, 495-GrndR, 497-SStMa, 503-DesMo, 511-Sioux, 520-Dubuq, 528-Daven, 532-Milwa, 537-Madis, 543-Green, 546-EauCl, 554-Minea, 558-Dulut, 559-Rochs, 571-Sioux, 581-Fargo, 606-Chica, 611-Rockf, 612-Rockl, 616-Peori, 618-Champ, 627-Sprin, 631-StLou, 634-Hanni, 638-CapeG, 641-Kanss, 645-St.Jo, 648-Jopli, 658-Sprin, 666-Topek, 672-Wichi, 681-Omaha, 685-Linco, 712-Monro, 722-Litle, 727-Fayet, 729-Ft.Sm, 741-Tulsa, 981-Seatt, 982-Evere, 984-Tacom

Distribution Center: Raleigh Market Areas (10):

200-Washn, 229-Harsn, 232-Richm, 235-Norfo, 240-Roano, 274-Green, 276-Ralei, 282-Charl, 283-Fayet, 294-Charl

Distribution Center: Atlanta Market Areas (22):

292-Colmb, 296-Grenv, 303-Atlan, 306-Athen, 309-Augus, 312-Macon, 314-Savan, 317-Alban, 319-Colum, 322-Jacks, 323-Talla, 328-Orlan, 331-Miami, 334-W.Plm, 336-Tampa, 339-FtMye, 359-Gadsd, 361-Montg, 587-Minot, 701-NewOr, 708-BatrR, 713-Alexn

Distribution Center: Dallas Market Areas (24):

678-Dodge, 711-Shrev, 731-OklaC, 745-Mcals, 752-Dalla, 755-Texar, 757-Tyler, 761-Ft.Wo, 763-Wicht, 767-Waco,, 769-SanAn, 770-Houst, 777-Beaum, 782-SanAn, 784-CorpC, 787-Austi, 791-Amari, 794-Lubbo, 796-Abile, 799-El Pa, 802-Denve, 810-Puebl, 871-Albuq, 881-Roswe

Distribution Center: Los Angeles Market Areas (9):

900-LosAn, 921-SanDi, 924-SanBe, 933-Bakrs, 937-Fresn, 946-Oakla, 952-Stoc, 958-Sacra, 960-Reddi

Distribution Center: Salt Lake City Market Areas (22):

577-Rapid, 591-Billi, 594-Great, 596-Helen, 598-Misou, 691-N.Pla, 815-GrndJ, 820-Cheye, 832-Pocat, 837-Boise, 841-SltLk, 846-Provo, 850-Phoen, 857-Tucso, 891-LasVe, 895-Reno,, 972-Portl, 973-Salem, 975-Medfo, 989-Yakim, 992-Spoka, 993-WalaW

Table F-7

RQA3D Results: US-Canada 100 Percent Tariff Reduction

Summary

<u>Finished Product Demand</u>	<u>(000)</u>
Total Units	24,886.8

<u>Cost Information</u>	<u>(\$000)</u>
Total Purchase Cost	5,069,798.6
Total Manufacturing Cost	7,834,670.9
Total Distribution Center Cost	352,305.8
Total Transportation Cost	541,194.4
Total System Cost	8,671,785.4

<u>Transportation Cost Detail</u>	<u>(\$000)</u>
Inbound Freight:	56,385.7
Internal Transfer Freight:	145,000.4
Customer Freight:	339,808.3
Total Transportation Cost:	541,194.4

<u>Facilities Utilized</u>	<u>Type</u>
Woodstock	S
Ft. Wayne	S
Toronto	M
Indianapolis	M
Toronto	DC
Regina	DC
Worcester	DC
Indianapolis	DC
Raleigh	DC
Atlanta	DC
Dallas	DC
Los Angeles	DC
Salt Lake City	DC

Table F-7 (cont'd.)

Purchases By Manufacturing Plant Location / Purchases By Supplier Location

Manufacturing Plant Location: Toronto

Supplier Location: Woodstock

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.1630	3,020.6	3,513.0	52.3	3,565.2
102	Belts	2.4367	881.7	2,148.4	4.8	2,153.2
103	Compressors	50.4000	323.4	16,296.8	139.9	16,436.8
104	Copper Components	1.0574	942.9	997.1	16.3	1,013.4
105	Cord Sets	2.2799	634.1	1,445.7	8.8	1,454.5
106	Corrugated Packaging	2.2860	1,163.4	2,659.5	201.4	2,860.9
107	Fasteners	.0101	183,941.6	1,857.8	20.7	1,878.5
108	Door Gaskets	8.0640	323.4	2,607.5	112.0	2,719.4
109	Knobs	.2510	4,521.3	1,134.8	4.9	1,139.7
110	1 Speed Motors	18.4666	260.2	4,805.0	67.6	4,872.6
111	2 Speed Motors	24.9480	310.8	7,752.6	107.6	7,860.2
112	Paint (Powder)	3.2648	366.0	1,194.8	6.3	1,201.1
113	Plastic Components	3.5484	1,163.4	4,128.2	30.2	4,158.4
114	Polypropylene Resin	.3624	18,090.6	6,556.0	313.2	6,869.2
115	Pumps	6.0667	310.8	1,885.2	5.4	1,890.6
116	Relays	7.0689	634.1	4,482.4	6.9	4,489.2
117	Steel	.2829	96,684.2	27,352.0	1,673.7	29,025.6
118	Switches	.7554	5,334.6	4,029.8	9.2	4,039.0
119	Timers/Motors	7.2964	2,070.3	15,105.7	3.6	15,109.3
120	Wiring Harnesses	6.0776	1,163.4	7,070.7	40.3	7,111.0
121	Misc. Electronics	6.4461	1,163.4	7,499.4	6.0	7,505.4
122	Washer MP	46.0068	310.8	14,296.6	161.4	14,458.0
123	Dryer MP	39.2610	260.2	10,215.7	4.5	10,220.2
124	Range MP	177.6261	269.1	47,799.2	442.5	48,241.7
125	Refrigerator MP	114.1256	323.4	36,902.5	335.8	37,238.4
Total:				233,736.4	3,775.2	237,511.6

Manufacturing Plant Location: Indianapolis

Supplier Location: Fort Wayne

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	1.1500	67,134.6	77,204.7	999.0	78,203.7
102	Belts	2.4000	17,009.3	40,822.3	71.7	40,894.0
103	Compressors	50.0000	7,258.1	362,905.0	2,235.5	365,140.5
104	Copper Components	1.0500	21,015.0	22,065.8	221.9	22,287.7
105	Cord Sets	2.2500	13,541.6	30,468.6	123.9	30,592.5
106	Corrugated Packaging	2.2500	23,723.4	53,377.7	2,922.7	56,300.4
107	Fasteners	.0100	3,708,926.1	37,089.3	297.0	37,386.3
108	Door Gaskets	8.0000	7,258.1	58,064.8	1,788.4	59,853.2
109	Knobs	.2500	93,906.8	23,476.7	102.8	23,579.5
110	1 Speed Motors	18.3200	4,442.3	81,382.9	820.9	82,203.9
111	2 Speed Motors	24.7500	6,283.5	155,516.6	1,548.3	157,064.9
112	Paint (Powder)	3.2500	7,572.1	24,609.2	73.3	24,682.5
113	Plastic Components	3.5000	23,723.4	83,031.9	623.5	83,655.4
114	Polypropylene Resin	.3600	389,454.7	140,203.7	4,112.6	144,316.3
115	Pumps	6.0000	6,283.5	37,701.0	93.5	37,794.5
116	Relays	7.0000	13,541.6	94,791.2	114.1	94,905.3
117	Steel	.2810	1,940,114.2	545,172.1	17,073.0	562,245.1
118	Switches	.7500	106,480.5	79,860.4	143.5	80,003.9
119	Timers/Motors	7.2500	42,681.9	309,443.8	57.5	309,501.3
120	Wiring Harnesses	5.9800	23,723.4	141,865.9	542.8	142,408.7
121	Misc. Electronics	6.4000	23,723.4	151,829.8	95.9	151,925.7
122	Washer MP	45.4900	6,283.5	285,836.4	3,302.6	289,139.0
123	Dryer MP	38.8200	4,442.3	172,450.1	77.8	172,527.9
124	Range MP	175.7700	5,739.5	1,008,831.9	8,113.4	1,016,945.3
125	Refrigerator MP	112.7100	7,258.1	818,060.5	7,054.9	825,115.3
Total:				4,836,062.2	52,610.6	4,888,672.7

Table F-7 (cont'd.)

Total Purchase Expenditure For Each Purchased Item And Total Purchases For The Firm

Item No.	Description	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	70,155.2	80,717.7	1,051.3	81,768.9
102	Belts	17,891.0	42,970.8	76.4	43,047.2
103	Compressors	7,581.5	379,201.8	2,375.4	381,577.3
104	Copper Components	21,957.9	23,062.8	238.2	23,301.0
105	Cord Sets	14,175.7	31,914.3	132.7	32,047.0
106	Corrugated Packaging	24,886.8	56,037.2	3,124.1	59,161.3
107	Fasteners	3,892,867.7	38,947.1	317.7	39,264.8
108	Door Gaskets	7,581.5	60,672.3	1,900.4	62,572.6
109	Knobs	98,428.1	24,611.5	107.7	24,719.3
110	1 Speed Motors	4,702.5	86,187.9	888.5	87,076.4
111	2 Speed Motors	6,594.3	163,269.2	1,655.8	164,925.1
112	Paint (Powder)	7,938.0	25,803.9	79.6	25,883.6
113	Plastic Components	24,886.8	87,160.1	653.7	87,813.8
114	Polypropylene Resin	407,545.3	146,759.7	4,425.8	151,185.5
115	Pumps	6,594.3	39,586.2	98.9	39,685.1
116	Relays	14,175.7	99,273.6	121.0	99,394.5
117	Steel	2,036,798.4	572,524.1	18,746.7	591,270.7
118	Switches	111,815.1	83,890.1	152.8	84,042.9
119	Timers/Motors	44,752.2	324,549.5	61.1	324,610.6
120	Wiring Harnesses	24,886.8	148,936.6	583.1	149,519.7
121	Misc. Electronics	24,886.8	159,329.2	102.0	159,431.1
122	Washer MP	6,594.3	300,133.0	3,464.0	303,597.0
123	Dryer MP	4,702.5	182,665.8	82.3	182,748.1
124	Range MP	6,008.6	1,056,631.1	8,555.9	1,065,187.0
125	Refrigerator MP	7,581.5	854,963.0	7,390.7	862,353.7
Total:			5,069,798.6	56,385.7	5,126,184.3

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Toronto

Item No.	Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201	Washers	310.8	159.17	38.15	2.35	199.67	62,048.0
202	Dryers	260.2	132.59	30.48	2.35	165.42	43,043.2
203	Ranges	269.1	244.32	49.38	2.35	296.05	79,667.7
204	Refrigerators	323.4	271.54	72.51	2.35	346.40	112,007.1
Total:		1,163.4				VC Total:	296,765.9
						FC Total:	112,239.7
						Plant Total:	409,005.6

Manufacturing Plant Location: Indianapolis

Item No.	Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201	Washers	6,283.5	156.63	35.32	2.50	194.45	1,221,853.9
202	Dryers	4,442.3	130.36	28.22	2.50	161.08	715,572.8
203	Ranges	5,739.5	240.83	45.72	2.50	289.05	1,659,016.8
204	Refrigerators	7,258.1	267.71	67.14	2.50	337.35	2,448,551.4
Total:		23,723.4				VC Total:	6,044,994.9
						FC Total:	1,380,670.4
						Plant Total:	7,425,665.3
Firm Total:		24,886.8				Firm VC Total:	6,341,760.8
						Firm FC Total:	1,492,910.1
						Firm MFG Total:	7,834,670.9

Table F-7 (cont'd.)

Source Of Finished Products By Distribution Center Location /
Total Cost For Distribution Center Operations

<u>DC Location</u>	<u>Description</u>	<u>Mfg.</u> <u>Source</u>	<u>Units</u> <u>(000)</u>	<u>Variable</u> <u>Labor</u> <u>(\$ 000)</u>	<u>Inv.</u> <u>CC.</u> <u>(\$ 000)</u>	<u>Fixed</u> <u>Cost</u> <u>(\$ 000)</u>	<u>Product</u> <u>DC Total</u> <u>(\$ 000)</u>
Toronto	Washers	CAN	310.8	1,460.5	2,237.4		3,697.9
	Dryers	CAN	260.2	1,222.9	1,561.2		2,784.1
	Ranges	CAN	269.1	1,264.8	2,615.7		3,880.4
	Refrigerators	CAN	323.4	1,519.7	3,676.5		5,196.2
	Total:		1,163.4	5,468.0	10,090.7	1,830.0	15,558.7
						DC Total:	17,388.7
Regina	Washers	US	174.3	742.3	1,254.6		1,996.9
	Dryers	US	143.0	609.0	857.7		1,466.7
	Ranges	US	152.0	647.5	1,477.4		2,125.0
	Refrigerators	US	183.7	782.6	2,088.7		2,871.2
	Total:		652.9	2,781.4	5,678.4	1,520.0	8,459.8
						DC Total:	9,979.8
Worcester	Washers	US	429.4	1,902.2	3,091.7		4,993.9
	Dryers	US	309.5	1,370.9	1,856.7		3,227.6
	Ranges	US	390.1	1,727.9	3,791.3		5,519.2
	Refrigerators	US	490.8	2,174.2	5,580.4		7,754.6
	Total:		1,619.7	7,175.3	14,320.1	1,670.0	21,495.3
						DC Total:	23,165.3
Indianapolis	Washers	US	2,997.7	14,988.3	21,583.1		36,571.3
	Dryers	US	2,105.7	10,528.5	12,634.2		23,162.7
	Ranges	US	2,743.2	13,715.8	26,663.4		40,379.2
	Refrigerators	US	3,474.6	17,373.0	39,506.2		56,879.2
	Total:		11,321.1	56,605.5	100,386.9	1,750.0	156,992.4
						DC Total:	158,742.4
Raleigh	Washers	US	365.4	1,487.0	2,630.5		4,117.5
	Dryers	US	256.7	1,044.8	1,540.2		2,585.0
	Ranges	US	334.3	1,360.4	3,248.9		4,609.3
	Refrigerators	US	423.5	1,723.7	4,815.2		6,538.9
	Total:		1,379.8	5,615.8	12,234.8	1,420.0	17,850.6
						DC Total:	19,270.6
Atlanta	Washers	US	661.9	2,892.5	4,765.7		7,658.2
	Dryers	US	464.9	2,031.4	2,789.1		4,820.5
	Ranges	US	605.6	2,646.3	5,886.0		8,532.2
	Refrigerators	US	767.1	3,352.0	8,721.4		12,073.4
	Total:		2,499.4	10,922.2	22,162.1	1,300.0	33,084.2
						DC Total:	34,384.2
Dallas	Washers	US	612.8	2,549.0	4,411.8		6,960.8
	Dryers	US	430.5	1,790.9	2,583.0		4,373.9
	Ranges	US	560.9	2,333.1	5,451.5		7,784.6
	Refrigerators	US	710.4	2,955.3	8,077.3		11,032.5
	Total:		2,314.5	9,628.3	20,523.5	1,600.0	30,151.8
						DC Total:	31,751.8
Los Angeles	Washers	US	698.7	3,619.0	5,030.3		8,649.3
	Dryers	US	490.9	2,542.6	2,945.1		5,487.7
	Ranges	US	639.4	3,311.8	6,214.5		9,526.3
	Refrigerators	US	810.0	4,195.5	9,209.1		13,404.7
	Total:		2,638.8	13,669.0	23,399.0	1,830.0	37,068.0
						DC Total:	38,898.0

Table F-7 (cont'd.)

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Salt Lake City	Washers	US	343.6	1,470.4	2,473.6		3,944.0
	Dryers	US	241.3	1,032.8	1,447.8		2,480.6
	Ranges	US	314.3	1,345.2	3,055.0		4,400.2
	Refrigerators	US	398.1	1,703.9	4,526.4		6,230.3
Total: 1,297.3				5,552.2	11,502.8	1,670.0	17,055.0
						DC Total:	18,725.0
						Firm DC Total:	352,305.8

Market Areas Serviced By Distribution Center Location

Distribution Center: Toronto Market Areas (13):

A1B-St Jo, G8V-Trois, H9P-Montr, J8X-Ottaw, J9X-Rouyn, K7K-Kings, L2M-St. C, L4N-Barri, L4V-Toron, N2B-Kitch, N5Y-Londo, N8N-Winds, P3A-Sudbu

Distribution Center: Regina Market Areas (11):

581-Fargo, 587-Minot, P7A-Thund, P9N-Kenor, R2X-Winni, S4P-Regin, S7K-Saska, T2H-Calga, T5J-Edmon, V1H-Princ, V3M-Vanco

Distribution Center: Worcester Market Areas (21):

011-Sprng, 016-Worch, 021-Bosto, 029-Provd, 031-Manch, 041-Portl, 047-Bango, 054-Burln, 061-Hartf, 065-NewHa, 069-Stamf, 122-Alban, 126-Pough, B2V-Halif, C1A-Charl, E1C-Monct, E2H-Saint, G1A-Quebe, G5H-Rimou, G6G-Thetf, J1E-Sherb

Distribution Center: Indianapolis Market Areas (99):

071-Newar, 081-Camde, 089-NewBr, 106-WhitP, 112-Brook, 132-Syrac, 139-Bingp, 141-Buffa, 146-Rochs, 152-Pitts, 158-Du Bo, 159-Johns, 165-Erie, 171-Harrs, 181-Allen, 187-Wlks-, 194-Phila, 196-Readi, 198-Wilmn, 212-Balti, 215-Cumbr, 253-Charl, 265-Clrks, 288-Ashev, 352-Birmg, 354-Tusca, 356-Hunts, 366-Mobil, 372-Nashv, 374-Chata, 376-Johns, 379-Knoxv, 381-Memph, 383-Jacks, 387-Grenv, 388-Tupel, 392-Jacks, 393-Merid, 402-Louis, 405-Lexin, 421-BowlN, 432-Colum, 436-Toled, 441-Clevl, 442-Akron, 445-Young, 449-Mansf, 452-Cncin, 454-Dayto, 458-Lima, 462-Indan, 466-South, 468-Ft.Wa, 473-Munci, 474-Blomm, 477-Evans, 482-Detro, 485-Flint, 486-Sagin, 489-Lansi, 495-GrndR, 497-SStMa, 503-DesMo, 511-Sioux, 520-Dubuq, 528-Daven, 532-Milwa, 537-Madis, 543-Green, 546-EauCl, 554-Minea, 558-Dulut, 559-Rochs, 571-Sioux, 606-Chica, 611-Rockf, 612-RockI, 616-Peori, 618-Champ, 627-Sprin, 631-StLou, 634-Hanni, 638-CapeG, 641-Kanss, 645-St.Jo, 648-Jopli, 658-Sprin, 666-Topek, 672-Wichi, 681-Omaha, 685-Linco, 712-Monro, 722-Litle, 727-Fayet, 729-Ft.Sm, 741-Tulsa, 981-Seatt, 982-Evere, 984-Tacom

Distribution Center: Raleigh Market Areas (10):

200-Washn, 229-Harsn, 232-Richm, 235-Norfo, 240-Roano, 274-Green, 276-Ralei, 282-Charl, 283-Fayet, 294-Charl

Distribution Center: Atlanta Market Areas (21):

292-Colmb, 296-Grenv, 303-Atlan, 306-Athen, 309-Augus, 312-Macon, 314-Savan, 317-Alban, 319-Colum, 322-Jacks, 323-Talla, 328-Orlan, 331-Miami, 334-W.Plm, 336-Tampa, 339-FtMye, 359-Gadsd, 361-Montg, 701-NewOr, 708-BatnR, 713-Alexn

Distribution Center: Dallas Market Areas (24):

678-Dodge, 711-Shrev, 731-OklaC, 745-Mcals, 752-Dalla, 755-Texar, 757-Tyler, 761-Ft.Wo, 763-Wicht, 767-Waco,, 769-SanAn, 770-Houst, 777-Beaum, 782-SanAn, 784-CorpC, 787-Austi, 791-Amari, 794-Lubbo, 796-Abile, 799-El Pa, 802-Denve, 810-Puebl, 871-Albuq, 881-Roswe

Distribution Center: Los Angeles Market Areas (9):

900-LosAn, 921-SanDi, 924-SanBe, 933-Bakrs, 937-Fresn, 946-Oakla, 952-Stock, 958-Sacra, 960-Reddi

Distribution Center: Salt Lake City Market Areas (22):

577-Rapid, 591-Billi, 594-Great, 596-Helen, 598-Misou, 691-N.Pla, 815-GrndJ, 820-Cheye, 832-Pocat, 837-Boise, 841-SltLk, 846-Provo, 850-Phoen, 857-Tucso, 891-LasVe, 895-Reno,, 972-Portl, 973-Salem, 975-Medfo, 989-Yakim, 992-Spoka, 993-WalaW

Table F-8

RQA3E Results: US-Canada 25 Percent Decrease in Cross-Border Transaction Costs

Summary

<u>Finished Product Demand</u>	(000)
Total Units	24,886.8

<u>Cost Information</u>	(\$000)
Total Purchase Cost	5,071,176.2
Total Manufacturing Cost	7,839,160.5
Total Distribution Center Cost	353,985.7
Total Transportation Cost	544,889.0
Total System Cost	8,680,951.1

<u>Transportation Cost Detail</u>	(\$000)
Inbound Freight:	57,084.1
Internal Transfer Freight:	137,507.6
Customer Freight:	350,297.3

Total Transportation Cost:	544,889.0
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<u>Facilities Utilized</u>	<u>Type</u>
Woodstock	S
Ft. Wayne	S
Toronto	M
Indianapolis	M
Moncton	DC
Toronto	DC
Edmonton	DC
Worcester	DC
Indianapolis	DC
Atlanta	DC
Dallas	DC
Los Angeles	DC
Salt Lake City	DC

Table F-8 (cont'd.)

Purchases By Manufacturing Plant Location / Purchases By Supplier Location

Manufacturing Plant Location: Toronto

Supplier Location: Woodstock

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.1630	5,073.2	5,900.1	87.8	5,987.9
102	Belts	2.4367	1,331.9	3,245.4	7.2	3,252.7
103	Compressors	50.4000	543.1	27,369.7	235.0	27,604.7
104	Copper Components	1.0574	1,583.7	1,674.6	27.4	1,702.0
105	Cord Sets	2.2799	1,065.1	2,428.3	14.8	2,443.1
106	Corrugated Packaging	2.2860	1,805.0	4,126.2	312.5	4,438.7
107	Fasteners	.0101	281,225.2	2,840.4	31.6	2,872.0
108	Door Gaskets	8.0640	543.1	4,379.2	188.0	4,567.2
109	Knobs	.2510	7,296.8	1,831.5	7.9	1,839.4
110	1 Speed Motors	18.4666	287.8	5,314.7	74.7	5,389.4
111	2 Speed Motors	24.9480	522.1	13,024.1	180.7	13,204.8
112	Paint (Powder)	3.2648	582.6	1,902.1	10.1	1,912.2
113	Plastic Components	3.5484	1,805.0	6,404.9	46.9	6,451.7
114	Polypropylene Resin	.3624	30,236.6	10,957.7	523.4	11,481.2
115	Pumps	6.0667	522.1	3,167.1	9.0	3,176.2
116	Relays	7.0689	1,065.1	7,529.1	11.5	7,540.6
117	Steel	.2829	147,037.8	41,597.0	2,545.3	44,142.3
118	Switches	.7554	8,065.8	6,092.9	14.0	6,106.9
119	Timers/Motors	7.2964	3,178.9	23,194.5	5.5	23,200.0
120	Wiring Harnesses	6.0776	1,805.0	10,970.1	62.5	11,032.6
121	Misc. Electronics	6.4461	1,805.0	11,635.2	9.4	11,644.6
122	Washer MP	46.0068	522.1	24,017.8	271.1	24,289.0
123	Dryer MP	39.2610	287.8	11,299.3	5.0	11,304.3
124	Range MP	177.6261	452.1	80,304.8	743.5	81,048.2
125	Refrigerator MP	114.1256	543.1	61,975.9	564.0	62,539.9
Total:				373,182.7	5,988.9	379,171.5

Manufacturing Plant Location: Indianapolis

Supplier Location: Fort Wayne

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	1.1500	65,082.0	74,844.3	968.4	75,812.7
102	Belts	2.4000	16,559.1	39,741.8	69.8	39,811.6
103	Compressors	50.0000	7,038.4	351,920.0	2,167.8	354,087.8
104	Copper Components	1.0500	20,374.3	21,393.0	215.2	21,608.1
105	Cord Sets	2.2500	13,110.6	29,498.9	120.0	29,618.8
106	Corrugated Packaging	2.2500	23,081.8	51,934.1	2,843.7	54,777.7
107	Fasteners	.0100	3,611,642.6	36,116.4	289.2	36,405.6
108	Door Gaskets	8.0000	7,038.4	56,307.2	1,734.3	58,041.5
109	Knobs	.2500	91,131.3	22,782.8	99.8	22,882.6
110	1 Speed Motors	18.3200	4,414.7	80,877.3	815.8	81,693.1
111	2 Speed Motors	24.7500	6,072.2	150,287.0	1,496.2	151,783.1
112	Paint (Powder)	3.2500	7,355.4	23,905.1	71.2	23,976.3
113	Plastic Components	3.5000	23,081.8	80,786.3	606.6	81,392.9
114	Polypropylene Resin	.3600	377,308.7	135,831.1	3,984.4	139,815.5
115	Pumps	6.0000	6,072.2	36,433.2	90.4	36,523.6
116	Relays	7.0000	13,110.6	91,774.2	110.5	91,884.7
117	Steel	.2810	1,889,760.6	531,022.7	16,629.9	547,652.6
118	Switches	.7500	103,749.3	77,812.0	139.9	77,951.8
119	Timers/Motors	7.2500	41,573.3	301,406.4	56.0	301,462.5
120	Wiring Harnesses	5.9800	23,081.8	138,029.2	528.1	138,557.3
121	Misc. Electronics	6.4000	23,081.8	147,723.5	93.3	147,816.9
122	Washer MP	45.4900	6,072.2	276,224.4	3,191.6	279,415.9
123	Dryer MP	38.8200	4,414.7	171,378.7	77.4	171,456.0
124	Range MP	175.7700	5,556.5	976,666.0	7,854.7	984,520.7
125	Refrigerator MP	112.7100	7,038.4	793,298.1	6,841.3	800,139.4
Total:				4,697,993.6	51,095.2	4,749,088.8

Table F-8 (cont'd.)

Total Purchase Expenditure For Each Purchased Item And Total Purchases For The Firm

Item No.	Description	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	70,155.2	80,744.4	1,056.2	81,800.6
102	Belts	17,891.0	42,987.3	77.0	43,064.3
103	Compressors	7,581.5	379,289.7	2,402.8	381,692.6
104	Copper Components	21,957.9	23,067.5	242.6	23,310.1
105	Cord Sets	14,175.7	31,927.2	134.7	32,061.9
106	Corrugated Packaging	24,886.8	56,060.3	3,156.1	59,216.4
107	Fasteners	3,892,867.8	38,956.8	320.9	39,277.7
108	Door Gaskets	7,581.5	60,686.4	1,922.3	62,608.6
109	Knobs	98,428.1	24,614.3	107.7	24,722.0
110	1 Speed Motors	4,702.5	86,192.0	890.6	87,082.6
111	2 Speed Motors	6,594.3	163,311.1	1,676.9	164,988.0
112	Paint (Powder)	7,938.0	25,807.2	81.3	25,888.5
113	Plastic Components	24,886.8	87,191.2	653.5	87,844.6
114	Polypropylene Resin	407,545.3	146,788.9	4,507.8	151,296.7
115	Pumps	6,594.3	39,600.3	99.4	39,699.7
116	Relays	14,175.7	99,303.3	122.0	99,425.3
117	Steel	2,036,798.4	572,619.7	19,175.2	591,794.9
118	Switches	111,815.1	83,904.9	153.8	84,058.7
119	Timers/Motors	44,752.2	324,601.0	61.5	324,662.5
120	Wiring Harnesses	24,886.8	148,999.2	590.6	149,589.8
121	Misc. Electronics	24,886.8	159,358.7	102.7	159,461.4
122	Washer MP	6,594.3	300,242.2	3,462.7	303,704.9
123	Dryer MP	4,702.5	182,678.0	82.3	182,760.3
124	Range MP	6,008.6	1,056,970.8	8,598.2	1,065,568.9
125	Refrigerator MP	7,581.5	855,274.0	7,405.4	862,679.3
Total:			5,071,176.2	57,084.1	5,128,260.3

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Toronto

Item No.	Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201	Washers	522.1	159.17	38.15	2.35	199.67	104,238.6
202	Dryers	287.8	132.59	30.48	2.35	165.42	47,608.9
203	Ranges	452.1	244.32	49.38	2.35	296.05	133,845.2
204	Refrigerators	543.1	271.54	72.51	2.35	346.40	188,110.2
Total:		1,805.0				VC Total:	473,802.9
						FC Total:	112,239.7
						Plant Total:	586,042.6

Manufacturing Plant Location: Indianapolis

Item No.	Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201	Washers	6,072.2	156.63	35.32	2.50	194.45	1,180,765.7
202	Dryers	4,414.7	130.36	28.22	2.50	161.08	711,126.9
203	Ranges	5,556.5	240.83	45.72	2.50	289.05	1,606,120.2
204	Refrigerators	7,038.4	267.71	67.14	2.50	337.35	2,374,434.7
Total:		23,081.8				VC Total:	5,872,447.5
						FC Total:	1,380,670.4
						Plant Total:	7,253,117.9

Firm Total: 24,886.8

Firm VC Total: 6,346,250.4
Firm FC Total: 1,492,910.1
Firm MFG Total: 7,839,160.5

Table F-8 (cont'd.)

Source Of Finished Products By Distribution Center Location /
Total Cost For Distribution Center Operations

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Moncton	Washers	CAN	48.5	213.4	349.2		562.6
	Dryers	US	40.6	178.6	243.6		422.2
	Ranges	CAN	42.0	184.6	407.8		592.3
	Refrigerators	CAN	50.4	221.8	573.1		794.8
	Total:		181.5	798.4	1,573.6	1,440.0	2,372.0
						DC Total:	3,812.0
Toronto	Washers	CAN	343.8	1,615.6	2,475.0		4,090.6
	Dryers	CAN	287.8	1,352.7	1,726.8		3,079.5
	Ranges	CAN	297.7	1,399.2	2,893.6		4,292.8
	Refrigerators	CAN	357.7	1,681.2	4,067.1		5,748.2
	Total:		1,287.0	6,048.7	11,162.5	1,830.0	17,211.2
						DC Total:	19,041.2
Edmonton	Washers	CAN	129.8	607.5	934.6		1,542.0
	Dryers	US	108.6	508.3	651.6		1,159.9
	Ranges	CAN	112.5	526.3	1,093.0		1,619.3
	Refrigerators	CAN	135.0	631.6	1,534.4		2,166.0
	Total:		485.8	2,273.6	4,213.6	1,640.0	6,487.1
						DC Total:	8,127.1
Worcester	Washers	US	371.3	1,644.6	2,673.0		4,317.6
	Dryers	US	260.8	1,155.1	1,564.5		2,719.6
	Ranges	US	339.7	1,504.9	3,301.9		4,806.8
	Refrigerators	US	430.3	1,906.2	4,892.5		6,798.7
	Total:		1,402.0	6,210.9	12,431.9	1,670.0	18,642.8
						DC Total:	20,312.8
Indianapolis	Washers	US	3,363.4	16,816.8	24,216.1		41,032.9
	Dryers	US	2,362.7	11,813.3	14,175.9		25,989.2
	Ranges	US	3,077.8	15,388.8	29,915.7		45,304.5
	Refrigerators	US	3,898.6	19,492.8	44,326.5		63,819.3
	Total:		12,702.3	63,511.5	112,634.3	1,750.0	176,145.8
						DC Total:	177,895.8
Atlanta	Washers	US	682.7	2,983.2	4,915.1		7,898.3
	Dryers	US	479.5	2,095.2	2,876.7		4,971.9
	Ranges	US	624.6	2,729.3	6,070.6		8,799.9
	Refrigerators	US	791.1	3,457.1	8,994.8		12,451.9
	Total:		2,577.8	11,264.8	22,857.2	1,300.0	34,122.0
						DC Total:	35,422.0
Dallas	Washers	US	612.8	2,549.0	4,411.8		6,960.8
	Dryers	US	430.5	1,790.9	2,583.0		4,373.9
	Ranges	US	560.9	2,333.1	5,451.5		7,784.6
	Refrigerators	US	710.4	2,955.3	8,077.3		11,032.5
	Total:		2,314.5	9,628.3	20,523.5	1,600.0	30,151.8
						DC Total:	31,751.8
Los Angeles	Washers	US	698.7	3,619.0	5,030.3		8,649.3
	Dryers	US	490.9	2,542.6	2,945.1		5,487.7
	Ranges	US	639.4	3,311.8	6,214.5		9,526.3
	Refrigerators	US	810.0	4,195.5	9,209.1		13,404.7
	Total:		2,638.8	13,669.0	23,399.0	1,830.0	37,068.0
						DC Total:	38,898.0

6
9

D
2
3
36

Di
67
767
796

Dis
906

Dist
577-
837-
975-M

Table F-8 (cont'd.)

DC Location	Description	Mfg. Source	Units (000)	Variable Labor (\$ 000)	Inv. CC. (\$ 000)	Fixed Cost (\$ 000)	Product DC Total (\$ 000)
Salt Lake City	Washers	US	343.6	1,470.4	2,473.6		3,944.0
	Dryers	US	241.3	1,032.8	1,447.8		2,480.6
	Ranges	US	314.3	1,345.2	3,055.0		4,400.2
	Refrigerators	US	398.1	1,703.9	4,526.4		6,230.3
Total: 1,297.3				5,552.2	11,502.8	1,670.0	17,055.0
DC Total: 18,725.0							
Firm DC Total: 353,985.7							

Market Areas Served By Distribution Center Location

Distribution Center: Moncton Market Areas (6):

B2V-Halif, C1A-Charl, E1C-Monct, E2H-Saint, G1A-Quebe, G5H-Rimou

Distribution Center: Toronto Market Areas (18):

A1B-St Jo, G6G-Thetf, G8V-Trois, H9P-Montr, J1E-Sherb, J8X-Ottaw, J9X-Rouyn, K7K-Kings, L2M-St. C, L4N-Barri, L4V-Toron, N2B-Kitch, N5Y-Londo, N8N-Winds, P3A-Sudbu, P7A-Thund, P9N-Kenor, R2X-Winni

Distribution Center: Edmonton Market Areas (6):

S4P-Regin, S7K-Saska, T2H-Calga, T5J-Edmon, V1H-Princ, V3M-Vanco

Distribution Center: Worcester Market Areas (13):

011-Sprng, 016-Worch, 021-Bosto, 029-Provd, 031-Manch, 041-Portl, 047-Bango, 054-Burln, 061-Hartf, 065-NewHa, 069-Stamf, 122-Alban, 126-Pough

Distribution Center: Indianapolis Market Areas (109):

071-Newar, 081-Camde, 089-NewBr, 106-WhitP, 112-Brook, 132-Syrac, 139-Bingp, 141-Buffa, 146-Rochs, 152-Pitts, 158-Du Bo, 159-Johns, 165-Erie, 171-Harrs, 181-Allen, 187-Wlks-, 194-Phila, 196-Readi, 198-Wilmn, 200-Washn, 212-Balti, 215-Cumbr, 229-Harsn, 232-Richm, 235-Norfo, 240-Roano, 253-Charl, 265-Clrks, 274-Green, 276-Ralei, 282-Charl, 283-Fayet, 288-Ashev, 352-Birmg, 354-Tusca, 356-Hunts, 366-Mobil, 372-Nashv, 374-Chata, 376-Johns, 379-Knoxv, 381-Memph, 383-Jacks, 387-Grenv, 388-Tupel, 392-Jacks, 393-Merid, 402-Louis, 405-Lexin, 421-Bowln, 432-Colum, 436-Toled, 441-Clevl, 442-Akron, 445-Young, 449-Mansf, 452-Cncin, 454-Dayto, 458-Lima, 462-Indan, 466-South, 468-Ft.Wa, 473-Munci, 474-Blomn, 477-Evans, 482-Detro, 485-Flint, 486-Sagin, 489-Lansi, 495-GrndR, 497-SstMa, 503-DesMo, 511-Sioux, 520-Dubuq, 528-Daven, 532-Milwa, 537-Madis, 543-Green, 546-EauCl, 554-Minea, 558-Dulut, 559-Rochs, 571-Sioux, 581-Fargo, 606-Chica, 611-Rockf, 612-Rockl, 616-Peori, 618-Champ, 627-Sprin, 631-StLou, 634-Hanni, 638-CapeG, 641-Kanss, 645-St.Jo, 648-Jopli, 658-Sprin, 666-Topek, 672-Wichi, 681-Omaha, 685-Linco, 712-Monro, 722-Litle, 727-Fayet, 729-Ft.Sm, 741-Tulsa, 981-Seatt, 982-Evere, 984-Tacom

Distribution Center: Atlanta Market Areas (23):

292-Colmb, 294-Charl, 296-Grenv, 303-Atlan, 306-Athen, 309-Augus, 312-Macon, 314-Savan, 317-Alban, 319-Colum, 322-Jacks, 323-Talla, 328-Orlan, 331-Miami, 334-W.Plm, 336-Tampa, 339-FtMye, 359-Gadsd, 361-Montg, 587-Minot, 701-NewOr, 708-BatrR, 713-Alexn

Distribution Center: Dallas Market Areas (24):

678-Dodge, 711-Shrev, 731-OklaC, 745-Mcals, 752-Dalla, 755-Texar, 757-Tyler, 761-Ft.Wo, 763-Wicht, 767-Waco, 769-SanAn, 770-Houst, 777-Beaum, 782-SanAn, 784-CorpC, 787-Austi, 791-Amari, 794-Lubbo, 796-Abile, 799-El Pa, 802-Denve, 810-Puebl, 871-Albuq, 881-Roswe

Distribution Center: Los Angeles Market Areas (9):

900-LosAn, 921-SanDi, 924-SanBe, 933-Bakrs, 937-Fresn, 946-Oakla, 952-Stock, 958-Sacra, 960-Reddi

Distribution Center: Salt Lake City Market Areas (22):

577-Rapid, 591-Billi, 594-Great, 596-Helen, 598-Misou, 691-N.Pla, 815-GrndJ, 820-Cheye, 832-Pocat, 837-Boise, 841-SltLk, 846-Provo, 850-Phoen, 857-Tucso, 891-LasVe, 895-Reno, 972-Portl, 973-Salem, 975-Medfo, 989-Yakim, 992-Spoka, 993-Walaw

Table F-9

RQA3F Results: US-Canada 50 Percent Decrease in Cross-Border Transaction Costs

Summary

<u>Finished Product Demand</u>	(000)
Total Units	24,886.8

<u>Cost Information</u>	(000)
Total Purchase Cost	5,071,176.2
Total Manufacturing Cost	7,839,160.5
Total Distribution Center Cost	353,985.7
Total Transportation Cost	544,821.0
Total System Cost	8,680,883.1

<u>Transportation Cost Detail</u>	(000)
Inbound Freight:	57,084.1
Internal Transfer Freight:	137,439.5
Customer Freight:	350,297.3
Total Transportation Cost:	544,821.0

<u>Facilities Utilized</u>	Type
Woodstock	S
Ft. Wayne	S
Toronto	M
Indianapolis	M
Moncton	DC
Toronto	DC
Edmonton	DC
Worcester	DC
Indianapolis	DC
Atlanta	DC
Dallas	DC
Los Angeles	DC
Salt Lake City	DC

Table F-9 (cont'd.)

Purchases By Manufacturing Plant Location / Purchases By Supplier Location

Manufacturing Plant Location: Toronto

Supplier Location: Woodstock

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.1630	5,073.2	5,900.1	87.8	5,987.9
102	Belts	2.4367	1,331.9	3,245.4	7.2	3,252.7
103	Compressors	50.4000	543.1	27,369.7	235.0	27,604.7
104	Copper Components	1.0574	1,583.7	1,674.6	27.4	1,702.0
105	Cord Sets	2.2799	1,065.1	2,428.3	14.8	2,443.1
106	Corrugated Packaging	2.2860	1,805.0	4,126.2	312.5	4,438.7
107	Fasteners	.0101	281,225.2	2,840.4	31.6	2,872.0
108	Door Gaskets	8.0640	543.1	4,379.2	188.0	4,567.2
109	Knobs	.2510	7,296.8	1,831.5	7.9	1,839.4
110	1 Speed Motors	18.4666	287.8	5,314.7	74.7	5,389.4
111	2 Speed Motors	24.9480	522.1	13,024.1	180.7	13,204.8
112	Paint (Powder)	3.2648	582.6	1,902.1	10.1	1,912.2
113	Plastic Components	3.5484	1,805.0	6,404.9	46.9	6,451.7
114	Polypropylene Resin	.3624	30,236.6	10,957.7	523.4	11,481.2
115	Pumps	6.0667	522.1	3,167.1	9.0	3,176.2
116	Relays	7.0689	1,065.1	7,529.1	11.5	7,540.6
117	Steel	.2829	147,037.8	41,597.0	2,545.3	44,142.3
118	Switches	.7554	8,065.8	6,092.9	14.0	6,106.9
119	Timers/Motors	7.2964	3,178.9	23,194.5	5.5	23,200.0
120	Wiring Harnesses	6.0776	1,805.0	10,970.1	62.5	11,032.6
121	Misc. Electronics	6.4461	1,805.0	11,635.2	9.4	11,644.6
122	Washer MP	46.0068	522.1	24,017.8	271.1	24,289.0
123	Dryer MP	39.2610	287.8	11,299.3	5.0	11,304.3
124	Range MP	177.6261	452.1	80,304.8	743.5	81,048.2
125	Refrigerator MP	114.1256	543.1	61,975.9	564.0	62,539.9
Total:				373,182.7	5,988.9	379,171.5

Manufacturing Plant Location: Indianapolis

Supplier Location: Fort Wayne

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	1.1500	65,082.0	74,844.3	968.4	75,812.7
102	Belts	2.4000	16,559.1	39,741.8	69.8	39,811.6
103	Compressors	50.0000	7,038.4	351,920.0	2,167.8	354,087.8
104	Copper Components	1.0500	20,374.3	21,393.0	215.2	21,608.1
105	Cord Sets	2.2500	13,110.6	29,498.9	120.0	29,618.8
106	Corrugated Packaging	2.2500	23,081.8	51,934.1	2,843.7	54,777.7
107	Fasteners	.0100	3,611,642.6	36,116.4	289.2	36,405.6
108	Door Gaskets	8.0000	7,038.4	56,307.2	1,734.3	58,041.5
109	Knobs	.2500	91,131.3	22,782.8	99.8	22,882.6
110	1 Speed Motors	18.3200	4,414.7	80,877.3	815.8	81,693.1
111	2 Speed Motors	24.7500	6,072.2	150,287.0	1,496.2	151,783.1
112	Paint (Powder)	3.2500	7,355.4	23,905.1	71.2	23,976.3
113	Plastic Components	3.5000	23,081.8	80,786.3	606.6	81,392.9
114	Polypropylene Resin	.3600	377,308.7	135,831.1	3,984.4	139,815.5
115	Pumps	6.0000	6,072.2	36,433.2	90.4	36,523.6
116	Relays	7.0000	13,110.6	91,774.2	110.5	91,884.7
117	Steel	.2810	1,889,760.6	531,022.7	16,629.9	547,652.6
118	Switches	.7500	103,749.3	77,812.0	139.9	77,951.8
119	Timers/Motors	7.2500	41,573.3	301,406.4	56.0	301,462.5
120	Wiring Harnesses	5.9800	23,081.8	138,029.2	528.1	138,557.3
121	Misc. Electronics	6.4000	23,081.8	147,723.5	93.3	147,816.9
122	Washer MP	45.4900	6,072.2	276,224.4	3,191.6	279,415.9
123	Dryer MP	38.8200	4,414.7	171,378.7	77.4	171,456.0
124	Range MP	175.7700	5,556.5	976,666.0	7,854.7	984,520.7
125	Refrigerator MP	112.7100	7,038.4	793,298.1	6,841.3	800,139.4
Total:				4,697,993.6	51,095.2	4,749,088.8

Table F-9 (cont'd.)

Total Purchase Expenditure For Each Purchased Item And Total Purchases For The Firm

Item No.	Description	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	70,155.2	80,744.4	1,056.2	81,800.6
102	Belts	17,891.0	42,987.3	77.0	43,064.3
103	Compressors	7,581.5	379,289.7	2,402.8	381,692.6
104	Copper Components	21,957.9	23,067.5	242.6	23,310.1
105	Cord Sets	14,175.7	31,927.2	134.7	32,061.9
106	Corrugated Packaging	24,886.8	56,060.3	3,156.1	59,216.4
107	Fasteners	3,892,867.8	38,956.8	320.9	39,277.7
108	Door Gaskets	7,581.5	60,686.4	1,922.3	62,608.6
109	Knobs	98,428.1	24,614.3	107.7	24,722.0
110	1 Speed Motors	4,702.5	86,192.0	890.6	87,082.6
111	2 Speed Motors	6,594.3	163,311.1	1,676.9	164,988.0
112	Paint (Powder)	7,938.0	25,807.2	81.3	25,888.5
113	Plastic Components	24,886.8	87,191.2	653.5	87,844.6
114	Polypropylene Resin	407,545.3	146,788.9	4,507.8	151,296.7
115	Pumps	6,594.3	39,600.3	99.4	39,699.7
116	Relays	14,175.7	99,303.3	122.0	99,425.3
117	Steel	2,036,798.4	572,619.7	19,175.2	591,794.9
118	Switches	111,815.1	83,904.9	153.8	84,058.7
119	Timers/Motors	44,752.2	324,601.0	61.5	324,662.5
120	Wiring Harnesses	24,886.8	148,999.2	590.6	149,589.8
121	Misc. Electronics	24,886.8	159,358.7	102.7	159,461.4
122	Washer MP	6,594.3	300,242.2	3,462.7	303,704.9
123	Dryer MP	4,702.5	182,678.0	82.3	182,760.3
124	Range MP	6,008.6	1,056,970.8	8,598.2	1,065,568.9
125	Refrigerator MP	7,581.5	855,274.0	7,405.4	862,679.3
Total:			5,071,176.2	57,084.1	5,128,260.3

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Toronto

Item No.	Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201	Washers	522.1	159.17	38.15	2.35	199.67	104,238.6
202	Dryers	287.8	132.59	30.48	2.35	165.42	47,608.9
203	Ranges	452.1	244.32	49.38	2.35	296.05	133,845.2
204	Refrigerators	543.1	271.54	72.51	2.35	346.40	188,110.2
Total:		1,805.0				VC Total:	473,802.9
						FC Total:	112,239.7
						Plant Total:	586,042.6

Manufacturing Plant Location: Indianapolis

Item No.	Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201	Washers	6,072.2	156.63	35.32	2.50	194.45	1,180,765.7
202	Dryers	4,414.7	130.36	28.22	2.50	161.08	711,126.9
203	Ranges	5,556.5	240.83	45.72	2.50	289.05	1,606,120.2
204	Refrigerators	7,038.4	267.71	67.14	2.50	337.35	2,374,434.7
Total:		23,081.8				VC Total:	5,872,447.5
						FC Total:	1,380,670.4
						Plant Total:	7,253,117.9
Firm Total:		24,886.8				Firm VC Total:	6,346,250.4
						Firm FC Total:	1,492,910.1
						Firm MFG Total:	7,839,160.5

Table F-9 (cont'd.)

Source Of Finished Products By Distribution Center Location /
Total Cost For Distribution Center Operations

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Moncton	Washers	CAN	48.5	213.4	349.2		562.6
	Dryers	US	40.6	178.6	243.6		422.2
	Ranges	CAN	42.0	184.6	407.8		592.3
	Refrigerators	CAN	50.4	221.8	573.1		794.8
	Total:		181.5	798.4	1,573.6	1,440.0	2,372.0
						DC Total:	3,812.0
Toronto	Washers	CAN	343.8	1,615.6	2,475.0		4,090.6
	Dryers	CAN	287.8	1,352.7	1,726.8		3,079.5
	Ranges	CAN	297.7	1,399.2	2,893.6		4,292.8
	Refrigerators	CAN	357.7	1,681.2	4,067.1		5,748.2
	Total:		1,287.0	6,048.7	11,162.5	1,830.0	17,211.2
						DC Total:	19,041.2
Edmonton	Washers	CAN	129.8	607.5	934.6		1,542.0
	Dryers	US	108.6	508.3	651.6		1,159.9
	Ranges	CAN	112.5	526.3	1,093.0		1,619.3
	Refrigerators	CAN	135.0	631.6	1,534.4		2,166.0
	Total:		485.8	2,273.6	4,213.6	1,640.0	6,487.1
						DC Total:	8,127.1
Worcester	Washers	US	371.3	1,644.6	2,673.0		4,317.6
	Dryers	US	260.8	1,155.1	1,564.5		2,719.6
	Ranges	US	339.7	1,504.9	3,301.9		4,806.8
	Refrigerators	US	430.3	1,906.2	4,892.5		6,798.7
	Total:		1,402.0	6,210.9	12,431.9	1,670.0	18,642.8
						DC Total:	20,312.8
Indianapolis	Washers	US	3,363.4	16,816.8	24,216.1		41,032.9
	Dryers	US	2,362.7	11,813.3	14,175.9		25,989.2
	Ranges	US	3,077.8	15,388.8	29,915.7		45,304.5
	Refrigerators	US	3,898.6	19,492.8	44,326.5		63,819.3
	Total:		12,702.3	63,511.5	112,634.3	1,750.0	176,145.8
						DC Total:	177,895.8
Atlanta	Washers	US	682.7	2,983.2	4,915.1		7,898.3
	Dryers	US	479.5	2,095.2	2,876.7		4,971.9
	Ranges	US	624.6	2,729.3	6,070.6		8,799.9
	Refrigerators	US	791.1	3,457.1	8,994.8		12,451.9
	Total:		2,577.8	11,264.8	22,857.2	1,300.0	34,122.0
						DC Total:	35,422.0
Dallas	Washers	US	612.8	2,549.0	4,411.8		6,960.8
	Dryers	US	430.5	1,790.9	2,583.0		4,373.9
	Ranges	US	560.9	2,333.1	5,451.5		7,784.6
	Refrigerators	US	710.4	2,955.3	8,077.3		11,032.5
	Total:		2,314.5	9,628.3	20,523.5	1,600.0	30,151.8
						DC Total:	31,751.8
Los Angeles	Washers	US	698.7	3,619.0	5,030.3		8,649.3
	Dryers	US	490.9	2,542.6	2,945.1		5,487.7
	Ranges	US	639.4	3,311.8	6,214.5		9,526.3
	Refrigerators	US	810.0	4,195.5	9,209.1		13,404.7
	Total:		2,638.8	13,669.0	23,399.0	1,830.0	37,068.0
						DC Total:	38,898.0

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Table F-9 (cont'd.)

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Salt Lake City	Washers	US	343.6	1,470.4	2,473.6		3,944.0
	Dryers	US	241.3	1,032.8	1,447.8		2,480.6
	Ranges	US	314.3	1,345.2	3,055.0		4,400.2
	Refrigerators	US	398.1	1,703.9	4,526.4		6,230.3
Total: 1,297.3				5,552.2	11,502.8	1,670.0	17,055.0
DC Total: 18,725.0							
Firm DC Total: 353,985.7							

Market Areas Serviced By Distribution Center Location

Distribution Center: Moncton Market Areas (6):

B2V-Halif, C1A-Charl, E1C-Monct, E2H-Saint, G1A-Quebe, G5H-Rimou

Distribution Center: Toronto Market Areas (18):

A1B-St Jo, G6G-Thetf, G8V-Trois, H9P-Montr, J1E-Sherb, J8X-Ottaw, J9X-Rouyn, K7K-Kings, L2M-St. C, L4N-Barri, L4V-Toron, N2B-Kitch, N5Y-Londo, N8N-Winds, P3A-Sudbu, P7A-Thund, P9N-Kenor, R2X-Winni

Distribution Center: Edmonton Market Areas (6):

S4P-Regin, S7K-Saska, T2H-Calga, T5J-Edmon, V1H-Princ, V3M-Vanco

Distribution Center: Worcester Market Areas (13):

011-Sprng, 016-Worch, 021-Bosto, 029-Provd, 031-Manch, 041-Portl, 047-Bango, 054-Burln, 061-Hartf, 065-NewHa, 069-Stamf, 122-Alban, 126-Pough

Distribution Center: Indianapolis Market Areas (109):

071-Newar, 081-Camde, 089-NewBr, 106-WhitP, 112-Brook, 132-Syrac, 139-Bingp, 141-Buffa, 146-Rochs, 152-Pitts, 158-Du Bo, 159-Johns, 165-Erie,, 171-Harrs, 181-Allen, 187-Wlks-, 194-Phila, 196-Readi, 198-Wilmn, 200-Washn, 212-Balti, 215-Cumbr, 229-Harsn, 232-Richm, 235-Norfo, 240-Roano, 253-Charl, 265-Clrks, 274-Green, 276-Ralei, 282-Charl, 283-Fayet, 288-Ashev, 352-Birmg, 354-Tusca, 356-Hunts, 366-Mobil, 372-Washv, 374-Chata, 376-Johns, 379-Knoxv, 381-Memph, 383-Jacks, 387-Grenv, 388-Tupel, 392-Jacks, 393-Merid, 402-Louis, 405-Lexin, 421-Bowln, 432-Colum, 436-Toled, 441-Clevl, 442-Akron, 445-Young, 449-Mansf, 452-Cncin, 454-Dayto, 458-Lima,, 462-Indan, 466-South, 468-Ft.Wa, 473-Munci, 474-Blomn, 477-Evans, 482-Detro, 485-Flint, 486-Sagin, 489-Lansi, 495-GrndR, 497-SStMa, 503-DesMo, 511-Sioux, 520-Dubuq, 528-Daven, 532-Milwa, 537-Madis, 543-Green, 546-EauCL, 554-Minea, 558-Dulut, 559-Rochs, 571-Sioux, 581-Fargo, 606-Chica, 611-Rockf, 612-Rockl, 616-Peori, 618-Champ, 627-Sprin, 631-StLou, 634-Hanni, 638-CapeG, 641-Kanss, 645-St.Jo, 648-Jopli, 658-Sprin, 666-Topek, 672-Wichi, 681-Omaha, 685-Linco, 712-Monro, 722-Little, 727-Fayet, 729-Ft.Sm, 741-Tulsa, 981-Seatt, 982-Evere, 984-Tacom

Distribution Center: Atlanta Market Areas (23):

292-Colmb, 294-Charl, 296-Grenv, 303-Atlan, 306-Athen, 309-Augus, 312-Macon, 314-Savan, 317-Alban, 319-Colum, 322-Jacks, 323-Talla, 328-Orlan, 331-Miami, 334-W.Plm, 336-Tampa, 339-FtMye, 359-Gadsd, 361-Montg, 587-Minot, 701-NewOr, 708-BatnR, 713-Alexn

Distribution Center: Dallas Market Areas (24):

678-Dodge, 711-Shrev, 731-OklaC, 745-Mcals, 752-Dalla, 755-TEXAR, 757-Tyler, 761-Ft.Wo, 763-Wicht, 767-Waco,, 769-SanAn, 770-Houst, 777-Beaum, 782-SanAn, 784-CorpC, 787-Austi, 791-Amari, 794-Lubbo, 796-Abile, 799-El Pa, 802-Denve, 810-Puebl, 871-Albuq, 881-Roswe

Distribution Center: Los Angeles Market Areas (9):

900-LosAn, 921-SanDi, 924-SanBe, 933-Bakrs, 937-Fresn, 946-Oakla, 952-Stock, 958-Sacra, 960-Reddi

Distribution Center: Salt Lake City Market Areas (22):

577-Rapid, 591-Billi, 594-Great, 596-Helen, 598-Misou, 691-N.Pla, 815-GrndJ, 820-Cheye, 832-Pocat, 837-Boise, 841-SltLk, 846-Provo, 850-Phoen, 857-Tucso, 891-LasVe, 895-Reno, 972-Portl, 973-Salem, 975-Medfo, 989-Yakim, 992-Spoka, 993-Walaw

APPENDIX G

NORTH AMERICA SIMULATION RESULTS

APPENDIX G

NORTH AMERICA SIMULATION RESULTS

Table G-1

RQB1A Results: North America Separate Countries

Summary

<u>Finished Product Demand</u>	(000)
Total Units	24,992.8

<u>Cost Information</u>	(\$000)
Total Purchase Cost	5,092,347.4
Total Manufacturing Cost	7,868,245.9
Total Distribution Center Cost	347,993.2
Transfer Point Cost	0.0
Total Transportation Cost	545,384.5
Total System Cost	8,704,112.9

<u>Transportation Cost Detail</u>	(\$000)
Inbound Freight:	57,510.7
Internal Transfer Freight:	145,160.7
Customer Freight:	342,713.1
 Total Transportation Cost:	 545,384.5

<u>Facilities Utilized</u>	<u>Type</u>
Woodstock	S
Reynosa	S
Ft. Wayne	S
Toronto	M
Monterrey	M
Indianapolis	M
Montreal	DC
Toronto	DC
Edmonton	DC
Monterrey	DC
Mexico City	DC
Worcester	DC
Indianapolis	DC
Atlanta	DC
Dallas	DC
Los Angeles	DC
Salt Lake City	DC

Table G-1 (cont'd.)

Purchases By Manufacturing Plant Location / Purchases By Supplier Location

Manufacturing Plant Location: Toronto

Supplier Location: Woodstock

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.1630	5,073.2	5,900.1	87.8	5,987.9
102	Belts	2.4367	1,481.1	3,609.0	8.0	3,617.0
103	Compressors	50.4000	543.1	27,369.7	235.0	27,604.7
104	Copper Components	1.0574	1,583.7	1,674.6	27.4	1,702.0
105	Cord Sets	2.2799	1,065.1	2,428.3	14.8	2,443.1
106	Corrugated Packaging	2.2860	1,954.2	4,467.3	338.3	4,805.6
107	Fasteners	.0101	308,976.4	3,120.7	34.8	3,155.4
108	Door Gaskets	8.0640	543.1	4,379.2	188.0	4,567.2
109	Knobs	.2510	7,595.2	1,906.4	8.2	1,914.6
110	1 Speed Motors	18.4666	437.0	8,069.9	113.5	8,183.4
111	2 Speed Motors	24.9480	522.1	13,024.1	180.7	13,204.8
112	Paint (Powder)	3.2648	614.7	2,006.8	10.6	2,017.5
113	Plastic Components	3.5484	1,954.2	6,934.3	50.7	6,985.0
114	Polypropylene Resin	.3624	30,385.8	11,011.8	526.0	11,537.8
115	Pumps	6.0667	522.1	3,167.1	9.0	3,176.2
116	Relays	7.0689	1,065.1	7,529.1	11.5	7,540.6
117	Steel	.2829	162,405.4	45,944.5	2,811.3	48,755.8
118	Switches	.7554	8,961.0	6,769.1	15.5	6,784.6
119	Timers/Motors	7.2964	3,477.3	25,371.8	6.0	25,377.8
120	Wiring Harnesses	6.0776	1,954.2	11,876.8	67.7	11,944.5
121	Misc. Electronics	6.4461	1,954.2	12,597.0	10.2	12,607.1
122	Washer MP	46.0068	522.1	24,017.8	271.1	24,289.0
123	Dryer MP	39.2610	437.0	17,157.1	7.6	17,164.6
124	Range MP	177.6261	452.1	80,304.8	743.5	81,048.2
125	Refrigerator MP	114.1256	543.1	61,975.9	564.0	62,539.9
			Total:	392,613.2	6,341.3	398,954.5

Manufacturing Plant Location: Monterrey

Supplier Location: Reynosa

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	1.0073	341.4	343.9	4.4	348.3
102	Belts	1.9966	49.7	99.1	.2	99.3
103	Compressors	45.6000	36.2	1,650.7	11.6	1,662.3
104	Copper Components	.9687	110.9	107.4	1.4	108.9
105	Cord Sets	1.9213	56.9	109.3	.6	109.9
106	Corrugated Packaging	1.8540	106.0	196.5	13.6	210.1
107	Fasteners	.0085	16,672.1	141.7	1.4	143.1
108	Door Gaskets	7.2960	36.2	264.1	9.3	273.4
109	Knobs	.2390	518.7	124.0	.4	124.4
110	1 Speed Motors	16.7078	8.3	137.8	1.6	139.4
111	2 Speed Motors	22.5720	20.7	467.2	5.3	472.5
112	Paint (Powder)	3.0870	29.5	91.1	.4	91.5
113	Plastic Components	2.9672	106.0	314.5	2.0	316.6
114	Polypropylene Resin	.3337	1,694.5	565.4	21.7	587.1
115	Pumps	5.2661	20.7	109.0	.3	109.3
116	Relays	6.2423	56.9	355.2	.5	355.6
117	Steel	.2600	8,487.2	2,206.7	108.6	2,315.3
118	Switches	.6906	490.7	338.8	.6	339.5
119	Timers/Motors	6.7396	186.7	1,257.9	.2	1,258.2
120	Wiring Harnesses	4.9065	106.0	520.1	2.7	522.8
121	Misc. Electronics	5.8931	106.0	624.7	.4	625.1
122	Washer MP	39.8056	20.7	824.0	8.0	831.9
123	Dryer MP	33.9691	8.3	280.2	.1	280.4
124	Range MP	155.3526	40.9	6,346.2	49.7	6,395.8
125	Refrigerator MP	97.1380	36.2	3,516.4	27.8	3,544.2
			Total:	20,992.2	272.6	21,264.8

Table G-1 (cont'd.)

Manufacturing Plant Location: Indianapolis

Supplier Location: Fort Wayne

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	1.1500	65,082.0	74,844.3	968.4	75,812.7
102	Belts	2.4000	16,409.9	39,383.8	69.1	39,452.9
103	Compressors	50.0000	7,038.4	351,920.0	2,167.8	354,087.8
104	Copper Components	1.0500	20,374.3	21,393.0	215.2	21,608.1
105	Cord Sets	2.2500	13,110.6	29,498.9	120.0	29,618.8
106	Corrugated Packaging	2.2500	22,932.6	51,598.4	2,825.3	54,423.7
107	Fasteners	.0100	3,583,891.3	35,838.9	287.0	36,125.9
108	Door Gaskets	8.0000	7,038.4	56,307.2	1,734.3	58,041.5
109	Knobs	.2500	90,832.9	22,708.2	99.5	22,807.7
110	1 Speed Motors	18.3200	4,265.5	78,144.0	788.3	78,932.2
111	2 Speed Motors	24.7500	6,072.2	150,287.0	1,496.2	151,783.1
112	Paint (Powder)	3.2500	7,323.3	23,800.9	70.9	23,871.7
113	Plastic Components	3.5000	22,932.6	80,264.1	602.7	80,866.8
114	Polypropylene Resin	.3600	377,159.5	135,777.4	3,982.8	139,760.2
115	Pumps	6.0000	6,072.2	36,433.2	90.4	36,523.6
116	Relays	7.0000	13,110.6	91,774.2	110.5	91,884.7
117	Steel	.2810	1,874,393.0	526,704.4	16,494.7	543,199.1
118	Switches	.7500	102,854.1	77,140.6	138.7	77,279.2
119	Timers/Motors	7.2500	41,274.9	299,243.0	55.6	299,298.7
120	Wiring Harnesses	5.9800	22,932.6	137,136.9	524.7	137,661.6
121	Misc. Electronics	6.4000	22,932.6	146,768.6	92.7	146,861.4
122	Washer MP	45.4900	6,072.2	276,224.4	3,191.6	279,415.9
123	Dryer MP	38.8200	4,265.5	165,586.7	74.7	165,661.4
124	Range MP	175.7700	5,556.5	976,666.0	7,854.7	984,520.7
125	Refrigerator MP	112.7100	7,038.4	793,298.1	6,841.3	800,139.4

Total: 4,678,742.0 50,896.8 4,729,638.8

Total Purchase Expenditure For Each Purchased Item And Total Purchases For The Firm

Item No.	Description	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	70,497	81,088.3	1,060.6	82,148.9
102	Belts	17,941	43,091.9	77.3	43,169.2
103	Compressors	7,618	380,940.4	2,414.4	383,354.9
104	Copper Components	22,069	23,175.0	244.0	23,419.0
105	Cord Sets	14,233	32,036.5	135.3	32,171.8
106	Corrugated Packaging	24,993	56,262.2	3,177.2	59,439.3
107	Fasteners	3,909,540	39,101.3	323.2	39,424.4
108	Door Gaskets	7,618	60,950.5	1,931.5	62,882.0
109	Knobs	98,947	24,738.6	108.1	24,846.7
110	1 Speed Motors	4,711	86,351.7	903.3	87,255.0
111	2 Speed Motors	6,615	163,778.3	1,682.2	165,460.5
112	Paint (Powder)	7,968	25,898.8	81.9	25,980.7
113	Plastic Components	24,993	87,512.9	655.4	88,168.3
114	Polypropylene Resin	409,240	147,354.7	4,530.5	151,885.2
115	Pumps	6,615	39,709.3	99.7	39,809.0
116	Relays	14,233	99,658.5	122.4	99,780.9
117	Steel	2,045,286	574,855.6	19,414.6	594,270.2
118	Switches	112,306	84,248.6	154.8	84,403.3
119	Timers/Motors	44,939	325,872.7	61.9	325,934.6
120	Wiring Harnesses	24,993	149,533.9	595.1	150,129.0
121	Misc. Electronics	24,993	159,990.3	103.3	160,093.6
122	Washer MP	6,615	301,066.2	3,470.6	304,536.8
123	Dryer MP	4,711	183,024.0	82.4	183,106.4
124	Range MP	6,049	1,063,316.9	8,647.8	1,071,964.7
125	Refrigerator MP	7,618	858,790.4	7,433.2	866,223.5
Total:			5,092,347.4	57,510.7	5,149,858.1

Table G-1 (cont'd.)

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Toronto

Item	Quantity	Purchased	Mfg.	Transfer		Total
No. Description	(000)	Materials/ Unit (\$)	Labor/ Unit (\$)	Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Mfg. VC (\$ 000)
201 Washers	522.1	159.17	38.15	2.35	199.67	104,238.6
202 Dryers	437.0	132.59	30.48	2.35	165.42	72,290.0
203 Ranges	452.1	244.32	49.38	2.35	296.05	133,845.2
204 Refrigerators	543.1	271.54	72.51	2.35	346.40	188,110.2
Total:	1,954.2				VC Total:	498,484.0
					FC Total:	112,239.7
					Plant Total:	610,723.7

Manufacturing Plant Location: Monterrey

Item	Quantity	Purchased	Mfg.	Transfer		Total
No. Description	(000)	Materials/ Unit (\$)	Labor/ Unit (\$)	Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Mfg. VC (\$ 000)
201 Washers	20.7	140.39	4.24	1.40	146.03	3,022.7
202 Dryers	8.3	117.50	3.89	1.40	122.79	1,013.0
203 Ranges	40.9	214.63	5.49	1.40	221.52	9,049.0
204 Refrigerators	36.2	238.17	8.06	1.40	247.63	8,964.4
Total:	106.0				VC Total:	22,049.1
					FC Total:	6,388.5
					Plant Total:	28,437.6

Manufacturing Plant Location: Indianapolis

Item	Quantity	Purchased	Mfg.	Transfer		Total
No. Description	(000)	Materials/ Unit (\$)	Labor/ Unit (\$)	Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Mfg. VC (\$ 000)
201 Washers	6,072.2	156.63	35.32	2.50	194.45	1,180,765.7
202 Dryers	4,265.5	130.36	28.22	2.50	161.08	687,093.5
203 Ranges	5,556.5	240.83	45.72	2.50	289.05	1,606,120.2
204 Refrigerators	7,038.4	267.71	67.14	2.50	337.35	2,374,434.7
Total:	22,932.6				VC Total:	5,848,414.2
					FC Total:	1,380,670.4
					Plant Total:	7,229,084.6
Firm Total:	24,992.8				Firm VC Total:	6,368,947.3
					Firm FC Total:	1,499,298.6
					Firm MFG Total:	7,868,245.9

Table G-1 (cont'd.)

Source Of Finished Products By Distribution Center Location /
Total Cost For Distribution Center Operations

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Montreal	Washers	CAN	140.8	662.9	979.1		1,642.1
	Dryers	CAN	117.9	555.3	683.5		1,238.8
	Ranges	CAN	121.9	574.2	1,144.8		1,718.9
	Refrigerators	CAN	146.5	689.8	1,608.8		2,298.6
	Total:		527.0	2,482.2	4,416.2	1,670.0	6,898.4
						DC Total:	8,568.4
Toronto	Washers	CAN	230.9	1,085.0	1,605.9		2,690.9
	Dryers	CAN	193.3	908.3	1,120.3		2,028.6
	Ranges	CAN	199.9	939.5	1,877.3		2,816.8
	Refrigerators	CAN	240.2	1,128.9	2,638.7		3,767.6
	Total:		864.2	4,061.7	7,242.2	1,830.0	11,303.9
						DC Total:	13,133.9
Edmonton	Washers	CAN	150.5	704.1	1,046.6		1,750.7
	Dryers	CAN	125.9	589.0	729.6		1,318.5
	Ranges	CAN	130.3	609.8	1,223.7		1,833.5
	Refrigerators	CAN	156.4	732.0	1,718.1		2,450.1
	Total:		563.0	2,634.8	4,718.0	1,640.0	7,352.8
						DC Total:	8,992.8
Monterrey	Washers	MEX	17.4	48.6	120.7		169.3
	Dryers	MEX	7.0	19.5	40.3		59.8
	Ranges	MEX	34.2	95.8	321.2		416.9
	Refrigerators	MEX	30.4	85.0	333.4		418.4
	Total:		88.9	248.8	815.6	100.0	1,064.4
						DC Total:	1,164.4
Mexico City	Washers	MEX	3.4	9.4	23.3		32.7
	Dryers	MEX	1.3	3.6	7.5		11.2
	Ranges	MEX	6.7	18.6	62.5		81.1
	Refrigerators	MEX	5.9	16.4	64.3		80.6
	Total:		17.2	48.0	157.6	20.0	205.6
						DC Total:	225.6
Worcester	Washers	US	371.3	1,644.6	2,582.6		4,227.2
	Dryers	US	260.8	1,155.1	1,511.6		2,666.7
	Ranges	US	339.7	1,504.9	3,190.2		4,695.1
	Refrigerators	US	430.3	1,906.2	4,727.0		6,633.3
	Total:		1,402.0	6,210.9	12,011.4	1,670.0	18,222.3
						DC Total:	19,892.3
Indianapolis	Washers	US	3,283.7	16,418.3	22,842.6		39,260.8
	Dryers	US	2,306.7	11,533.3	13,371.8		24,905.0
	Ranges	US	3,004.8	15,024.0	28,218.7		43,242.7
	Refrigerators	US	3,806.1	19,030.5	41,811.6		60,842.1
	Total:		12,401.2	62,006.0	106,244.7	1,750.0	168,250.7
						DC Total:	170,000.7
Atlanta	Washers	US	676.1	2,954.3	4,702.9		7,657.3
	Dryers	US	474.8	2,074.9	2,752.4		4,827.3
	Ranges	US	618.5	2,702.8	5,808.5		8,511.3
	Refrigerators	US	783.5	3,423.7	8,606.5		12,030.2
	Total:		2,552.8	11,155.7	21,870.3	1,300.0	33,026.1
						DC Total:	34,326.1

Table G-1 (cont'd.)

<u>DC Location</u>	<u>Description</u>	<u>Mfg.</u> <u>Source</u>	<u>Units</u> <u>(000)</u>	<u>Variable</u> <u>Labor</u> <u>(\$ 000)</u>	<u>Inv.</u> <u>CC.</u> <u>(\$ 000)</u>	<u>Fixed</u> <u>Cost</u> <u>(\$ 000)</u>	<u>Product</u> <u>DC Total</u> <u>(\$ 000)</u>
Dallas	Washers	US	612.8	2,549.0	4,262.6		6,811.6
	Dryers	US	430.5	1,790.9	2,495.6		4,286.5
	Ranges	US	560.9	2,333.1	5,267.1		7,600.2
	Refrigerators	US	710.4	2,955.3	7,804.0		10,759.3
	Total:		2,314.5	9,628.3	19,829.3	1,600.0	29,457.6
						DC Total:	31,057.6
Los Angeles	Washers	US	698.7	3,619.0	4,860.1		8,479.1
	Dryers	US	490.9	2,542.6	2,845.5		5,388.1
	Ranges	US	639.4	3,311.8	6,004.3		9,316.1
	Refrigerators	US	810.0	4,195.5	8,897.6		13,093.2
	Total:		2,638.8	13,669.0	22,607.5	1,830.0	36,276.5
						DC Total:	38,106.5
Salt Lake City	Washers	US	429.9	1,839.8	2,990.2		4,830.0
	Dryers	US	302.0	1,292.4	1,750.4		3,042.8
	Ranges	US	393.3	1,683.3	3,693.6		5,376.9
	Refrigerators	US	498.2	2,132.3	5,472.9		7,605.2
	Total:		1,623.3	6,947.7	13,907.2	1,670.0	20,854.9
						DC Total:	22,524.9
						Firm DC Total:	347,993.2

Table G-1 (cont'd.)

Market Areas Served By Distribution Center Location

Distribution Center: Montreal Market Areas (10):

C1A-Charl, E1C-Monct, E2H-Saint, G1A-Quebe, G5H-Rimou, G6G-Thetf, G8V-Trois, H9P-Montr, J1E-Sherb, J9X-Rouyn

Distribution Center: Toronto Market Areas (13):

A1B-St Jo, B2V-Halif, J8X-Ottaw, K7K-Kings, L2M-St. C, L4N-Barri, L4V-Toron, N2B-Kitch, N5Y-Londo, N8N-Winds, P3A-Sudbu, P7A-Thund, P9N-Kenor

Distribution Center: Edmonton Market Areas (7):

R2X-Winni, S4P-Regin, S7K-Saska, T2H-Calga, T5J-Edmon, V1H-Princ, V3M-Vanco,

Distribution Center: Monterrey Market Areas (56):

MX1001-Ti, MX1002-Me, MX1003-En, MX1004-Ba, MX1005-Ba, MX1006-Se, MX1007-He, MX1008-Ca, MX1009-Ci, MX1010-N, MX1011-Ch, MX1012-S, MX1013-N, MX1014-Mo, MX1015-Sa, MX1016-To, MX1017-NW, MX1018-Mo, MX1019-SN, MX1020-NL, MX1021-Re, MX1022-Ma, MX1023-CO, MX1024-ST, MX1025-SL, MX1026-N, MX1027-S, MX1028-ND, MX1029-Du, MX1030-LM, MX1031-Cu, MX1032-Ma, MX1033-Na, MX1034-SJ, MX1035-Gu, MX1036-NJ, MX1037-Ag, MX1038-Le, MX1039-Ir, MX1040-Ce, MX1041-Qu, MX1042-Hi, MX1043-NV, MX1044-Ja, MX1045-Or, MX1046-Ve, MX1048-Pu, MX1049-Tl, MX1050-Me, MX1051-Me, MX1052-Mo, MX1053-E, MX1055-Co, MX1060-Ca, MX1061-Yu, MX1062-Qu

Distribution Center: Mexico City Market Areas (6):

MX1047-Co, MX1054-W, MX1056-Gu, MX1057-Oa, MX1058-Ch, MX1059-Ta

Distribution Center: Worcester Market Areas (13):

011-Sprng, 016-Worch, 021-Bosto, 029-Provd, 031-Manch, 041-Portl, 047-Bango, 054-Burln, 061-Hartf, 065-NewHa, 069-Stamf, 122-Alban, 126-Pough

Distribution Center: Indianapolis Market Areas (107):

071-Newar, 081-Camde, 089-NewBr, 106-WhitP, 112-Brook, 132-Syrac, 139-Bingp, 141-Buffa, 146-Rochs, 152-Pitts, 158-Du Bo, 159-Johns, 165-Erie,, 171-Harrs, 181-Allen, 187-Wlks-, 194-Phila, 196-Readi, 198-Wilmn, 200-Washn, 212-Balti, 215-Cumbr, 229-Harsn, 232-Richm, 235-Norfo, 240-Roano, 253-Charl, 265-Clrks, 274-Green, 276-Ralei, 282-Charl, 283-Fayet, 288-Ashev, 352-Birmg, 354-Tusca, 356-Hunts, 366-Mobil, 372-Nashv, 374-Chata, 376-Johns, 379-Knoxv, 381-Memph, 383-Jacks, 387-Grenv, 388-Tupel, 392-Jacks, 393-Merid, 402-Louis, 405-Lexin, 421-BowlN, 432-Colum, 436-Toled, 441-Clevl, 442-Akron, 445-Young, 449-Mansf, 452-Cncin, 454-Dayto, 458-Lima,, 462-Indan, 466-South, 468-Ft.Wa, 473-Munci, 474-Blomm, 477-Evans, 482-Detro, 485-Flint, 486-Sagin, 489-Lansi, 495-GrndR, 497-SStMa, 503-DesMo, 511-Sioux, 520-Dubuq, 528-Daven, 532-Milwa, 537-Madis, 543-Green, 546-EauCl, 554-Minea, 558-Dulut, 559-Rochs, 571-Sioux, 581-Fargo, 587-Minot, 606-Chica, 611-Rockf, 612-Rockl, 616-Peori, 618-Champ, 627-Sprin, 631-StLou, 634-Hanni, 638-CapeG, 641-Kanss, 645-St.Jo, 648-Jopli, 658-Sprin, 666-Topek, 672-Wichi, 681-Omaha, 685-Linco, 712-Monro, 722-Litle, 727-Fayet, 729-Ft.Sm, 741-Tulsa

Distribution Center: Atlanta Market Areas (22):

292-Colmb, 294-Charl, 296-Grenv, 303-Atlan, 306-Athen, 309-Augus, 312-Macon, 314-Savan, 317-Alban, 319-Colum, 322-Jacks, 323-Talla, 328-Orlan, 331-Miami, 334-W.Plm, 336-Tampa, 339-FtMye, 359-Gadsd, 361-Montg, 701-NewOr, 708-BatnR, 713-Alexn

Distribution Center: Dallas Market Areas (24):

678-Dodge, 711-Shrev, 731-OklaC, 745-Mcals, 752-Dalla, 755-Texar, 757-Tyler, 761-Ft.Wo, 763-Wicht, 767-Waco,, 769-SanAn, 770-Houst, 777-Beaum, 782-SanAn, 784-CorpC, 787-Austi, 791-Amari, 794-Lubbo, 796-Abile, 799-El Pa, 802-Denve, 810-Puebl, 871-Albuq, 881-Roswe

Distribution Center: Los Angeles Market Areas (9):

900-LosAn, 921-SanDi, 924-SanBe, 933-Bakrs, 937-Fresn, 946-Oakla, 952-Stock, 958-Sacra, 960-Reddi

Distribution Center: Salt Lake City Market Areas (25):

577-Rapid, 591-Billi, 594-Great, 596-Helen, 598-Misou, 691-N.Pla, 815-GrndJ, 820-Cheye, 832-Pocat, 837-Boise, 841-SltLk, 846-Provo, 850-Phoen, 857-Tucso, 891-LasVe, 895-Reno,, 972-Portl, 973-Salem, 975-Medfo, 981-Seatt, 982-Evere, 984-Tacom, 989-Yakim, 992-Spoka, 993-Walaw

Table G-2

RQB1B Results: North America Initial Integration

Summary

<u>Finished Product Demand</u>	<u>(000)</u>
Total Units	24,992.8

<u>Cost Information</u>	<u>(\$000)</u>
Total Purchase Cost	4,533,937.5
Total Manufacturing Cost	6,270,132.2
Total Distribution Center Cost	336,518.9
Transfer Point Cost	46,469.1
Total Transportation Cost	859,847.3
Total System Cost	7,452,043.2

<u>Transportation Cost Detail</u>	<u>(\$000)</u>
Inbound Freight:	60,924.3
Internal Transfer Freight:	459,504.2
Customer Freight:	339,418.8
Total Transportation Cost:	859,847.3

<u>Facilities Utilized</u>	<u>Type</u>
Reynosa	S
Monterrey	M
Nuevo Laredo	TP
Ciudad Juarez	TP
Toronto	DC
Regina	DC
Monterrey	DC
Mexico City	DC
Newark	DC
Kansas City	DC
Atlanta	DC
Memphis	DC
Dallas	DC
Phoenix	DC
Salt Lake City	DC

Table G-2 (cont'd.)

Purchases By Manufacturing Plant Location (Firm)/ Purchases By Supplier Location

Manufacturing Plant Location: Monterrey

Supplier Location: Reynosa

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.0073	70,496.6	71,011.2	902.2	71,913.4
102	Belts	1.9966	17,940.7	35,820.3	71.8	35,892.1
103	Compressors	45.6000	7,617.7	347,364.8	2,437.3	349,802.1
104	Copper Components	.9687	22,068.8	21,378.1	282.4	21,660.5
105	Cord Sets	1.9213	14,232.6	27,345.1	145.7	27,490.8
106	Corrugated Packaging	1.8540	24,992.8	46,336.7	3,198.6	49,535.2
107	Fasteners	.0085	3,909,539.8	33,231.1	325.2	33,556.3
108	Door Gaskets	7.2960	7,617.7	55,578.4	1,949.8	57,528.2
109	Knobs	.2390	98,946.7	23,648.3	79.1	23,727.4
110	1 Speed Motors	16.7078	4,710.8	78,706.3	904.3	79,610.6
111	2 Speed Motors	22.5720	6,615.0	149,312.7	1,693.2	151,005.8
112	Paint (Powder)	3.0870	7,967.5	24,595.8	102.0	24,697.8
113	Plastic Components	2.9672	24,992.8	74,158.6	479.8	74,638.4
114	Polypropylene Resin	.3337	409,239.8	136,563.3	5,237.5	141,800.8
115	Pumps	5.2661	6,615.0	34,835.0	84.7	34,919.6
116	Relays	6.2423	14,232.6	88,844.2	113.8	88,958.0
117	Steel	.2600	2,045,285.6	531,774.3	26,175.6	557,949.8
118	Switches	.6906	112,305.8	77,558.4	143.7	77,702.1
119	Timers/Motors	6.7396	44,938.9	302,869.9	57.5	302,927.4
120	Wiring Harnesses	4.9065	24,992.8	122,627.2	639.7	123,266.9
121	Misc. Electronics	5.8931	24,992.8	147,285.1	96.0	147,381.0
122	Washer MP	39.8056	6,615.0	263,312.1	2,539.7	265,851.8
123	Dryer MP	33.9691	4,710.8	160,019.9	60.3	160,080.2
124	Range MP	155.3526	6,049.5	939,797.8	7,355.0	947,152.8
125	Refrigerator MP	97.1380	7,617.7	739,963.3	5,849.4	745,812.7

Total: 4,533,937.5 60,924.3 4,594,861.8

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Monterrey

Item No.	Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201	Washers	6,615.0	140.38	4.24	1.40	146.02	965,947.4
202	Dryers	4,710.8	117.50	3.89	1.40	122.79	578,432.7
203	Ranges	6,049.5	214.63	5.49	1.40	221.52	1,340,065.1
204	Refrigerators	7,617.7	238.17	8.06	1.40	247.63	1,886,388.4

Total: 24,992.8

VC Total: 4,770,833.6

FC Total: 1,499,298.6

Plant Total: 6,270,132.2

Firm Total: 24,992.8

Firm VC Total: 4,770,833.6

Firm FC Total: 1,499,298.6

Firm MFG Total: 6,270,132.2

Table G-1 (cont'd.)

Source Of Finished Products By Distribution Center Location /
Total Cost For Distribution Center Operations

DC Location	Description	Mfg. Source	Units (000)	Variable Labor (\$ 000)	Inv. CC. (\$ 000)	Fixed Cost (\$ 000)	Product DC Total (\$ 000)
Toronto	Washers	MEX	320.5	1,506.1	2,229.2		3,735.3
	Dryers	MEX	268.3	1,261.0	1,555.4		2,816.4
	Ranges	MEX	277.5	1,304.0	2,605.6		3,909.6
	Refrigerators	MEX	333.4	1,567.0	3,662.5		5,229.5
	Total:		1,199.6	5,638.1	10,052.7	1,830.0	15,690.8
						DC Total:	17,520.8
Regina	Washers	MEX	97.2	413.9	675.8		1,089.7
	Dryers	MEX	80.4	342.3	465.8		808.1
	Ranges	MEX	84.5	360.0	793.6		1,153.5
	Refrigerators	MEX	101.8	433.5	1,117.8		1,551.2
	Total:		363.8	1,549.6	3,052.9	1,520.0	4,602.5
						DC Total:	6,122.5
Monterrey	Washers	MEX	17.4	48.6	120.7		169.3
	Dryers	MEX	7.0	19.5	40.3		59.8
	Ranges	MEX	34.2	95.8	321.2		416.9
	Refrigerators	MEX	30.4	85.0	333.4		418.4
	Total:		88.9	248.8	815.6	100.0	1,064.4
						DC Total:	1,164.4
Mexico City	Washers	MEX	3.4	9.4	23.3		32.7
	Dryers	MEX	1.3	3.6	7.5		11.2
	Ranges	MEX	6.7	18.6	62.5		81.1
	Refrigerators	MEX	5.9	16.4	64.3		80.6
	Total:		17.2	48.0	157.6	20.0	205.6
						DC Total:	225.6
Newark	Washers	MEX	1,149.7	5,368.9	7,997.5		13,366.4
	Dryers	MEX	814.1	3,801.6	4,719.1		8,520.7
	Ranges	MEX	1,049.7	4,901.9	9,857.5		14,759.4
	Refrigerators	MEX	1,327.0	6,196.9	14,577.1		20,774.0
	Total:		4,340.3	20,269.2	37,151.2	1,830.0	57,420.4
						DC Total:	59,250.4
Kansas City	Washers	MEX	308.7	1,330.5	2,147.5		3,478.0
	Dryers	MEX	216.9	934.8	1,257.4		2,192.2
	Ranges	MEX	282.7	1,218.2	2,654.4		3,872.7
	Refrigerators	MEX	357.9	1,542.3	3,931.1		5,473.5
	Total:		1,166.1	5,025.9	9,990.4	1,640.0	15,016.3
						DC Total:	16,656.3
Atlanta	Washers	MEX	1,412.6	6,173.1	9,826.7		15,999.8
	Dryers	MEX	992.3	4,336.4	5,752.4		10,088.8
	Ranges	MEX	1,292.4	5,647.8	12,137.2		17,785.0
	Refrigerators	MEX	1,637.3	7,155.0	17,986.4		25,141.4
	Total:		5,334.6	23,312.2	45,702.7	1,300.0	69,014.9
						DC Total:	70,314.9
Memphis	Washers	MEX	1,387.7	5,814.5	9,653.5		15,467.9
	Dryers	MEX	974.8	4,084.2	5,650.7		9,734.9
	Ranges	MEX	1,269.8	5,320.5	11,925.0		17,245.4
	Refrigerators	MEX	1,608.3	6,738.8	17,667.8		24,406.6
	Total:		5,240.6	21,957.9	44,897.0	1,600.0	66,854.9
						DC Total:	68,454.9

Table G-2 (cont'd.)

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Dallas	Washers	MEX	708.5	2,947.2	4,928.3		7,875.5
	Dryers	MEX	497.7	2,070.4	2,885.2		4,955.6
	Ranges	MEX	648.4	2,697.3	6,089.3		8,786.6
	Refrigerators	MEX	821.3	3,416.4	9,021.8		12,438.2
	Total:		2,675.8	11,131.3	22,924.5	1,600.0	34,055.9
						DC Total:	35,655.9
<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Phoenix	Washers	MEX	810.9	3,275.8	5,640.7		8,916.5
	Dryers	MEX	569.7	2,301.4	3,302.3		5,603.7
	Ranges	MEX	742.1	2,997.9	6,968.8		9,966.6
	Refrigerators	MEX	940.0	3,797.4	10,325.7		14,123.1
	Total:		3,062.5	12,372.5	26,237.4	1,600.0	38,609.9
						DC Total:	40,209.9
Salt Lake City	Washers	MEX	398.7	1,706.4	2,773.5		4,480.0
	Dryers	MEX	288.5	1,234.8	1,672.5		2,907.2
	Ranges	MEX	361.7	1,548.1	3,396.8		4,944.9
	Refrigerators	MEX	454.7	1,946.1	4,995.1		6,941.2
	Total:		1,503.6	6,435.4	12,837.9	1,670.0	19,273.3
						DC Total:	20,943.3
Firm DC Total:							336,518.9

Total Cost For Transfer Point Operations

<u>TP Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Transfer Cost (\$ 000)</u>
Nuevo Laredo	Washers	MEX	5,384.7	8,561.7
	Dryers	MEX	3,844.4	6,112.5
	Ranges	MEX	4,904.9	7,798.7
	Refrigerators	MEX	6,186.8	15,467.0
	Total:		20,320.7	37,939.9
Ciudad Juarez	Washers	MEX	1,209.6	1,923.2
	Dryers	MEX	858.2	1,364.5
	Ranges	MEX	1,103.8	1,755.0
	Refrigerators	MEX	1,394.7	3,486.6
	Total:		4,566.1	8,529.2
Firm Transfer Point Total:				46,469.1

Table G-2 (cont'd.)

Market Areas Serviced By Distribution Center Location

Distribution Center: Toronto Market Areas (14):

A1B-St Jo, B2V-Halif, C1A-Charl, H9P-Montr, J8X-Ottaw, J9X-Rouyn, K7K-Kings, L2M-St. C, L4N-Barri, L4V-Toron, N2B-Kitch, N5Y-Londo, N8N-Winds, P3A-Sudbu

Distribution Center: Regina Market Areas (9):

587-Minot, P7A-Thund, P9N-Kenor, R2X-Winni, S4P-Regin, S7K-Saska, T2H-Calga, T5J-Edmon, V1H-Princ

Distribution Center: Monterrey Market Areas (56):

MX1001-Ti, MX1002-Me, MX1003-En, MX1004-Ba, MX1005-Ba, MX1006-Se, MX1007-He, MX1008-Ca, MX1009-Ci, MX1010-N, MX1011-Ch, MX1012-S, MX1013-N, MX1014-Mo, MX1015-Sa, MX1016-To, MX1017-NW, MX1018-Mo, MX1019-SN, MX1020-NL, MX1021-Re, MX1022-Ma, MX1023-CO, MX1024-ST, MX1025-SL, MX1026-N, MX1027-S, MX1028-ND, MX1029-Du, MX1030-LM, MX1031-Cu, MX1032-Ma, MX1033-Na, MX1034-SJ, MX1035-Gu, MX1036-NJ, MX1037-Ag, MX1038-Le, MX1039-Ir, MX1040-Ce, MX1041-Qu, MX1042-Hi, MX1043-NV, MX1044-Ja, MX1045-Or, MX1046-Ve, MX1048-Pu, MX1049-Tl, MX1050-Me, MX1051-Me, MX1052-Mo, MX1053-E, MX1055-Co, MX1060-Ca, MX1061-Yu, MX1062-Qu

Distribution Center: Mexico City Market Areas (6):

MX1047-Co, MX1054-W, MX1056-Gu, MX1057-Oa, MX1058-Ch, MX1059-Ta

Distribution Center: Newark Market Areas (34):

011-Sprng, 016-Worch, 021-Bosto, 029-Provd, 031-Manch, 041-Portl, 047-Bango, 054-Burln, 061-Hartf, 065-NewHa, 069-Stamf, 071-Newar, 089-NewBr, 106-WhitP, 112-Brook, 122-Alban, 126-Pough, 132-Syrac, 139-Bingp, 141-Buffa, 146-Rochs, 181-Allen, 187-Wlks-, 194-Phila, 196-Readi, 198-Wilmn, 497-SstMa, E1C-Monct, E2H-Saint, G1A-Quebe, G5H-Rimou, G6G-Thet, G8V-Trois, J1E-Sherb

Distribution Center: Kansas City Market Areas (15):

503-DesMo, 511-Sioux, 543-Green, 546-EauCl, 554-Minea, 558-Dulut, 559-Rochs, 571-Sioux, 581-Fargo, 641-Kanss, 645-St.Jo, 666-Topek, 681-Omaha, 685-Linco, 691-N.Pla

Distribution Center: Atlanta Market Areas (45):

081-Camde, 152-Pitts, 158-Du Bo, 159-Johns, 165-Erie,, 171-Harrs, 200-Washn, 212-Balti, 215-Cumbr, 229-Harsn, 232-Richm, 235-Norfo, 240-Roano, 253-Charl, 265-Clrks, 274-Green, 276-Ralei, 282-Charl, 283-Fayet, 288-Ashev, 292-Colmb, 294-Charl, 296-Grenv, 303-Atlan, 306-Athen, 309-Augus, 312-Macon, 314-Savan, 317-Alban, 319-Colum, 322-Jacks, 323-Talla, 328-Orlan, 331-Miami, 334-W.Plm, 336-Tampa, 339-FtMye, 352-Birmg, 359-Gadsd, 361-Montg, 366-Mobil, 374-Chata, 376-Johns, 379-Knoxv, 405-Lexin

Distribution Center: Memphis Market Areas (47):

354-Tusca, 356-Hunts, 372-Nashv, 381-Memph, 383-Jacks, 387-Grenv, 388-Tupel, 392-Jacks, 393-Merid, 402-Louis, 421-Bowln, 432-Colum, 436-Toled, 441-Clevl, 442-Akron, 445-Young, 449-Mansf, 452-Cncin, 454-Dayto, 458-Lima,, 462-Indan, 466-South, 468-Ft.Wa, 473-Munci, 474-Blomn, 477-Evans, 482-Detro, 485-Flint, 486-Sagin, 489-Lansi, 495-GrndR, 520-Dubuq, 528-Daven, 532-Milwa, 537-Madis, 606-Chica, 611-Rockf, 612-Rockl, 616-Peori, 618-Champ, 627-Sprin, 631-StLou, 634-Hanni, 638-CapeG, 701-NewOr, 708-BatrR, 722-Litle

Distribution Center: Dallas Market Areas (31):

648-Jopli, 658-Sprin, 672-Wichi, 678-Dodge, 711-Shrev, 712-Monro, 713-Alexn, 727-Fayet, 729-Ft.Sm, 731-OklaC, 741-Tulsa, 745-Mcals, 752-Dalla, 755-Texar, 757-Tyler, 761-Ft.Wo, 763-Wicht, 767-Waco,, 769-SanAn, 770-Houst, 777-Beaum, 782-SanAn, 784-CorpC, 787-Austi, 791-Amari, 794-Lubb,, 796-Abile, 802-Denve, 810-Puebl, 871-Albuq, 881-Roswe

Distribution Center: Phoenix Market Areas (12):

799-El Pa, 850-Phoen, 857-Tucso, 891-LasVe, 900-LosAn, 921-SanDi, 924-SanBe, 933-Bakrs, 937-Fresn, 946-Oakla, 952-Stock, 958-Sacra

Distribution Center: Salt Lake City Market Areas (23):

577-Rapid, 591-Billi, 594-Great, 596-Helen, 598-Misou, 815-GrndJ, 820-Cheye, 832-Pocat, 837-Boise, 841-SltLk, 846-Provo, 895-Reno,, 960-Reddi, 972-Portl, 973-Salem, 975-Medfo, 981-Seatt, 982-Evere, 984-Tacom, 989-Yakim, 992-Spoka, 993-WalaW, V3M-Vanco

Table G-3

RQB2A Results: North America Most Likely Case

Summary

<u>Finished Product Demand</u>	<u>(000)</u>
Total Units	25,116.5

<u>Cost Information</u>	<u>(\$000)</u>
Total Purchase Cost	4,556,476.3
Total Manufacturing Cost	6,293,842.4
Total Distribution Center Cost	334,774.2
Transfer Point Cost	0.0
Total Transportation Cost	756,597.3
Total System Cost	7,323,987.7

<u>Transportation Cost Detail</u>	<u>(\$000)</u>
Inbound Freight:	61,226.2
Internal Transfer Freight:	349,443.4
Customer Freight:	345,927.6

Total Transportation Cost:	756,597.3
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<u>Facilities Utilized</u>	<u>Type</u>
Reynosa	S
Monterrey	M
Nuevo Laredo	TP
Cuidad Juarez	TP
Toronto	DC
Regina	DC
Nuevo Laredo	DC
Cuidad Juarez	DC
Monterrey	DC
Mexico City	DC
Newark	DC
Kansas City	DC
Raleigh	DC
Atlanta	DC
Los Angeles	DC

Table G-3 (cont'd.)

Purchases By Manufacturing Plant Location (Firm) / Purchases By Supplier Location

Manufacturing Plant Location: Monterrey

Supplier Location: Reynosa

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.0073	70,836.2	71,353.3	906.6	72,259.9
102	Belts	1.9966	18,026.1	35,990.8	72.1	36,062.9
103	Compressors	45.6000	7,653.9	349,017.8	2,448.9	351,466.7
104	Copper Components	.9687	22,176.1	21,481.9	283.8	21,765.7
105	Cord Sets	1.9213	14,300.0	27,474.5	146.4	27,620.9
106	Corrugated Packaging	1.8540	25,116.5	46,566.0	3,214.4	49,780.4
107	Fasteners	.0085	3,929,066.9	33,397.1	326.9	33,723.9
108	Door Gaskets	7.2960	7,653.9	55,842.9	1,959.1	57,801.9
109	Knobs	.2390	99,457.3	23,770.3	79.6	23,849.8
110	1 Speed Motors	16.7078	4,734.0	79,093.9	908.8	80,002.7
111	2 Speed Motors	22.5720	6,646.1	150,014.6	1,701.1	151,715.8
112	Paint (Powder)	3.0870	8,005.4	24,712.8	102.5	24,815.2
113	Plastic Components	2.9672	25,116.5	74,525.7	482.2	75,007.8
114	Polypropylene Resin	.3337	411,179.6	137,210.6	5,262.3	142,472.9
115	Pumps	5.2661	6,646.1	34,998.8	85.1	35,083.8
116	Relays	6.2423	14,300.0	89,264.6	114.4	89,379.0
117	Steel	.2600	2,055,473.1	534,423.0	26,305.9	560,729.0
118	Switches	.6906	112,873.9	77,950.7	144.5	78,095.2
119	Timers/Motors	6.7396	45,158.3	304,348.5	57.8	304,406.3
120	Wiring Harnesses	4.9065	25,116.5	123,234.1	642.9	123,877.0
121	Misc. Electronics	5.8931	25,116.5	148,014.0	96.4	148,110.5
122	Washer MP	39.8056	6,646.1	264,550.0	2,551.7	267,101.7
123	Dryer MP	33.9691	4,734.0	160,808.0	60.6	160,868.6
124	Range MP	155.3526	6,082.6	944,947.7	7,395.3	952,343.0
125	Refrigerator MP	97.1380	7,653.9	743,484.5	5,877.3	749,361.8
Total:				4,556,476.3	61,226.2	4,617,702.5

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Monterrey

Item No.	Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)		
201	Washers	6,646.1	140.38	4.24	1.40	146.02	970,488.8		
202	Dryers	4,734.0	117.50	3.89	1.40	122.79	581,281.4		
203	Ranges	6,082.6	214.63	5.49	1.40	221.52	1,347,408.5		
204	Refrigerators	7,653.9	238.17	8.06	1.40	247.63	1,895,365.1		
Total:		25,116.5				VC Total:	4,794,543.8		
							FC Total:	1,499,298.6	
							Plant Total:	6,293,842.4	
Firm Total:		25,116.5						Firm VC Total:	4,794,543.8
								Firm FC Total:	1,499,298.6
								Firm MFG Total:	6,293,842.4

Table G-3 (cont'd.)

Source Of Finished Products By Distribution Center Location /
Total Cost For Distribution Center Operations

<u>DC Location</u>	<u>Description</u>	<u>Mfg.</u> <u>Source</u>	<u>Units</u> <u>(000)</u>	<u>Variable</u> <u>Labor</u> <u>(\$ 000)</u>	<u>Inv.</u> <u>CC.</u> <u>(\$ 000)</u>	<u>Fixed</u> <u>Cost</u> <u>(\$ 000)</u>	<u>Product</u> <u>DC Total</u> <u>(\$ 000)</u>
Toronto	Washers	MEX	336.5	1,581.6	2,340.9		3,922.4
	Dryers	MEX	281.7	1,324.0	1,633.0		2,957.0
	Ranges	MEX	291.4	1,369.3	2,736.1		4,105.5
	Refrigerators	MEX	350.2	1,645.7	3,846.5		5,492.2
	Total:		1,259.7	5,920.6	10,556.6	1,830.0	16,477.1
						DC Total:	18,307.1
Regina	Washers	MEX	188.2	801.7	1,309.2		2,110.9
	Dryers	MEX	153.7	654.6	890.7		1,545.3
	Ranges	MEX	164.4	700.1	1,543.5		2,243.6
	Refrigerators	MEX	198.9	847.3	2,185.0		3,032.3
	Total:		705.1	3,003.7	5,928.4	1,520.0	8,932.1
						DC Total:	10,452.1
Nuevo Laredo	Washers	MEX	650.7	1,822.0	4,526.6		6,348.5
	Dryers	MEX	457.0	1,279.6	2,649.3		3,928.9
	Ranges	MEX	595.5	1,667.3	5,592.0		7,259.3
	Refrigerators	MEX	754.2	2,111.8	8,285.2		10,397.0
	Total:		2,457.4	6,880.6	21,053.0	1,300.0	27,933.6
						DC Total:	29,233.6
Ciudad Juarez	Washers	MEX	431.0	1,206.8	2,998.2		4,205.0
	Dryers	MEX	302.4	846.6	1,752.7		2,599.3
	Ranges	MEX	395.7	1,107.8	3,715.6		4,823.5
	Refrigerators	MEX	500.3	1,400.7	5,495.5		6,896.2
	Total:		1,629.3	4,561.9	13,962.1	1,300.0	18,524.0
						DC Total:	19,824.0
Monterrey	Washers	MEX	20.3	56.7	140.9		197.6
	Dryers	MEX	7.6	21.3	44.1		65.3
	Ranges	MEX	40.5	113.3	379.9		493.1
	Refrigerators	MEX	35.7	100.0	392.2		492.1
	Total:		104.0	291.2	957.0	100.0	1,248.2
						DC Total:	1,348.2
Mexico City	Washers	MEX	4.2	11.8	29.2		41.0
	Dryers	MEX	1.7	4.8	9.9		14.6
	Ranges	MEX	8.4	23.4	78.4		101.8
	Refrigerators	MEX	7.4	20.6	80.7		101.3
	Total:		21.6	60.5	198.2	20.0	258.7
						DC Total:	278.7
Newark	Washers	MEX	843.1	3,937.3	5,865.0		9,802.3
	Dryers	MEX	599.1	2,797.6	3,472.7		6,270.3
	Ranges	MEX	769.1	3,591.7	7,222.8		10,814.5
	Refrigerators	MEX	971.3	4,536.0	10,670.1		15,206.1
	Total:		3,182.6	14,862.5	27,230.6	1,830.0	42,093.1
						DC Total:	43,923.1
Kansas City	Washers	MEX	395.5	1,704.4	2,750.9		4,455.3
	Dryers	MEX	278.0	1,198.0	1,611.3		2,809.3
	Ranges	MEX	362.1	1,560.4	3,400.1		4,960.5
	Refrigerators	MEX	458.4	1,975.7	5,035.7		7,011.4
	Total:		1,493.9	6,438.5	12,798.0	1,640.0	19,236.5
						DC Total:	20,876.5

Table G-3 (cont'd.)

<u>DC Location</u>	<u>Description</u>	<u>Mfg.</u> <u>Source</u>	<u>Units</u> <u>(000)</u>	<u>Variable</u> <u>Labor</u> <u>(\$ 000)</u>	<u>Inv.</u> <u>CC.</u> <u>(\$ 000)</u>	<u>Fixed</u> <u>Cost</u> <u>(\$ 000)</u>	<u>Product</u> <u>DC Total</u> <u>(\$ 000)</u>
Raleigh	Washers	MEX	976.1	3,972.5	6,789.9		10,762.4
	Dryers	MEX	685.7	2,790.6	3,974.8		6,765.4
	Ranges	MEX	893.0	3,634.5	8,386.4		12,020.9
	Refrigerators	MEX	1,131.4	4,604.6	12,428.3		17,032.9
	Total:		3,686.1	15,002.2	31,579.3	1,420.0	46,581.5
						DC Total:	48,001.5
Atlanta	Washers	MEX	1,963.7	8,581.4	13,660.4		22,241.8
	Dryers	MEX	1,379.3	6,027.5	7,995.9		14,023.4
	Ranges	MEX	1,796.8	7,852.0	16,874.2		24,726.2
	Refrigerators	MEX	2,276.0	9,946.1	25,002.8		34,948.9
	Total:		7,415.8	32,407.1	63,533.2	1,300.0	95,940.3
						DC Total:	97,240.3
Los Angeles	Washers	MEX	836.9	4,335.1	5,821.9		10,157.0
	Dryers	MEX	588.0	3,045.8	3,408.7		6,454.5
	Ranges	MEX	766.1	3,968.1	7,194.1		11,162.3
	Refrigerators	MEX	970.3	5,026.2	10,659.1		15,685.3
	Total:		3,161.3	16,375.3	27,083.8	1,830.0	43,459.1
						DC Total:	45,289.1
						Firm DC Total:	334,774.2

Table G-3 (cont'd.)

Market Areas Serviced By Distribution Center Location

Distribution Center: Toronto **Market Areas (14):**
 A1B-St Jo, B2V-Halif, C1A-Charl, H9P-Montr, J8X-Ottaw, J9X-Rouyn, K7K-Kings, L2M-St. C, L4N-Barri,
 L4V-Toron, N2B-Kitch, N5Y-Londo, N8N-Winds, P3A-Sudbu

Distribution Center: Regina **Market Areas (14):**
 587-Minot, 591-Billi, 594-Great, 596-Helen, 598-Misou, P7A-Thund, P9N-Kenor, R2X-Winni, S4P-Regin,
 S7K-Saska, T2H-Calga, T5J-Edmon, V1H-Princ, V3M-Vanco

Distribution Center: Nuevo Laredo **Market Areas (26):**
 387-Grenv, 392-Jacks, 701-NewOr, 708-BatnR, 711-Shrev, 712-Monro, 713-Alexn, 722-Litle, 729-Ft.Sm,
 731-OklaC, 741-Tulsa, 745-Mcals, 752-Dalla, 755-Texar, 757-Tyler, 761-Ft.Wo, 763-Wicht, 767-Waco,,
 769-SanAn, 770-Houst, 777-Beaum, 782-SanAn, 784-CorpC, 787-Austi, 794-Lubbo, 796-Abile

Distribution Center: Cuidad Juarez **Market Areas (24):**
 672-Wichi, 678-Dodge, 791-Amari, 799-El Pa, 802-Denve, 810-Puebl, 815-GrndJ, 820-Cheye, 832-Pocat,
 837-Boise, 846-Provo, 850-Phoen, 857-Tucso, 871-Albuq, 881-Roswe, 891-LasVe, 921-SanDi, 924-SanBe,
 MX1001-Ti, MX1002-Me, MX1006-Se, MX1007-He, MX1008-Ca, MX1023-Co

Distribution Center: Monterrey **Market Areas (48):**
 MX1005-Ba, MX1009-Ci, MX1010-N, MX1011-Ch, MX1012-S, MX1013-N, MX1014-Mo, MX1015-Sa, MX1016-To,
 MX1017-NN, MX1018-Mo, MX1019-SN, MX1020-NL, MX1021-Re, MX1022-Ma, MX1024-ST, MX1025-SL, MX1026-N ,
 MX1027-S , MX1028-ND, MX1029-Du, MX1030-LM, MX1031-Cu, MX1032-Ma, MX1033-Na, MX1034-SJ, MX1035-Gu,
 MX1036-NJ, MX1037-Ag, MX1038-Le, MX1039-Ir, MX1040-Ce, MX1041-Qu, MX1042-Hi, MX1043-NV, MX1044-Ja,
 MX1045-Or, MX1046-Ve, MX1048-Pu, MX1049-Tl, MX1050-Me, MX1051-Me, MX1052-Mo, MX1053-E , MX1055-Co,
 MX1060-Ca, MX1061-Yu, MX1062-Qu

Distribution Center: Mexico City **Market Areas (6):**
 MX1047-Co, MX1054-W, MX1056-Gu, MX1057-Oa, MX1058-Ch, MX1059-Ta

Distribution Center: Newark **Market Areas (24):**
 011-Sprng, 016-Worch, 021-Bosto, 029-Provd, 041-Portl, 047-Bango, 054-Burln, 061-Hartf, 065-NewHa,
 069-Stamf, 071-Newar, 089-NewBr, 106-WhitP, 112-Brook, 122-Alban, 126-Pough, 497-SStMa, E1C-Monct,
 E2H-Saint, G1A-Quebe, G5H-Rimou, G6G-Thetf, G8V-Trois, J1E-Sherb

Distribution Center: Kansas City **Market Areas (22):**
 503-DesMo, 511-Sioux, 520-Dubuq, 528-Daven, 537-Madis, 543-Green, 546-EauCl, 554-Minea, 558-Dulut,
 559-Rochs, 571-Sioux, 577-Rapid, 581-Fargo, 612-RockI, 641-Kanss, 645-St.Jo, 648-Jopli, 666-Topek,
 681-Omah,, 685-Linco, 691-N.Pla, 727-Fayet

Distribution Center: Raleigh **Market Areas (29):**
 031-Manch, 081-Camde, 132-Syrac, 139-Bingp, 141-Buffa, 146-Rochs, 152-Pitts, 158-Du Bo, 159-Johns,
 171-Harrs, 181-Allen, 187-Wlks-, 194-Phila, 196-Readi, 198-Wilmn, 200-Washn, 212-Balti, 215-Cumbr,
 229-Marsn, 232-Richm, 235-Norfo, 240-Roano, 253-Charl, 265-Clrks, 274-Green, 276-Ralei, 282-Charl,
 283-Fayet, 445-Young

Distribution Center: Atlanta **Market Areas (65):**
 165-Erie,, 288-Ashev, 292-Colmb, 294-Charl, 296-Grenv, 303-Atlan, 306-Athen, 309-Augus, 312-Macon,
 314-Savan, 317-Alban, 319-Colum, 322-Jacks, 323-Talla, 328-Orlan, 331-Miami, 334-W.Plm, 336-Tampa,
 339-FtMye, 352-Birmg, 354-Tusca, 356-Hunts, 359-Gadsd, 361-Montg, 366-Mobil, 372-Nashv, 374-Chata,
 376-Johns, 379-Knoxv, 381-Memph, 383-Jacks, 388-Tupel, 393-Merid, 402-Louis, 405-Lexin, 421-Bowln,
 432-Colum, 436-Toled, 441-Clevl, 442-Akron, 449-Mansf, 452-Cncin, 454-Dayto, 458-Lima,, 462-Indan,
 466-South, 468-Ft.Wa, 473-Munci, 474-Blomm, 477-Evans, 482-Detro, 485-Flint, 486-Sagin, 489-Lansi,
 495-GrndR, 532-Milwa, 606-Chica, 611-Rockf, 616-Peori, 618-Champ, 627-Sprin, 631-StLou, 634-Hanni,
 638-CapeG, 658-Sprin

Distribution Center: Los Angeles **Market Areas (20):**
 841-SltLk, 895-Reno,, 900-LosAn, 933-Bakrs, 937-Fresn, 946-Oakla, 952-Stock, 958-Sacra, 960-Reddi,
 972-Portl, 973-Salem, 975-Medfo, 981-Seatt, 982-Evere, 984-Tacom, 989-Yakim, 992-Spoka, 993-Walaw,
 MX1003-En, MX1004-Ba

Table G-4

RQB3A Results: North America 5 Percent Increase In Canadian Demand
And 25 Percent Increase In Mexican Demand

Summary

<u>Finished Product Demand</u>	(000)
Total Units	25,116.5

<u>Cost Information</u>	(\$000)
Total Purchase Cost	4,556,476.3
Total Manufacturing Cost	6,293,842.4
Total Distribution Center Cost	338,098.7
Total Transfer Point Cost	46,649.4
Total Transportation Cost	866,033.1
Total System Cost	7,483,397.4

<u>Transportation Cost Detail</u>	(\$000)
Inbound Freight:	61,226.2
Internal Transfer Freight:	463,529.8
Customer Freight:	341,277.1

Total Transportation Cost:	866,033.1
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<u>Facilities Utilized</u>	<u>Type</u>
Reynosa	S
Monterrey	M
Nuevo Laredo	TP
Cuidad Juarez	TP
Toronto	DC
Regina	DC
Monterrey	DC
Mexico City	DC
Newark	DC
Kansas City	DC
Atlanta	DC
Memphis	DC
Dallas	DC
Phoenix	DC
Salt Lake City	DC

Table G-4 (cont'd.)

Purchases By Manufacturing Plant Location (Firm) / Purchases By Supplier Location

Manufacturing Plant Location: Monterrey

Supplier Location: Reynosa

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.0073	70,836.2	71,353.3	906.6	72,259.9
102	Belts	1.9966	18,026.1	35,990.8	72.1	36,062.9
103	Compressors	45.6000	7,653.9	349,017.8	2,448.9	351,466.7
104	Copper Components	.9687	22,176.1	21,481.9	283.8	21,765.7
105	Cord Sets	1.9213	14,300.0	27,474.5	146.4	27,620.9
106	Corrugated Packaging	1.8540	25,116.5	46,566.0	3,214.4	49,780.4
107	Fasteners	.0085	3,929,066.9	33,397.1	326.9	33,723.9
108	Door Gaskets	7.2960	7,653.9	55,842.9	1,959.1	57,801.9
109	Knobs	.2390	99,457.3	23,770.3	79.6	23,849.8
110	1 Speed Motors	16.7078	4,734.0	79,093.9	908.8	80,002.7
111	2 Speed Motors	22.5720	6,646.1	150,014.6	1,701.1	151,715.8
112	Paint (Powder)	3.0870	8,005.4	24,712.8	102.5	24,815.2
113	Plastic Components	2.9672	25,116.5	74,525.7	482.2	75,007.8
114	Polypropylene Resin	.3337	411,179.6	137,210.6	5,262.3	142,472.9
115	Pumps	5.2661	6,646.1	34,998.8	85.1	35,083.8
116	Relays	6.2423	14,300.0	89,264.6	114.4	89,379.0
117	Steel	.2600	2,055,473.1	534,423.0	26,305.9	560,729.0
118	Switches	.6906	112,873.9	77,950.7	144.5	78,095.2
119	Timers/Motors	6.7396	45,158.3	304,348.5	57.8	304,406.3
120	Wiring Harnesses	4.9065	25,116.5	123,234.1	642.9	123,877.0
121	Misc. Electronics	5.8931	25,116.5	148,014.0	96.4	148,110.5
122	Washer MP	39.8056	6,646.1	264,550.0	2,551.7	267,101.7
123	Dryer MP	33.9691	4,734.0	160,808.0	60.6	160,868.6
124	Range MP	155.3526	6,082.6	944,947.7	7,395.3	952,343.0
125	Refrigerator MP	97.1380	7,653.9	743,484.5	5,877.3	749,361.8
Total:				4,556,476.3	61,226.2	4,617,702.5

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Monterrey

Item No.	Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201	Washers	6,646.1	140.38	4.24	1.40	146.02	970,488.8
202	Dryers	4,734.0	117.50	3.89	1.40	122.79	581,281.4
203	Ranges	6,082.6	214.63	5.49	1.40	221.52	1,347,408.5
204	Refrigerators	7,653.9	238.17	8.06	1.40	247.63	1,895,365.1
Total:				25,116.5			
						VC Total:	4,794,543.8
						FC Total:	1,499,298.6
						Plant Total:	6,293,842.4
Firm Total:				25,116.5		Firm VC Total:	4,794,543.8
						Firm FC Total:	1,499,298.6
						Firm MFG Total:	6,293,842.4

Table G-4 (cont'd.)

Source Of Finished Products By Distribution Center Location /
Total Cost For Distribution Center Operations

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product Total (\$ 000)</u>
Toronto	Washers	MEX	336.5	1,581.6	2,340.9		3,922.4
	Dryers	MEX	281.7	1,324.0	1,633.0		2,957.0
	Ranges	MEX	291.4	1,369.3	2,736.1		4,105.5
	Refrigerators	MEX	350.2	1,645.7	3,846.5		5,492.2
	Total:		1,259.7	5,920.6	10,556.6	1,830.0	16,477.1
						DC Total:	18,307.1
Regina	Washers	MEX	101.7	433.2	707.5		1,140.7
	Dryers	MEX	84.1	358.1	487.2		845.3
	Ranges	MEX	88.5	376.8	830.7		1,207.5
	Refrigerators	MEX	106.5	453.5	1,169.4		1,622.9
	Total:		380.7	1,621.6	3,194.8	1,520.0	4,816.3
						DC Total:	6,336.3
Monterrey	Washers	MEX	21.5	60.1	149.2		209.3
	Dryers	MEX	8.1	22.5	46.7		69.2
	Ranges	MEX	43.0	120.3	403.4		523.6
	Refrigerators	MEX	37.9	106.0	415.8		521.8
	Total:		110.3	308.8	1,015.0	100.0	1,323.9
						DC Total:	1,423.9
Mexico City	Washers	MEX	4.2	11.8	29.2		41.0
	Dryers	MEX	1.7	4.8	9.9		14.6
	Ranges	MEX	8.4	23.4	78.4		101.8
	Refrigerators	MEX	7.4	20.6	80.7		101.3
	Total:		21.6	60.5	198.2	20.0	258.7
						DC Total:	278.7
Newark	Washers	MEX	1,152.1	5,380.1	8,014.2		13,394.3
	Dryers	MEX	816.1	3,811.0	4,730.7		8,541.6
	Ranges	MEX	1,051.8	4,911.9	9,877.7		14,789.6
	Refrigerators	MEX	1,329.5	6,208.8	14,605.1		20,813.9
	Total:		4,349.4	20,311.7	37,227.7	1,830.0	57,539.4
						DC Total:	59,369.4
Kansas City	Washers	MEX	308.7	1,330.5	2,147.5		3,478.0
	Dryers	MEX	216.9	934.8	1,257.4		2,192.2
	Ranges	MEX	282.7	1,218.2	2,654.4		3,872.7
	Refrigerators	MEX	357.9	1,542.3	3,931.1		5,473.5
	Total:		1,166.1	5,025.9	9,990.4	1,640.0	15,016.3
						DC Total:	16,656.3
Atlanta	Washers	MEX	1,412.6	6,173.1	9,826.7		15,999.8
	Dryers	MEX	992.3	4,336.4	5,752.4		10,088.8
	Ranges	MEX	1,292.4	5,647.8	12,137.2		17,785.0
	Refrigerators	MEX	1,637.3	7,155.0	17,986.4		25,141.4
	Total:		5,334.6	23,312.2	45,702.7	1,300.0	69,014.9
						DC Total:	70,314.9

Table G-4 (cont'd.)

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product Total (\$ 000)</u>
Memphis	Washers	MEX	1,387.7	5,814.5	9,653.5		15,467.9
	Dryers	MEX	974.8	4,084.2	5,650.7		9,734.9
	Ranges	MEX	1,269.8	5,320.5	11,925.0		17,245.4
	Refrigerators	MEX	1,608.3	6,738.8	17,667.8		24,406.6
	Total:		5,240.6	21,957.9	44,897.0	1,600.0	66,854.9
						DC Total:	68,454.9
Dallas	Washers	MEX	708.5	2,947.2	4,928.3		7,875.5
	Dryers	MEX	497.7	2,070.4	2,885.2		4,955.6
	Ranges	MEX	648.4	2,697.3	6,089.3		8,786.6
	Refrigerators	MEX	821.3	3,416.4	9,021.8		12,438.2
	Total:		2,675.8	11,131.3	22,924.5	1,600.0	34,055.9
						DC Total:	35,655.9
Phoenix	Washers	MEX	810.9	3,275.8	5,640.7		8,916.5
	Dryers	MEX	569.7	2,301.4	3,302.3		5,603.7
	Ranges	MEX	742.1	2,997.9	6,968.8		9,966.6
	Refrigerators	MEX	940.0	3,797.4	10,325.7		14,123.1
	Total:		3,062.5	12,372.5	26,237.4	1,600.0	38,609.9
						DC Total:	40,209.9
Salt Lake City	Washers	MEX	401.9	1,719.9	2,795.5		4,515.4
	Dryers	MEX	291.1	1,245.9	1,687.5		2,933.4
	Ranges	MEX	364.4	1,559.6	3,422.2		4,981.8
	Refrigerators	MEX	458.0	1,960.0	5,030.8		6,990.8
	Total:		1,515.3	6,485.5	12,935.9	1,670.0	19,421.4
						DC Total:	21,091.4
Firm DC Total:							338,098.7

Total Cost For Transfer Point Operations

<u>TP Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Transfer Cost (\$ 000)</u>	
Nuevo Laredo	Washers	MEX	5,407.7	8,598.2	8,598.2
	Dryers	MEX	3,863.5	6,142.9	6,142.9
	Ranges	MEX	4,924.9	7,830.5	7,830.5
	Refrigerators	MEX	6,210.8	15,527.0	15,527.0
	Total:		20,406.8	38,098.6	38,098.6
Transfer Point Total:					38,098.6
Ciudad Juarez	Washers	MEX	1,212.7	1,928.2	1,928.2
	Dryers	MEX	860.8	1,368.6	1,368.6
	Ranges	MEX	1,106.5	1,759.3	1,759.3
	Refrigerators	MEX	1,397.9	3,494.8	3,494.8
	Total:		4,577.8	8,550.8	8,550.8
Firm Transfer Point Total:					46,649.4

Table G-4 (cont'd.)

Market Areas Serviced By Distribution Center Location

Distribution Center: Toronto Market Areas (14):

A18-St Jo, B2V-Halif, C1A-Charl, H9P-Montr, J8X-Ottaw, J9X-Rouyn, K7K-Kings, L2M-St. C, L4N-Barri,
L4V-Toron, N2B-Kitch, N5Y-Londo, N8N-Winds, P3A-Sudbu

Distribution Center: Regina Market Areas (9):

587-Minot, P7A-Thund, P9N-Kenor, R2X-Winni, S4P-Regin, S7K-Saska, T2H-Calga, T5J-Edmon, V1H-Princ

Distribution Center: Monterrey Market Areas (56):

MX1001-Ti, MX1002-Me, MX1003-En, MX1004-Ba, MX1005-Ba, MX1006-Se, MX1007-He, MX1008-Ca, MX1009-Ci,
MX1010-N, MX1011-Ch, MX1012-S, MX1013-N, MX1014-Mo, MX1015-Sa, MX1016-To, MX1017-NM, MX1018-Mo,
MX1019-SN, MX1020-NL, MX1021-Re, MX1022-Ma, MX1023-CO, MX1024-ST, MX1025-SL, MX1026-N, MX1027-S,
MX1028-ND, MX1029-Du, MX1030-LM, MX1031-Cu, MX1032-Ma, MX1033-Na, MX1034-SJ, MX1035-Gu, MX1036-NJ,
MX1037-Ag, MX1038-Le, MX1039-Ir, MX1040-Ce, MX1041-Qu, MX1042-Hi, MX1043-NV, MX1044-Ja, MX1045-Or,
MX1046-Ve, MX1048-Pu, MX1049-Tl, MX1050-Me, MX1051-Me, MX1052-Mo, MX1053-E, MX1055-Co, MX1060-Ca,
MX1061-Yu, MX1062-Qu

Distribution Center: Mexico City Market Areas (6):

MX1047-Co, MX1054-W, MX1056-Gu, MX1057-Oa, MX1058-Ch, MX1059-Ta

Distribution Center: Newark Market Areas (34):

011-Sprng, 016-Worch, 021-Bosto, 029-Provd, 031-Manch, 041-Portl, 047-Bango, 054-Burln, 061-Hartf,
065-NewHa, 069-Stamf, 071-Newar, 089-NewBr, 106-WhitP, 112-Brook, 122-Alban, 126-Pough, 132-Syrac,
139-Bingp, 141-Buffa, 146-Rochs, 181-Allen, 187-Wlks-, 194-Phila, 196-Readi, 198-Wilmn, 497-SStMa,
E1C-Monct, E2H-Saint, G1A-Quebe, G5H-Rimou, G6G-Thetf, G8V-Trois, J1E-Sherb

Distribution Center: Kansas City Market Areas (15):

503-DesMo, 511-Sioux, 543-Green, 546-EauCl, 554-Minea, 558-Dulut, 559-Rochs, 571-Sioux, 581-Fargo,
641-Kanss, 645-St.Jo, 666-Topek, 681-Omaha, 685-Linco, 691-N.Pla

Distribution Center: Atlanta Market Areas (45):

081-Camde, 152-Pitts, 158-Du Bo, 159-Johns, 165-Erie, 171-Harrs, 200-Washn, 212-Balti, 215-Cumbr,
229-Harsn, 232-Richm, 235-Norfo, 240-Roano, 253-Charl, 265-Clrks, 274-Green, 276-Ralei, 282-Charl,
283-Fayet, 288-Ashev, 292-Colmb, 294-Charl, 296-Grenv, 303-Atlan, 306-Athen, 309-Augus, 312-Macon,
314-Savan, 317-Alban, 319-Colum, 322-Jacks, 323-Talla, 328-Orlan, 331-Miami, 334-W.Plm, 336-Tampa,
339-FtMye, 352-Birmg, 359-Gadsd, 361-Montg, 366-Mobil, 374-Chata, 376-Johns, 379-Knoxv, 405-Lexin

Distribution Center: Memphis Market Areas (47):

354-Tusca, 356-Hunts, 372-Nashv, 381-Memph, 383-Jacks, 387-Grenv, 388-Tupel, 392-Jacks, 393-Merid,
402-Louis, 421-Bowln, 432-Colum, 436-Toled, 441-Clevl, 442-Akron, 445-Young, 449-Mansf, 452-Cncin,
454-Dayto, 458-Lima, 462-Indan, 466-South, 468-Ft.Wa, 473-Munci, 474-Blomn, 477-Evans, 482-Detro,
485-Flint, 486-Sagin, 489-Lansi, 495-GrndR, 520-Dubuq, 528-Daven, 532-Milwa, 537-Madis, 606-Chica,
611-Rockf, 612-Rockl, 616-Peori, 618-Champ, 627-Sprin, 631-StLou, 634-Hanni, 638-CapeG, 701-NewOr,
708-BatnR, 722-Litle

Distribution Center: Dallas Market Areas (31):

648-Jopli, 658-Sprin, 672-Wichi, 678-Dodge, 711-Shrev, 712-Monro, 713-Alexn, 727-Fayet, 729-Ft.Sm,
731-OklaC, 741-Tulsa, 745-Mcals, 752-Dalla, 755-Texar, 757-Tyler, 761-Ft.Wo, 763-Wicht, 767-Waco,,
769-SanAn, 770-Houst, 777-Beaum, 782-SanAn, 784-CorpC, 787-Austi, 791-Amari, 794-Lubbo, 796-Abile,
802-Denve, 810-Puebl, 871-Albuq, 881-Roswe

Distribution Center: Phoenix Market Areas (12):

799-El Pa, 850-Phoen, 857-Tucso, 891-LasVe, 900-LosAn, 921-SanDi, 924-SanBe, 933-Bakrs, 937-Fresn,
946-Oakla, 952-Stoc, 958-Sacra

Distribution Center: Salt Lake City Market Areas (23):

577-Rapid, 591-Billi, 594-Great, 596-Helen, 598-Misou, 815-GrndJ, 820-Cheye, 832-Pocat, 837-Boise,
841-SltLk, 846-Provo, 895-Reno,, 960-Reddi, 972-Portl, 973-Salem, 975-Medfo, 981-Seatt, 982-Evere,
984-Tacom, 989-Yakim, 992-Spoka, 993-WalaW, V3M-Vanco

Table G-5

RQB38 Results: North America 10 Percent Increase In Canadian Demand
And 50 Percent Increase In Mexican Demand

Summary

<u>Finished Product Demand</u>	(000)
Total Units	25,244.7

<u>Cost Information</u>	(\$000)
Total Purchase Cost	4,579,672.2
Total Manufacturing Cost	6,318,246.9
Total Distribution Center Cost	339,723.0
Transfer Point Cost	46,829.6
Total Transportation Cost	872,244.6
Total System Cost	7,515,506.6

<u>Transportation Cost Detail</u>	(\$000)
Inbound Freight:	61,537.5
Internal Transfer Freight:	467,552.4
Customer Freight:	343,154.7

Total Transportation Cost:	872,244.6
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<u>Facilities Utilized</u>	<u>Type</u>
Reynosa	S
Monterrey	M
Nuevo Laredo	TP
Cuidad Juarez	TP
Toronto	DC
Regina	DC
Monterrey	DC
Mexico City	DC
Newark	DC
Kansas City	DC
Atlanta	DC
Memphis	DC
Dallas	DC
Phoenix	DC
Salt Lake City	DC

Table G-5 (cont'd.)

Purchases By Manufacturing Plant Location (Firm)/ Purchases By Supplier Location

Manufacturing Plant Location: Monterrey

Supplier Location: Reynosa

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.0073	71,183.3	71,703.0	911.0	72,614.0
102	Belts	1.9966	18,115.8	36,170.0	72.5	36,242.5
103	Compressors	45.6000	7,691.0	350,709.6	2,460.7	353,170.3
104	Copper Components	.9687	22,285.5	21,587.9	285.2	21,873.2
105	Cord Sets	1.9213	14,369.1	27,607.4	147.1	27,754.5
106	Corrugated Packaging	1.8540	25,244.7	46,803.6	3,230.8	50,034.4
107	Fasteners	.0085	3,949,329.0	33,569.3	328.5	33,897.8
108	Door Gaskets	7.2960	7,691.0	56,113.5	1,968.6	58,082.1
109	Knobs	.2390	99,979.1	23,895.0	80.0	23,975.0
110	1 Speed Motors	16.7078	4,759.6	79,522.4	913.7	80,436.1
111	2 Speed Motors	22.5720	6,678.1	150,738.1	1,709.3	152,447.4
112	Paint (Powder)	3.0870	8,044.7	24,834.1	103.0	24,937.0
113	Plastic Components	2.9672	25,244.7	74,905.9	484.6	75,390.5
114	Polypropylene Resin	.3337	413,171.8	137,875.4	5,287.8	143,163.2
115	Pumps	5.2661	6,678.1	35,167.5	85.5	35,253.0
116	Relays	6.2423	14,369.1	89,696.2	114.9	89,811.2
117	Steel	.2600	2,066,060.5	537,175.7	26,441.4	563,617.2
118	Switches	.6906	113,463.7	78,358.0	145.2	78,503.2
119	Timers/Motors	6.7396	45,386.3	305,885.2	58.1	305,943.3
120	Wiring Harnesses	4.9065	25,244.7	123,862.9	646.2	124,509.0
121	Misc. Electronics	5.8931	25,244.7	148,769.2	96.9	148,866.2
122	Washer MP	39.8056	6,678.1	265,825.8	2,564.0	268,389.8
123	Dryer MP	33.9691	4,759.6	161,679.3	60.9	161,740.2
124	Range MP	155.3526	6,116.0	950,128.7	7,435.8	957,564.6
125	Refrigerator MP	97.1380	7,691.0	747,088.4	5,905.8	752,994.1
Total:				4,579,672.2	61,537.5	4,641,209.7

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Monterrey

Item No.	Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201	Washers	6,678.1	140.38	4.24	1.40	146.02	975,168.9
202	Dryers	4,759.6	117.50	3.89	1.40	122.79	584,431.0
203	Ranges	6,116.0	214.63	5.49	1.40	221.52	1,354,796.1
204	Refrigerators	7,691.0	238.17	8.06	1.40	247.63	1,904,552.3
Total:		25,244.7				VC Total:	4,818,948.3
						FC Total:	1,499,298.6
						Plant Total:	6,318,246.9
Firm Total:		25,244.7				Firm VC Total:	4,818,948.3
						Firm FC Total:	1,499,298.6
						Firm MFG Total:	6,318,246.9

Table G-5 (cont'd.)

Source Of Finished Products By Distribution Center Location /
Total Cost For Distribution Center Operations

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Toronto	Washers	MEX	352.6	1,657.0	2,452.5		4,109.5
	Dryers	MEX	295.2	1,387.2	1,711.0		3,098.2
	Ranges	MEX	305.2	1,434.4	2,866.2		4,300.6
	Refrigerators	MEX	366.8	1,723.7	4,028.9		5,752.6
	Total:		1,319.7	6,202.3	11,058.6	1,830.0	17,260.9
						DC Total:	19,090.9
Regina	Washers	MEX	106.2	452.4	738.8		1,191.2
	Dryers	MEX	88.0	374.7	509.9		884.5
	Ranges	MEX	92.5	393.8	868.2		1,262.1
	Refrigerators	MEX	111.2	473.5	1,221.0		1,694.5
	Total:		397.8	1,694.4	3,337.9	1,520.0	5,032.3
						DC Total:	6,552.3
Monterrey	Washers	MEX	26.5	74.2	184.4		258.6
	Dryers	MEX	11.3	31.6	65.5		97.2
	Ranges	MEX	52.0	145.6	488.3		633.9
	Refrigerators	MEX	46.4	129.9	509.7		639.6
	Total:		136.2	381.4	1,247.9	100.0	1,629.3
						DC Total:	1,729.3
Mexico City	Washers	MEX	5.1	14.3	35.5		49.8
	Dryers	MEX	2.1	5.7	11.9		17.6
	Ranges	MEX	10.1	28.3	94.9		123.1
	Refrigerators	MEX	8.8	24.6	96.7		121.3
	Total:		26.1	72.9	238.9	20.0	311.8
						DC Total:	331.8
Newark	Washers	MEX	1,154.5	5,391.5	8,031.2		13,422.8
	Dryers	MEX	818.1	3,820.5	4,742.6		8,563.1
	Ranges	MEX	1,053.8	4,921.3	9,896.5		14,817.7
	Refrigerators	MEX	1,332.1	6,220.7	14,633.1		20,853.8
	Total:		4,358.5	20,354.0	37,303.4	1,830.0	57,657.4
						DC Total:	59,487.4
Kansas City	Washers	MEX	308.7	1,330.5	2,147.5		3,478.0
	Dryers	MEX	216.9	934.8	1,257.4		2,192.2
	Ranges	MEX	282.7	1,218.2	2,654.4		3,872.7
	Refrigerators	MEX	357.9	1,542.3	3,931.1		5,473.5
	Total:		1,166.1	5,025.9	9,990.4	1,640.0	15,016.3
						DC Total:	16,656.3
Atlanta	Washers	MEX	1,412.6	6,173.1	9,826.7		15,999.8
	Dryers	MEX	992.3	4,336.4	5,752.4		10,088.8
	Ranges	MEX	1,292.4	5,647.8	12,137.2		17,785.0
	Refrigerators	MEX	1,637.3	7,155.0	17,986.4		25,141.4
	Total:		5,334.6	23,312.2	45,702.7	1,300.0	69,014.9
						DC Total:	70,314.9
Memphis	Washers	MEX	1,387.7	5,814.5	9,653.5		15,467.9
	Dryers	MEX	974.8	4,084.2	5,650.7		9,734.9
	Ranges	MEX	1,269.8	5,320.5	11,925.0		17,245.4
	Refrigerators	MEX	1,608.3	6,738.8	17,667.8		24,406.6
	Total:		5,240.6	21,957.9	44,897.0	1,600.0	66,854.9
						DC Total:	68,454.9

Table G-5 (cont'd.)

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Dallas	Washers	MEX	708.5	2,947.2	4,928.3		7,875.5
	Dryers	MEX	497.7	2,070.4	2,885.2		4,955.6
	Ranges	MEX	648.4	2,697.3	6,089.3		8,786.6
	Refrigerators	MEX	821.3	3,416.4	9,021.8		12,438.2
	Total:		2,675.8	11,131.3	22,924.5	1,600.0	34,055.9
						DC Total:	35,655.9
Phoenix	Washers	MEX	810.9	3,275.8	5,640.7		8,916.5
	Dryers	MEX	569.7	2,301.4	3,302.3		5,603.7
	Ranges	MEX	742.1	2,997.9	6,968.8		9,966.6
	Refrigerators	MEX	940.0	3,797.4	10,325.7		14,123.1
	Total:		3,062.5	12,372.5	26,237.4	1,600.0	38,609.9
						DC Total:	40,209.9
Salt Lake City	Washers	MEX	405.0	1,733.2	2,817.0		4,550.2
	Dryers	MEX	293.8	1,257.3	1,702.9		2,960.1
	Ranges	MEX	367.1	1,571.2	3,447.5		5,018.7
	Refrigerators	MEX	461.2	1,973.9	5,066.5		7,040.4
	Total:		1,527.0	6,535.6	13,033.9	1,670.0	19,569.5
						DC Total:	21,239.5
Firm DC Total:							339,723.0

Total Cost For Transfer Point Operations

<u>TP Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Transfer Cost (\$ 000)</u>	
Nuevo Laredo	Washers	MEX	5,430.7	8,634.8	8,634.8
	Dryers	MEX	3,882.9	6,173.7	6,173.7
	Ranges	MEX	4,944.7	7,862.1	7,862.1
	Refrigerators	MEX	6,234.7	15,586.6	15,586.6
	Total:		20,492.9	38,257.2	Transfer Point Total: 38,257.2
Ciudad Juarez	Washers	MEX	1,215.8	1,933.1	1,933.1
	Dryers	MEX	863.4	1,372.8	1,372.8
	Ranges	MEX	1,109.2	1,763.6	1,763.6
	Refrigerators	MEX	1,401.2	3,502.9	3,502.9
	Total:		4,589.5	8,572.4	Transfer Point Total: 8,572.4
Firm Transfer Point Total:					46,829.6

Table G-5 (cont'd.)

Market Areas Served By Distribution Center Location

Distribution Center: Toronto Market Areas (14):

A1B-St Jo, B2V-Halif, C1A-Charl, H9P-Montr, J8X-Ottaw, J9X-Rouyn, K7K-Kings, L2M-St. C, L4N-Barri, L4V-Toron, N2B-Kitch, N5Y-Londo, N8N-Winds, P3A-Sudbu

Distribution Center: Regina Market Areas (9):

587-Minot, P7A-Thund, P9N-Kenor, R2X-Winni, S4P-Regin, S7K-Saska, T2H-Calga, T5J-Edmon, V1H-Princ

Distribution Center: Monterrey Market Areas (56):

MX1001-Ti, MX1002-Me, MX1003-En, MX1004-Ba, MX1005-Ba, MX1006-Se, MX1007-He, MX1008-Ca, MX1009-Ci, MX1010-N, MX1011-Ch, MX1012-S, MX1013-N, MX1014-Mo, MX1015-Sa, MX1016-To, MX1017-NN, MX1018-Mo, MX1019-SN, MX1020-NL, MX1021-Re, MX1022-Ma, MX1023-CO, MX1024-ST, MX1025-SL, MX1026-N, MX1027-S, MX1028-ND, MX1029-Du, MX1030-LM, MX1031-Cu, MX1032-Ma, MX1033-Na, MX1034-SJ, MX1035-Gu, MX1036-NJ, MX1037-Ag, MX1038-Le, MX1039-Ir, MX1040-Ce, MX1041-Qu, MX1042-Hi, MX1043-NV, MX1044-Ja, MX1045-Or, MX1046-Ve, MX1048-Pu, MX1049-Tl, MX1050-Me, MX1051-Me, MX1052-Mo, MX1053-E, MX1055-Co, MX1060-Ca, MX1061-Yu, MX1062-Qu

Distribution Center: Mexico City Market Areas (6):

MX1047-Co, MX1054-W, MX1056-Gu, MX1057-Oa, MX1058-Ch, MX1059-Ta

Distribution Center: Newark Market Areas (34):

011-Sprng, 016-Worch, 021-Bosto, 029-Provd, 031-Manch, 041-Portl, 047-Bango, 054-Burln, 061-Hartf, 065-NewHa, 069-Stamf, 071-Newar, 089-NewBr, 106-WhitP, 112-Brook, 122-Alban, 126-Pough, 132-Syrac, 139-Bingp, 141-Buffa, 146-Rochs, 181-Allen, 187-Wlks-, 194-Phila, 196-Readi, 198-Wilmn, 497-SStMa, E1C-Monct, E2H-Saint, G1A-Quebe, G5H-Rimou, G6G-Thetf, G8V-Trois, J1E-Sherb

Distribution Center: Kansas City Market Areas (15):

503-DesMo, 511-Sioux, 543-Green, 546-EauCl, 554-Minea, 558-Dulut, 559-Rochs, 571-Sioux, 581-Fargo, 641-Kanss, 645-St.Jo, 666-Topek, 681-Omaha, 685-Linco, 691-N.Pla

Distribution Center: Atlanta Market Areas (45):

081-Camde, 152-Pitts, 158-Du Bo, 159-Johns, 165-Erie,, 171-Harrs, 200-Washn, 212-Balti, 215-Cumbr, 229-Harsn, 232-Richm, 235-Norfo, 240-Roano, 253-Charl, 265-Clrks, 274-Green, 276-Ralei, 282-Charl, 283-Fayet, 288-Ashev, 292-Colmb, 294-Charl, 296-Grenv, 303-Atlan, 306-Athen, 309-Augus, 312-Macon, 314-Savan, 317-Alban, 319-Colum, 322-Jacks, 323-Talla, 328-Orlan, 331-Miami, 334-W.Plm, 336-Tampa, 339-FtMye, 352-Birmg, 359-Gadسد, 361-Montg, 366-Mobil, 374-Chata, 376-Johns, 379-Knoxv, 405-Lexin

Distribution Center: Memphis Market Areas (47):

354-Tusca, 356-Hunts, 372-Nashv, 381-Memph, 383-Jacks, 387-Grenv, 388-Tupel, 392-Jacks, 393-Merid, 402-Louis, 421-BowlN, 432-Colum, 436-Toled, 441-Clevl, 442-Akron, 445-Young, 449-Mansf, 452-Cncin, 454-Dayto, 458-Lima,, 462-Indan, 466-South, 468-Ft.Wa, 473-Munci, 474-Blomn, 477-Evans, 482-Detro, 485-Flint, 486-Sagin, 489-Lansi, 495-GrndR, 520-Dubuq, 528-Daven, 532-Milwa, 537-Madis, 606-Chica, 611-Rockf, 612-RockI, 616-Peori, 618-Champ, 627-Sprin, 631-StLou, 634-Hanni, 638-CapeG, 701-NewOr, 708-BatrR, 722-Litle

Distribution Center: Dallas Market Areas (31):

648-Jopli, 658-Sprin, 672-Wichi, 678-Dodge, 711-Shrev, 712-Monro, 713-Alexn, 727-Fayet, 729-Ft.Sm, 731-OklaC, 741-Tulsa, 745-Mcals, 752-Dalla, 755-Texar, 757-Tyler, 761-Ft.Wo, 763-Wicht, 767-Waco,, 769-SanAn, 770-Houst, 777-Beaum, 782-SanAn, 784-CorpC, 787-Austi, 791-Amari, 794-Lubbo, 796-Abile, 802-Denve, 810-Puebl, 871-Albuq, 881-Roswe

Distribution Center: Phoenix Market Areas (12):

799-El Pa, 850-Phoen, 857-Tucso, 891-LasVe, 900-LosAn, 921-SanDi, 924-SanBe, 933-Bakrs, 937-Fresn, 946-Oakla, 952-Stock, 958-Sacra

Distribution Center: Salt Lake City Market Areas (23):

577-Rapid, 591-Billi, 594-Great, 596-Helen, 598-Misou, 815-GrndJ, 820-Cheye, 832-Pocat, 837-Boise, 841-SltLk, 846-Provo, 895-Reno,, 960-Reddi, 972-Portl, 973-Salem, 975-Medfo, 981-Seatt, 982-Evere, 984-Tacom, 989-Yakim, 992-Spoka, 993-Walaw, V3M-Vanco

Table G-6

RQB3C Results: North America 50 Percent Reduction In Tariffs

Summary

<u>Finished Product Demand</u>	<u>(000)</u>
Total Units	24,992.8

<u>Cost Information</u>	<u>(\$000)</u>
Total Purchase Cost	4,533,937.5
Total Manufacturing Cost	6,270,132.2
Total Distribution Center Cost	336,518.9
Transfer Point Cost	46,469.1
Total Transportation Cost	836,678.8
Total System Cost	7,428,874.7

<u>Transportation Cost Detail</u>	<u>(\$000)</u>
Inbound Freight:	60,924.3
Internal Transfer Freight:	441,149.1
Customer Freight:	334,605.4

Total Transportation Cost:	836,678.8
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<u>Facilities Utilized</u>	<u>Type</u>
Reynosa	S
Monterrey	M
Nuevo Laredo	TP
Ciudad Juarez	TP
Toronto	DC
Regina	DC
Monterrey	DC
Mexico City	DC
Newark	DC
Kansas City	DC
Atlanta	DC
Memphis	DC
Dallas	DC
Phoenix	DC
Salt Lake City	DC

Table G-6 (cont'd.)

Purchases By Manufacturing Plant Location (Firm)/ Purchases By Supplier Location

Manufacturing Plant Location: Monterrey

Supplier Location: Reynosa

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.0073	70,496.6	71,011.2	902.2	71,913.4
102	Belts	1.9966	17,940.7	35,820.3	71.8	35,892.1
103	Compressors	45.6000	7,617.7	347,364.8	2,437.3	349,802.1
104	Copper Components	.9687	22,068.8	21,378.1	282.4	21,660.5
105	Cord Sets	1.9213	14,232.6	27,345.1	145.7	27,490.8
106	Corrugated Packaging	1.8540	24,992.8	46,336.7	3,198.6	49,535.2
107	Fasteners	.0085	3,909,539.8	33,231.1	325.2	33,556.3
108	Door Gaskets	7.2960	7,617.7	55,578.4	1,949.8	57,528.2
109	Knobs	.2390	98,946.7	23,648.3	79.1	23,727.4
110	1 Speed Motors	16.7078	4,710.8	78,706.3	904.3	79,610.6
111	2 Speed Motors	22.5720	6,615.0	149,312.7	1,693.2	151,005.8
112	Paint (Powder)	3.0870	7,967.5	24,595.8	102.0	24,697.8
113	Plastic Components	2.9672	24,992.8	74,158.6	479.8	74,638.4
114	Polypropylene Resin	.3337	409,239.8	136,563.3	5,237.5	141,800.8
115	Pumps	5.2661	6,615.0	34,835.0	84.7	34,919.6
116	Relays	6.2423	14,232.6	88,844.2	113.8	88,958.0
117	Steel	.2600	2,045,285.6	531,774.3	26,175.6	557,949.8
118	Switches	.6906	112,305.8	77,558.4	143.7	77,702.1
119	Timers/Motors	6.7396	44,938.9	302,869.9	57.5	302,927.4
120	Wiring Harnesses	4.9065	24,992.8	122,627.2	639.7	123,266.9
121	Misc. Electronics	5.8931	24,992.8	147,285.1	96.0	147,381.0
122	Washer MP	39.8056	6,615.0	263,312.1	2,539.7	265,851.8
123	Dryer MP	33.9691	4,710.8	160,019.9	60.3	160,080.2
124	Range MP	155.3526	6,049.5	939,797.8	7,355.0	947,152.8
125	Refrigerator MP	97.1380	7,617.7	739,963.3	5,849.4	745,812.7
Total:				4,533,937.5	60,924.3	4,594,861.8

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Monterrey

Item No.	Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201	Washers	6,615.0	140.38	4.24	1.40	146.02	965,947.4
202	Dryers	4,710.8	117.50	3.89	1.40	122.79	578,432.7
203	Ranges	6,049.5	214.63	5.49	1.40	221.52	1,340,065.1
204	Refrigerators	7,617.7	238.17	8.06	1.40	247.63	1,886,388.4
Total:		24,992.8				VC Total:	4,770,833.6
						FC Total:	1,499,298.6
						Plant Total:	6,270,132.2
Firm Total:		24,992.8				Firm VC Total:	4,770,833.6
						Firm FC Total:	1,499,298.6
						Firm MFG Total:	6,270,132.2

Table G-6 (cont'd.)

Source Of Finished Products By Distribution Center Location /
Total Cost For Distribution Center Operations

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Toronto	Washers	MEX	320.5	1,506.1	2,229.2		3,735.3
	Dryers	MEX	268.3	1,261.0	1,555.4		2,816.4
	Ranges	MEX	277.5	1,304.0	2,605.6		3,909.6
	Refrigerators	MEX	333.4	1,567.0	3,662.5		5,229.5
	Total:		1,199.6	5,638.1	10,052.7	1,830.0	15,690.8
						DC Total:	17,520.8
Regina	Washers	MEX	97.2	413.9	675.8		1,089.7
	Dryers	MEX	80.4	342.3	465.8		808.1
	Ranges	MEX	84.5	360.0	793.6		1,153.5
	Refrigerators	MEX	101.8	433.5	1,117.8		1,551.2
	Total:		363.8	1,549.6	3,052.9	1,520.0	4,602.5
						DC Total:	6,122.5
Monterrey	Washers	MEX	17.4	48.6	120.7		169.3
	Dryers	MEX	7.0	19.5	40.3		59.8
	Ranges	MEX	34.2	95.8	321.2		416.9
	Refrigerators	MEX	30.4	85.0	333.4		418.4
	Total:		88.9	248.8	815.6	100.0	1,064.4
						DC Total:	1,164.4
Mexico City	Washers	MEX	3.4	9.4	23.3		32.7
	Dryers	MEX	1.3	3.6	7.5		11.2
	Ranges	MEX	6.7	18.6	62.5		81.1
	Refrigerators	MEX	5.9	16.4	64.3		80.6
	Total:		17.2	48.0	157.6	20.0	205.6
						DC Total:	225.6
Newark	Washers	MEX	1,149.7	5,368.9	7,997.5		13,366.4
	Dryers	MEX	814.1	3,801.6	4,719.1		8,520.7
	Ranges	MEX	1,049.7	4,901.9	9,857.5		14,759.4
	Refrigerators	MEX	1,327.0	6,196.9	14,577.1		20,774.0
	Total:		4,340.3	20,269.2	37,151.2	1,830.0	57,420.4
						DC Total:	59,250.4
Kansas City	Washers	MEX	308.7	1,330.5	2,147.5		3,478.0
	Dryers	MEX	216.9	934.8	1,257.4		2,192.2
	Ranges	MEX	282.7	1,218.2	2,654.4		3,872.7
	Refrigerators	MEX	357.9	1,542.3	3,931.1		5,473.5
	Total:		1,166.1	5,025.9	9,990.4	1,640.0	15,016.3
						DC Total:	16,656.3
Atlanta	Washers	MEX	1,412.6	6,173.1	9,826.7		15,999.8
	Dryers	MEX	992.3	4,336.4	5,752.4		10,088.8
	Ranges	MEX	1,292.4	5,647.8	12,137.2		17,785.0
	Refrigerators	MEX	1,637.3	7,155.0	17,986.4		25,141.4
	Total:		5,334.6	23,312.2	45,702.7	1,300.0	69,014.9
						DC Total:	70,314.9
Memphis	Washers	MEX	1,387.7	5,814.5	9,653.5		15,467.9
	Dryers	MEX	974.8	4,084.2	5,650.7		9,734.9
	Ranges	MEX	1,269.8	5,320.5	11,925.0		17,245.4
	Refrigerators	MEX	1,608.3	6,738.8	17,667.8		24,406.6
	Total:		5,240.6	21,957.9	44,897.0	1,600.0	66,854.9
						DC Total:	68,454.9

Table G-6 (cont'd.)

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Dallas	Washers	MEX	708.5	2,947.2	4,928.3		7,875.5
	Dryers	MEX	497.7	2,070.4	2,885.2		4,955.6
	Ranges	MEX	648.4	2,697.3	6,089.3		8,786.6
	Refrigerators	MEX	821.3	3,416.4	9,021.8		12,438.2
	Total:		2,675.8	11,131.3	22,924.5	1,600.0	34,055.9
						DC Total:	35,655.9
Phoenix	Washers	MEX	810.9	3,275.8	5,640.7		8,916.5
	Dryers	MEX	569.7	2,301.4	3,302.3		5,603.7
	Ranges	MEX	742.1	2,997.9	6,968.8		9,966.6
	Refrigerators	MEX	940.0	3,797.4	10,325.7		14,123.1
	Total:		3,062.5	12,372.5	26,237.4	1,600.0	38,609.9
						DC Total:	40,209.9
Salt Lake City	Washers	MEX	398.7	1,706.4	2,773.5		4,480.0
	Dryers	MEX	288.5	1,234.8	1,672.5		2,907.2
	Ranges	MEX	361.7	1,548.1	3,396.8		4,944.9
	Refrigerators	MEX	454.7	1,946.1	4,995.1		6,941.2
	Total:		1,503.6	6,435.4	12,837.9	1,670.0	19,273.3
						DC Total:	20,943.3
Firm DC Total:							336,518.9

Total Cost For Transfer Point Operations

<u>TP Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Transfer Cost (\$ 000)</u>
Nuevo Laredo	Washers	MEX	5,384.7	8,561.7
	Dryers	MEX	3,844.4	6,112.5
	Ranges	MEX	4,904.9	7,798.7
	Refrigerators	MEX	6,186.8	15,467.0
	Total:		20,320.7	37,939.9
Ciudad Juarez	Washers	MEX	1,209.6	1,923.2
	Dryers	MEX	858.2	1,364.5
	Ranges	MEX	1,103.8	1,755.0
	Refrigerators	MEX	1,394.7	3,486.6
	Total:		4,566.1	8,529.2
Firm Transfer Point Total:				46,469.1

Table G-6 (cont'd.)

Market Areas Served By Distribution Center Location

Distribution Center: Toronto Market Areas (14):

A1B-St Jo, B2V-Halif, C1A-Charl, H9P-Montr, J8X-Ottaw, J9X-Rouyn, K7K-Kings, L2M-St. C, L4N-Barri,
L4V-Toron, N2B-Kitch, N5Y-Londo, N8N-Winds, P3A-Sudbu

Distribution Center: Regina Market Areas (9):

587-Minot, P7A-Thund, P9N-Kenor, R2X-Winni, S4P-Regin, S7K-Saska, T2H-Calga, T5J-Edmon, V1H-Princ

Distribution Center: Monterrey Market Areas (56):

MX1001-Ti, MX1002-Me, MX1003-En, MX1004-Ba, MX1005-Ba, MX1006-Se, MX1007-He, MX1008-Ca, MX1009-Ci,
MX1010-N, MX1011-Ch, MX1012-S, MX1013-N, MX1014-Mo, MX1015-Sa, MX1016-To, MX1017-NN, MX1018-Mo,
MX1019-SN, MX1020-NL, MX1021-Re, MX1022-Ma, MX1023-CO, MX1024-ST, MX1025-SL, MX1026-N, MX1027-S,
MX1028-ND, MX1029-Du, MX1030-LM, MX1031-Cu, MX1032-Ma, MX1033-Na, MX1034-SJ, MX1035-Gu, MX1036-NJ,
MX1037-Ag, MX1038-Le, MX1039-Ir, MX1040-Ce, MX1041-Qu, MX1042-Hi, MX1043-NV, MX1044-Ja, MX1045-Or,
MX1046-Ve, MX1048-Pu, MX1049-TL, MX1050-Me, MX1051-Me, MX1052-Mo, MX1053-E, MX1055-Co, MX1060-Ca,
MX1061-Yu, MX1062-Qu

Distribution Center: Mexico City Market Areas (6):

MX1047-Co, MX1054-W, MX1056-Gu, MX1057-Oa, MX1058-Ch, MX1059-Ta

Distribution Center: Newark Market Areas (34):

011-Sprng, 016-Worch, 021-Bosto, 029-Provd, 031-Manch, 041-Portl, 047-Bango, 054-Burln, 061-Hartf,
065-NewHa, 069-Stamf, 071-Newar, 089-NewBr, 106-WhitP, 112-Brook, 122-Alban, 126-Pough, 132-Syrac,
139-Bingp, 141-Buffa, 146-Rochs, 181-Allen, 187-Wlks-, 194-Phila, 196-Readi, 198-Wilmn, 497-SSTMa,
E1C-Monct, E2H-Saint, G1A-Quebe, G5H-Rimou, G6G-Thetf, G8V-Trois, J1E-Sherb

Distribution Center: Kansas City Market Areas (15):

503-DesMo, 511-Sioux, 543-Green, 546-EauCl, 554-Minea, 558-Dulut, 559-Rochs, 571-Sioux, 581-Fargo,
641-Kanss, 645-St.Jo, 666-Topek, 681-Omaha, 685-Linco, 691-N.Pla

Distribution Center: Atlanta Market Areas (45):

081-Camde, 152-Pitts, 158-Du Bo, 159-Johns, 165-Erie,, 171-Harrs, 200-Washn, 212-Balti, 215-Cumbr,
229-Harsn, 232-Richm, 235-Norfo, 240-Roano, 253-Charl, 265-Clrks, 274-Green, 276-Ralei, 282-Charl,
283-Fayet, 288-Ashev, 292-Colmb, 294-Charl, 296-Grenv, 303-Atlan, 306-Athen, 309-Augus, 312-Macon,
314-Savan, 317-Alban, 319-Colum, 322-Jacks, 323-Talla, 328-Orlan, 331-Miami, 334-W.Plm, 336-Tampa,
339-FtMye, 352-Birmg, 359-Gadss, 361-Montg, 366-Mobil, 374-Chata, 376-Johns, 379-Knoxv, 405-Lexin

Distribution Center: Memphis Market Areas (47):

354-Tusca, 356-Hunts, 372-Nashv, 381-Memph, 383-Jacks, 387-Grenv, 388-Tupel, 392-Jacks, 393-Merid,
402-Louis, 421-Bowln, 432-Colum, 436-Toled, 441-Clevl, 442-Akron, 445-Young, 449-Mansf, 452-Cncin,
454-Dayto, 458-Lima, 462-Indan, 466-South, 468-Ft.Wa, 473-Munci, 474-Blomn, 477-Evans, 482-Detro,
485-Flint, 486-Sagin, 489-Lansi, 495-GrndR, 520-Dubuq, 528-Daven, 532-Milwa, 537-Madis, 606-Chica,
611-Rockf, 612-Rockl, 616-Peori, 618-Champ, 627-Sprin, 631-StLou, 634-Hanni, 638-CapeG, 701-NewOr,
708-BatrR, 722-Litle

Distribution Center: Dallas Market Areas (31):

648-Jopli, 658-Sprin, 672-Wichi, 678-Dodge, 711-Shrev, 712-Monro, 713-Alexn, 727-Fayet, 729-Ft.Sm,
731-OklaC, 741-Tulsa, 745-Mcals, 752-Dalla, 755-Textar, 757-Tyler, 761-Ft.Wo, 763-Wicht, 767-Waco,,
769-SanAn, 770-Houst, 777-Beaum, 782-SanAn, 784-CorpC, 787-Austi, 791-Amari, 794-Lubbo, 796-Abile,
802-Denve, 810-Puebl, 871-Albuq, 881-Roswe,

Distribution Center: Phoenix Market Areas (12):

799-El Pa, 850-Phoen, 857-Tucso, 891-LasVe, 900-LosAn, 921-SanDi, 924-SanBe, 933-Bakrs, 937-Fresn,
946-Oakla, 952-Stock, 958-Sacra

Distribution Center: Salt Lake City Market Areas (23):

577-Rapid, 591-Billi, 594-Great, 596-Helen, 598-Misou, 815-GrndJ, 820-Cheye, 832-Pocat, 837-Boise,
841-SltLk, 846-Provo, 895-Reno,, 960-Reddi, 972-Portl, 973-Salem, 975-Medfo, 981-Seatt, 982-Evere,
984-Tacom, 989-Yakim, 992-Spoka, 993-Walaw, V3M-Vanco

Table G-7

RQB3D Results: North America 100 Percent Reduction In Tariffs

Summary

<u>Finished Product Demand</u>	<u>(000)</u>
Total Units	24,992.8

<u>Cost Information</u>	<u>(\$000)</u>
Total Purchase Cost	4,533,937.5
Total Manufacturing Cost	6,270,132.2
Total Distribution Center Cost	336,518.9
Transfer Point Cost	46,469.1
Total Transportation Cost	813,519.0
Total System Cost	7,405,714.9

<u>Transportation Cost Detail</u>	<u>(\$000)</u>
Inbound Freight:	60,924.3
Internal Transfer Freight:	422,805.4
Customer Freight:	329,789.3

Total Transportation Cost:	813,519.0
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<u>Facilities Utilized</u>	<u>Type</u>
Reynosa	S
Monterrey	M
Nuevo Laredo	TP
Cuidad Juarez	TP
Toronto	DC
Regina	DC
Monterrey	DC
Mexico City	DC
Newark	DC
Kansas City	DC
Atlanta	DC
Memphis	DC
Dallas	DC
Phoenix	DC
Salt Lake City	DC

Table G-7 (cont'd.)

Purchases By Manufacturing Plant Location (Firm)/ Purchases By Supplier Location

Manufacturing Plant Location: Monterrey

Supplier Location: Reynosa

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.0073	70,496.6	71,011.2	902.2	71,913.4
102	Belts	1.9966	17,940.7	35,820.3	71.8	35,892.1
103	Compressors	45.6000	7,617.7	347,364.8	2,437.3	349,802.1
104	Copper Components	.9687	22,068.8	21,378.1	282.4	21,660.5
105	Cord Sets	1.9213	14,232.6	27,345.1	145.7	27,490.8
106	Corrugated Packaging	1.8540	24,992.8	46,336.7	3,198.6	49,535.2
107	Fasteners	.0085	3,909,539.8	33,231.1	325.2	33,556.3
108	Door Gaskets	7.2960	7,617.7	55,578.4	1,949.8	57,528.2
109	Knobs	.2390	98,946.7	23,648.3	79.1	23,727.4
110	1 Speed Motors	16.7078	4,710.8	78,706.3	904.3	79,610.6
111	2 Speed Motors	22.5720	6,615.0	149,312.7	1,693.2	151,005.8
112	Paint (Powder)	3.0870	7,967.5	24,595.8	102.0	24,697.8
113	Plastic Components	2.9672	24,992.8	74,158.6	479.8	74,638.4
114	Polypropylene Resin	.3337	409,239.8	136,563.3	5,237.5	141,800.8
115	Pumps	5.2661	6,615.0	34,835.0	84.7	34,919.6
116	Relays	6.2423	14,232.6	88,844.2	113.8	88,958.0
117	Steel	.2600	2,045,285.6	531,774.3	26,175.6	557,949.8
118	Switches	.6906	112,305.8	77,558.4	143.7	77,702.1
119	Timers/Motors	6.7396	44,938.9	302,869.9	57.5	302,927.4
120	Wiring Harnesses	4.9065	24,992.8	122,627.2	639.7	123,266.9
121	Misc. Electronics	5.8931	24,992.8	147,285.1	96.0	147,381.0
122	Washer MP	39.8056	6,615.0	263,312.1	2,539.7	265,851.8
123	Dryer MP	33.9691	4,710.8	160,019.9	60.3	160,080.2
124	Range MP	155.3526	6,049.5	939,797.8	7,355.0	947,152.8
125	Refrigerator MP	97.1380	7,617.7	739,963.3	5,849.4	745,812.7
Total:				4,533,937.5	60,924.3	4,594,861.8

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Monterrey

Item No.	Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201	Washers	6,615.0	140.38	4.24	1.40	146.02	965,947.4
202	Dryers	4,710.8	117.50	3.89	1.40	122.79	578,432.7
203	Ranges	6,049.5	214.63	5.49	1.40	221.52	1,340,065.1
204	Refrigerators	7,617.7	238.17	8.06	1.40	247.63	1,886,388.4
Total:		24,992.8				VC Total:	4,770,833.6
						FC Total:	1,499,298.6
						Plant Total:	6,270,132.2
Firm Total:		24,992.8				Firm VC Total:	4,770,833.6
						Firm FC Total:	1,499,298.6
						Firm MFG Total:	6,270,132.2

Table G-7 (cont'd.)

Source Of Finished Products By Distribution Center Location /
Total Cost For Distribution Center Operations

DC Location	Description	Mfg. Source	Units (000)	Variable Labor (\$ 000)	Inv. CC. (\$ 000)	Fixed Cost (\$ 000)	Product DC Total (\$ 000)
Toronto	Washers	MEX	320.5	1,506.1	2,229.2		3,735.3
	Dryers	MEX	268.3	1,261.0	1,555.4		2,816.4
	Ranges	MEX	277.5	1,304.0	2,605.6		3,909.6
	Refrigerators	MEX	333.4	1,567.0	3,662.5		5,229.5
	Total:		1,199.6	5,638.1	10,052.7	1,830.0	15,690.8
						DC Total:	17,520.8
Regina	Washers	MEX	97.2	413.9	675.8		1,089.7
	Dryers	MEX	80.4	342.3	465.8		808.1
	Ranges	MEX	84.5	360.0	793.6		1,153.5
	Refrigerators	MEX	101.8	433.5	1,117.8		1,551.2
	Total:		363.8	1,549.6	3,052.9	1,520.0	4,602.5
						DC Total:	6,122.5
Monterrey	Washers	MEX	17.4	48.6	120.7		169.3
	Dryers	MEX	7.0	19.5	40.3		59.8
	Ranges	MEX	34.2	95.8	321.2		416.9
	Refrigerators	MEX	30.4	85.0	333.4		418.4
	Total:		88.9	248.8	815.6	100.0	1,064.4
						DC Total:	1,164.4
Mexico City	Washers	MEX	3.4	9.4	23.3		32.7
	Dryers	MEX	1.3	3.6	7.5		11.2
	Ranges	MEX	6.7	18.6	62.5		81.1
	Refrigerators	MEX	5.9	16.4	64.3		80.6
	Total:		17.2	48.0	157.6	20.0	205.6
						DC Total:	225.6
Newark	Washers	MEX	1,149.7	5,368.9	7,997.5		13,366.4
	Dryers	MEX	814.1	3,801.6	4,719.1		8,520.7
	Ranges	MEX	1,049.7	4,901.9	9,857.5		14,759.4
	Refrigerators	MEX	1,327.0	6,196.9	14,577.1		20,774.0
	Total:		4,340.3	20,269.2	37,151.2	1,830.0	57,420.4
						DC Total:	59,250.4
Kansas City	Washers	MEX	308.7	1,330.5	2,147.5		3,478.0
	Dryers	MEX	216.9	934.8	1,257.4		2,192.2
	Ranges	MEX	282.7	1,218.2	2,654.4		3,872.7
	Refrigerators	MEX	357.9	1,542.3	3,931.1		5,473.5
	Total:		1,166.1	5,025.9	9,990.4	1,640.0	15,016.3
						DC Total:	16,656.3
Atlanta	Washers	MEX	1,412.6	6,173.1	9,826.7		15,999.8
	Dryers	MEX	992.3	4,336.4	5,752.4		10,088.8
	Ranges	MEX	1,292.4	5,647.8	12,137.2		17,785.0
	Refrigerators	MEX	1,637.3	7,155.0	17,986.4		25,141.4
	Total:		5,334.6	23,312.2	45,702.7	1,300.0	69,014.9
						DC Total:	70,314.9
Memphis	Washers	MEX	1,387.7	5,814.5	9,653.5		15,467.9
	Dryers	MEX	974.8	4,084.2	5,650.7		9,734.9
	Ranges	MEX	1,269.8	5,320.5	11,925.0		17,245.4
	Refrigerators	MEX	1,608.3	6,738.8	17,667.8		24,406.6
	Total:		5,240.6	21,957.9	44,897.0	1,600.0	66,854.9
						DC Total:	68,454.9

Table G-7 (cont'd.)

<u>TP Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Dallas	Washers	MEX	708.5	2,947.2	4,928.3		7,875.5
	Dryers	MEX	497.7	2,070.4	2,885.2		4,955.6
	Ranges	MEX	648.4	2,697.3	6,089.3		8,786.6
	Refrigerators	MEX	821.3	3,416.4	9,021.8		12,438.2
	Total:		2,675.8	11,131.3	22,924.5	1,600.0	34,055.9
						DC Total:	35,655.9
Phoenix	Washers	MEX	810.9	3,275.8	5,640.7		8,916.5
	Dryers	MEX	569.7	2,301.4	3,302.3		5,603.7
	Ranges	MEX	742.1	2,997.9	6,968.8		9,966.6
	Refrigerators	MEX	940.0	3,797.4	10,325.7		14,123.1
	Total:		3,062.5	12,372.5	26,237.4	1,600.0	38,609.9
						DC Total:	40,209.9
Salt Lake City	Washers	MEX	398.7	1,706.4	2,773.5		4,480.0
	Dryers	MEX	288.5	1,234.8	1,672.5		2,907.2
	Ranges	MEX	361.7	1,548.1	3,396.8		4,944.9
	Refrigerators	MEX	454.7	1,946.1	4,995.1		6,941.2
	Total:		1,503.6	6,435.4	12,837.9	1,670.0	19,273.3
						DC Total:	20,943.3
Firm DC Total:							336,518.9

Total Cost For Transfer Point Operations

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Transfer Cost (\$ 000)</u>
Nuevo Laredo	Washers	MEX	5,384.7	8,561.7
	Dryers	MEX	3,844.4	6,112.5
	Ranges	MEX	4,904.9	7,798.7
	Refrigerators	MEX	6,186.8	15,467.0
	Total:		20,320.7	37,939.9
Ciudad Juarez	Washers	MEX	1,209.6	1,923.2
	Dryers	MEX	858.2	1,364.5
	Ranges	MEX	1,103.8	1,755.0
	Refrigerators	MEX	1,394.7	3,486.6
	Total:		4,566.1	8,529.2
Firm Transfer Point Total:				46,469.1

Table G-7 (cont'd.)

Market Areas Serviced By Distribution Center Location

Distribution Center: Toronto Market Areas (14):

A1B-St Jo, B2V-Halif, C1A-Charl, H9P-Montr, J8X-Ottaw, J9X-Rouyn, K7K-Kings, L2M-St. C, L4N-Barri, L4V-Toron, N2B-Kitch, N5Y-Londo, N8N-Winds, P3A-Sudbu

Distribution Center: Regina Market Areas (9):

587-Minot, P7A-Thund, P9N-Kenor, R2X-Winni, S4P-Regin, S7K-Saska, T2H-Calga, T5J-Edmon, V1H-Princ

Distribution Center: Monterrey Market Areas (56):

MX1001-Ti, MX1002-Me, MX1003-En, MX1004-Ba, MX1005-Ba, MX1006-Se, MX1007-He, MX1008-Ca, MX1009-Ci, MX1010-N, MX1011-Ch, MX1012-S, MX1013-N, MX1014-Mo, MX1015-Sa, MX1016-To, MX1017-NN, MX1018-Mo, MX1019-SN, MX1020-NL, MX1021-Re, MX1022-Ma, MX1023-CO, MX1024-ST, MX1025-SL, MX1026-N, MX1027-S, MX1028-ND, MX1029-Du, MX1030-LM, MX1031-Cu, MX1032-Ma, MX1033-Na, MX1034-SJ, MX1035-Gu, MX1036-NJ, MX1037-Ag, MX1038-Le, MX1039-Ir, MX1040-Ce, MX1041-Qu, MX1042-Hi, MX1043-NV, MX1044-Ja, MX1045-Or, MX1046-Ve, MX1048-Pu, MX1049-Tl, MX1050-Me, MX1051-Me, MX1052-Mo, MX1053-E, MX1055-Co, MX1060-Ca, MX1061-Yu, MX1062-Qu

Distribution Center: Mexico City Market Areas (6):

MX1047-Co, MX1054-W, MX1056-Gu, MX1057-Oa, MX1058-Ch, MX1059-Ta

Distribution Center: Newark Market Areas (34):

011-Sprng, 016-Worch, 021-Bosto, 029-Provd, 031-Manch, 041-Portl, 047-Bango, 054-Burln, 061-Hartf, 065-NewHa, 069-Stamf, 071-Newar, 089-NewBr, 106-WhitP, 112-Brook, 122-Alban, 126-Pough, 132-Syrac, 139-Bingp, 141-Buffa, 146-Rochs, 181-Allen, 187-Wlks-, 194-Phila, 196-Readi, 198-Wilmn, 497-SstMa, E1C-Monct, E2H-Saint, G1A-Quebe, G5H-Rimou, G6G-Thetf, G8V-Trois, J1E-Sherb

Distribution Center: Kansas City Market Areas (15):

503-DesMo, 511-Sioux, 543-Green, 546-EauCl, 554-Minea, 558-Dulut, 559-Rochs, 571-Sioux, 581-Fargo, 641-Kanss, 645-St.Jo, 666-Topek, 681-Omaha, 685-Linco, 691-N.Pla

Distribution Center: Atlanta Market Areas (45):

081-Camde, 152-Pitts, 158-Du Bo, 159-Johns, 165-Erie, 171-Harrs, 200-Washn, 212-Balti, 215-Cumbr, 229-Harsn, 232-Richm, 235-Norfo, 240-Roano, 253-Charl, 265-Clrks, 274-Green, 276-Ralei, 282-Charl, 283-Fayet, 288-Ashev, 292-Colmb, 294-Charl, 296-Grenv, 303-Atlan, 306-Athen, 309-Augus, 312-Macon, 314-Savan, 317-Alban, 319-Colum, 322-Jacks, 323-Talla, 328-Orlan, 331-Miami, 334-W.Plm, 336-Tampa, 339-FtMye, 352-Birmg, 359-Gadsd, 361-Montg, 366-Mobil, 374-Chata, 376-Johns, 379-Knoxv, 405-Lexin

Distribution Center: Memphis Market Areas (47):

354-Tusca, 356-Hunts, 372-Nashv, 381-Memph, 383-Jacks, 387-Grenv, 388-Tupel, 392-Jacks, 393-Merid, 402-Louis, 421-BowlN, 432-Colum, 436-Toled, 441-Clelv, 442-Akron, 445-Young, 449-Mansf, 452-Cncin, 454-Dayto, 458-Lima,, 462-Indan, 466-South, 468-Ft.Wa, 473-Munci, 474-Blomn, 477-Evans, 482-Detro, 485-Flint, 486-Sagin, 489-Lansi, 495-GrndR, 520-Dubuq, 528-Daven, 532-Milwa, 537-Madis, 606-Chica, 611-Rockf, 612-Rockl, 616-Peori, 618-Champ, 627-Sprin, 631-StLou, 634-Hanni, 638-CapeG, 701-NewOr, 708-BatrR, 722-Little

Distribution Center: Dallas Market Areas (31):

648-Jopli, 658-Sprin, 672-Wichi, 678-Dodge, 711-Shrev, 712-Monro, 713-Alexn, 727-Fayet, 729-Ft.Sm, 731-OklaC, 741-Tulsa, 745-Mcals, 752-Dalla, 755-Texar, 757-Tyler, 761-Ft.Wo, 763-Wicht, 767-Waco,, 769-SanAn, 770-Houst, 777-Beaum, 782-SanAn, 784-CorpC, 787-Austi, 791-Amari, 794-Lubbo, 796-Abile, 802-Denve, 810-Puebl, 871-Albuq, 881-Roswe

Distribution Center: Phoenix Market Areas (12):

799-El Pa, 850-Phoen, 857-Tucso, 891-LasVe, 900-LosAn, 921-SanDi, 924-SanBe, 933-Bakrs, 937-Fresn, 946-Oakla, 952-Stock, 958-Sacra

Distribution Center: Salt Lake City Market Areas (23):

577-Rapid, 591-Billi, 594-Great, 596-Helen, 598-Misou, 815-GrndJ, 820-Cheye, 832-Pocat, 837-Boise, 841-SltLk, 846-Provo, 895-Reno, 960-Reddi, 972-Portl, 973-Salem, 975-Medfo, 981-Seatt, 982-Evere, 984-Tacom, 989-Yakim, 992-Spoka, 993-Walaw, V3M-Vanco

Table G-8

RQB3E Results: North America 25 Percent Reduction In Cross Border Transaction Costs

Summary

<u>Finished Product Demand</u>	<u>(000)</u>
Total Units	24,992.8

<u>Cost Information</u>	<u>(\$000)</u>
Total Purchase Cost	4,533,937.5
Total Manufacturing Cost	6,270,132.2
Total Distribution Center Cost	336,518.9
Transfer Point Cost	46,469.1
Total Transportation Cost	831,276.7
Total System Cost	7,423,472.6

<u>Transportation Cost Detail</u>	<u>(\$000)</u>
Inbound Freight:	60,924.3
Internal Transfer Freight:	431,162.5
Customer Freight:	831,276.7

Total Transportation Cost:

<u>Facilities Utilized</u>	<u>Type</u>
Reynosa	S
Monterrey	M
Nuevo Laredo	TP
Cuidad Juarez	TP
Toronto	DC
Regina	DC
Monterrey	DC
Mexico City	DC
Newark	DC
Kansas City	DC
Atlanta	DC
Memphis	DC
Dallas	DC
Phoenix	DC
Salt Lake City	DC

Table G-8 (cont'd.)

Purchases By Manufacturing Plant Location (Firm)/ Purchases By Supplier Location

Manufacturing Plant Location: Monterrey

Supplier Location: Reynosa

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.0073	70,496.6	71,011.2	902.2	71,913.4
102	Belts	1.9966	17,940.7	35,820.3	71.8	35,892.1
103	Compressors	45.6000	7,617.7	347,364.8	2,437.3	349,802.1
104	Copper Components	.9687	22,068.8	21,378.1	282.4	21,660.5
105	Cord Sets	1.9213	14,232.6	27,345.1	145.7	27,490.8
106	Corrugated Packaging	1.8540	24,992.8	46,336.7	3,198.6	49,535.2
107	Fasteners	.0085	3,909,539.8	33,231.1	325.2	33,556.3
108	Door Gaskets	7.2960	7,617.7	55,578.4	1,949.8	57,528.2
109	Knobs	.2390	98,946.7	23,648.3	79.1	23,727.4
110	1 Speed Motors	16.7078	4,710.8	78,706.3	904.3	79,610.6
111	2 Speed Motors	22.5720	6,615.0	149,312.7	1,693.2	151,005.8
112	Paint (Powder)	3.0870	7,967.5	24,595.8	102.0	24,697.8
113	Plastic Components	2.9672	24,992.8	74,158.6	479.8	74,638.4
114	Polypropylene Resin	.3337	409,239.8	136,563.3	5,237.5	141,800.8
115	Pumps	5.2661	6,615.0	34,835.0	84.7	34,919.6
116	Relays	6.2423	14,232.6	88,844.2	113.8	88,958.0
117	Steel	.2600	2,045,285.6	531,774.3	26,175.6	557,949.8
118	Switches	.6906	112,305.8	77,558.4	143.7	77,702.1
119	Timers/Motors	6.7396	44,938.9	302,869.9	57.5	302,927.4
120	Wiring Harnesses	4.9065	24,992.8	122,627.2	639.7	123,266.9
121	Misc. Electronics	5.8931	24,992.8	147,285.1	96.0	147,381.0
122	Washer MP	39.8056	6,615.0	263,312.1	2,539.7	265,851.8
123	Dryer MP	33.9691	4,710.8	160,019.9	60.3	160,080.2
124	Range MP	155.3526	6,049.5	939,797.8	7,355.0	947,152.8
125	Refrigerator MP	97.1380	7,617.7	739,963.3	5,849.4	745,812.7

Total: 4,533,937.5 60,924.3 4,594,861.8

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Monterrey

Item No.	Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201	Washers	6,615.0	140.38	4.24	1.40	146.02	965,947.4
202	Dryers	4,710.8	117.50	3.89	1.40	122.79	578,432.7
203	Ranges	6,049.5	214.63	5.49	1.40	221.52	1,340,065.1
204	Refrigerators	7,617.7	238.17	8.06	1.40	247.63	1,886,388.4

Total: 24,992.8

VC Total: 4,770,833.6

FC Total: 1,499,298.6

Plant Total: 6,270,132.2

Firm Total: 24,992.8

Firm VC Total: 4,770,833.6

Firm FC Total: 1,499,298.6

Firm MFG Total: 6,270,132.2

Table G-8 (cont'd.)

Source Of Finished Products By Distribution Center Location /
Total Cost For Distribution Center Operations

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Toronto	Washers	MEX	320.5	1,506.1	2,229.2		3,735.3
	Dryers	MEX	268.3	1,261.0	1,555.4		2,816.4
	Ranges	MEX	277.5	1,304.0	2,605.6		3,909.6
	Refrigerators	MEX	333.4	1,567.0	3,662.5		5,229.5
	Total:		1,199.6	5,638.1	10,052.7	1,830.0	15,690.8
						DC Total:	17,520.8
Regina	Washers	MEX	97.2	413.9	675.8		1,089.7
	Dryers	MEX	80.4	342.3	465.8		808.1
	Ranges	MEX	84.5	360.0	793.6		1,153.5
	Refrigerators	MEX	101.8	433.5	1,117.8		1,551.2
	Total:		363.8	1,549.6	3,052.9	1,520.0	4,602.5
						DC Total:	6,122.5
Monterrey	Washers	MEX	17.4	48.6	120.7		169.3
	Dryers	MEX	7.0	19.5	40.3		59.8
	Ranges	MEX	34.2	95.8	321.2		416.9
	Refrigerators	MEX	30.4	85.0	333.4		418.4
	Total:		88.9	248.8	815.6	100.0	1,064.4
						DC Total:	1,164.4
Mexico City	Washers	MEX	3.4	9.4	23.3		32.7
	Dryers	MEX	1.3	3.6	7.5		11.2
	Ranges	MEX	6.7	18.6	62.5		81.1
	Refrigerators	MEX	5.9	16.4	64.3		80.6
	Total:		17.2	48.0	157.6	20.0	205.6
						DC Total:	225.6
Newark	Washers	MEX	1,149.7	5,368.9	7,997.5		13,366.4
	Dryers	MEX	814.1	3,801.6	4,719.1		8,520.7
	Ranges	MEX	1,049.7	4,901.9	9,857.5		14,759.4
	Refrigerators	MEX	1,327.0	6,196.9	14,577.1		20,774.0
	Total:		4,340.3	20,269.2	37,151.2	1,830.0	57,420.4
						DC Total:	59,250.4
Kansas City	Washers	MEX	308.7	1,330.5	2,147.5		3,478.0
	Dryers	MEX	216.9	934.8	1,257.4		2,192.2
	Ranges	MEX	282.7	1,218.2	2,654.4		3,872.7
	Refrigerators	MEX	357.9	1,542.3	3,931.1		5,473.5
	Total:		1,166.1	5,025.9	9,990.4	1,640.0	15,016.3
						DC Total:	16,656.3
Atlanta	Washers	MEX	1,412.6	6,173.1	9,826.7		15,999.8
	Dryers	MEX	992.3	4,336.4	5,752.4		10,088.8
	Ranges	MEX	1,292.4	5,647.8	12,137.2		17,785.0
	Refrigerators	MEX	1,637.3	7,155.0	17,986.4		25,141.4
	Total:		5,334.6	23,312.2	45,702.7	1,300.0	69,014.9
						DC Total:	70,314.9
Memphis	Washers	MEX	1,387.7	5,814.5	9,653.5		15,467.9
	Dryers	MEX	974.8	4,084.2	5,650.7		9,734.9
	Ranges	MEX	1,269.8	5,320.5	11,925.0		17,245.4
	Refrigerators	MEX	1,608.3	6,738.8	17,667.8		24,406.6
	Total:		5,240.6	21,957.9	44,897.0	1,600.0	66,854.9
						DC Total:	68,454.9

Table G-8 (cont'd.)

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Dallas	Washers	MEX	708.5	2,947.2	4,928.3		7,875.5
	Dryers	MEX	497.7	2,070.4	2,885.2		4,955.6
	Ranges	MEX	648.4	2,697.3	6,089.3		8,786.6
	Refrigerators	MEX	821.3	3,416.4	9,021.8		12,438.2
	Total:		2,675.8	11,131.3	22,924.5	1,600.0	34,055.9
						DC Total:	35,655.9
Phoenix	Washers	MEX	810.9	3,275.8	5,640.7		8,916.5
	Dryers	MEX	569.7	2,301.4	3,302.3		5,603.7
	Ranges	MEX	742.1	2,997.9	6,968.8		9,966.6
	Refrigerators	MEX	940.0	3,797.4	10,325.7		14,123.1
	Total:		3,062.5	12,372.5	26,237.4	1,600.0	38,609.9
						DC Total:	40,209.9
Salt Lake City	Washers	MEX	398.7	1,706.4	2,773.5		4,480.0
	Dryers	MEX	288.5	1,234.8	1,672.5		2,907.2
	Ranges	MEX	361.7	1,548.1	3,396.8		4,944.9
	Refrigerators	MEX	454.7	1,946.1	4,995.1		6,941.2
	Total:		1,503.6	6,435.4	12,837.9	1,670.0	19,273.3
						DC Total:	20,943.3
Firm DC Total:							336,518.9

Total Cost For Transfer Point Operations

<u>TP Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Transfer Cost (\$ 000)</u>
Nuevo Laredo	Washers	MEX	5,447.3	8,661.2
	Dryers	MEX	3,896.8	6,195.8
	Ranges	MEX	4,959.1	7,884.9
	Refrigerators	MEX	6,251.9	15,629.8
	Total:		20,555.0	38,371.7
Ciudad Juarez	Washers	MEX	1,147.0	1,823.7
	Dryers	MEX	805.8	1,281.1
	Ranges	MEX	1,049.6	1,668.8
	Refrigerators	MEX	1,329.6	3,323.9
	Total:		4,331.8	8,097.5
Firm Transfer Point Total:				46,469.1

Table G-8 (cont'd.)

Market Areas Served By Distribution Center Location

Distribution Center: Toronto Market Areas (14):

A1B-St Jo, B2V-Halif, C1A-Charl, H9P-Montr, J8X-Ottaw, J9X-Rouyn, K7K-Kings, L2M-St. C, L4N-Barri, L4V-Toron, N2B-Kitch, N5Y-Londo, N8N-Winds, P3A-Sudbu

Distribution Center: Regina Market Areas (9):

587-Minot, P7A-Thund, P9N-Kenor, R2X-Winni, S4P-Regin, S7K-Saska, T2H-Calga, T5J-Edmon, V1H-Princ

Distribution Center: Monterrey Market Areas (56):

MX1001-Ti, MX1002-Me, MX1003-En, MX1004-Ba, MX1005-Ba, MX1006-Se, MX1007-He, MX1008-Ca, MX1009-Ci, MX1010-N, MX1011-Ch, MX1012-S, MX1013-N, MX1014-Mo, MX1015-Sa, MX1016-To, MX1017-NM, MX1018-Mo, MX1019-SN, MX1020-NL, MX1021-Re, MX1022-Ma, MX1023-Co, MX1024-ST, MX1025-SL, MX1026-N, MX1027-S, MX1028-ND, MX1029-Du, MX1030-LM, MX1031-Cu, MX1032-Ma, MX1033-Na, MX1034-SJ, MX1035-Gu, MX1036-NJ, MX1037-Ag, MX1038-Le, MX1039-Ir, MX1040-Ce, MX1041-Qu, MX1042-Hi, MX1043-NV, MX1044-Ja, MX1045-Or, MX1046-Ve, MX1048-Pu, MX1049-Tl, MX1050-Me, MX1051-Me, MX1052-Mo, MX1053-E, MX1055-Co, MX1060-Ca, MX1061-Yu, MX1062-Qu

Distribution Center: Mexico City Market Areas (6):

MX1047-Co, MX1054-W, MX1056-Gu, MX1057-Oa, MX1058-Ch, MX1059-Ta

Distribution Center: Newark Market Areas (34):

011-Sprng, 016-Worch, 021-Bosto, 029-Provd, 031-Manch, 041-Portl, 047-Bango, 054-Burln, 061-Hartf, 065-NewHa, 069-Stamf, 071-Newar, 089-NewBr, 106-WhitP, 112-Brook, 122-Alban, 126-Pough, 132-Syrac, 139-Bingp, 141-Buffa, 146-Rochs, 181-Allen, 187-Wlks-, 194-Phila, 196-Readi, 198-Wilmn, 497-SSTMa, E1C-Monct, E2H-Saint, G1A-Quebe, G5H-Rimou, G6G-Thet, G8V-Trois, J1E-Sherb

Distribution Center: Kansas City Market Areas (15):

503-DesMo, 511-Sioux, 543-Green, 546-EauCl, 554-Minea, 558-Dulut, 559-Rochs, 571-Sioux, 581-Fargo, 641-Kanss, 645-St.Jo, 666-Topek, 681-Omaha, 685-Linco, 691-N.Pla

Distribution Center: Atlanta Market Areas (45):

081-Camde, 152-Pitts, 158-Du Bo, 159-Johns, 165-Erie,, 171-Harrs, 200-Washn, 212-Balti, 215-Cumbr, 229-Harsn, 232-Richm, 235-Norfo, 240-Roano, 253-Charl, 265-Clrks, 274-Green, 276-Ralei, 282-Charl, 283-Fayet, 288-Ashev, 292-Colmb, 294-Charl, 296-Grenv, 303-Atlan, 306-Athen, 309-Augus, 312-Macon, 314-Savan, 317-Alban, 319-Colum, 322-Jacks, 323-Talla, 328-Orlan, 331-Miami, 334-W.Plm, 336-Tampa, 339-FtMye, 352-Birmg, 359-Gadsd, 361-Montg, 366-Mobil, 374-Chata, 376-Johns, 379-Knoxv, 405-Lexin

Distribution Center: Memphis Market Areas (47):

354-Tusca, 356-Hunts, 372-Nashv, 381-Memph, 383-Jacks, 387-Grenv, 388-Tupel, 392-Jacks, 393-Merid, 402-Louis, 421-Bowln, 432-Colum, 436-Toled, 441-Clevl, 442-Akron, 445-Young, 449-Mansf, 452-Cncin, 454-Dayto, 458-Lima,, 462-Indan, 466-South, 468-Ft.Wa, 473-Munci, 474-Blomn, 477-Evans, 482-Detro, 485-Flint, 486-Sagin, 489-Lansi, 495-GrndR, 520-Dubuq, 528-Daven, 532-Milwa, 537-Madis, 606-Chica, 611-Rockf, 612-Rockl, 616-Peori, 618-Champ, 627-Sprin, 631-StLou, 634-Hanni, 638-CapeG, 701-NewOr, 708-BatrR, 722-Litle

Distribution Center: Dallas Market Areas (31):

648-Jopli, 658-Sprin, 672-Wichi, 678-Dodge, 711-Shrev, 712-Monro, 713-Alexn, 727-Fayet, 729-Ft.Sm, 731-OklaC, 741-Tulsa, 745-Mcals, 752-Dalla, 755-Textar, 757-Tyler, 761-Ft.Wo, 763-Wicht, 767-Waco,, 769-SanAn, 770-Houst, 777-Beaum, 782-SanAn, 784-CorpC, 787-Austi, 791-Amari, 794-Lubb,, 796-Abile, 802-Denve, 810-Puebl, 871-Albuq, 881-Roswe

Distribution Center: Phoenix Market Areas (12):

799-El Pa, 850-Phoen, 857-Tucso, 891-LasVe, 900-LosAn, 921-SanDi, 924-SanBe, 933-Bakrs, 937-Fresn, 946-Oakla, 952-Stock, 958-Sacra

Distribution Center: Salt Lake City Market Areas (23):

577-Rapid, 591-Billi, 594-Great, 596-Helen, 598-Misou, 815-GrndJ, 820-Cheye, 832-Pocat, 837-Boise, 841-SltLk, 846-Provo, 895-Reno,, 960-Reddi, 972-Portl, 973-Salem, 975-Medfo, 981-Seatt, 982-Evere, 984-Tacom, 989-Yakim, 992-Spoka, 993-Walaw, V3M-Vanco

Table G-9

RQB3F Results: North America 50 Percent Reduction In Cross Border Transaction Costs

Summary

<u>Finished Product Demand</u>	(000)
Total Units	24,992.8

<u>Cost Information</u>	(\$000)
Total Purchase Cost	4,533,937.5
Total Manufacturing Cost	6,270,132.2
Total Distribution Center Cost	336,518.9
Transfer Point Cost	46,469.1
Total Transportation Cost	806,324.9
Total System Cost	7,398,520.8

<u>Transportation Cost Detail</u>	(\$000)
Inbound Freight:	60,924.3
Internal Transfer Freight:	406,443.4
Customer Freight:	338,957.2

Total Transportation Cost:	806,324.9
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<u>Facilities Utilized</u>	<u>Type</u>
Reynosa	S
Monterrey	M
Nuevo Laredo	TP
Ciudad Juarez	TP
Toronto	DC
Regina	DC
Monterrey	DC
Mexico City	DC
Newark	DC
Kansas City	DC
Atlanta	DC
Memphis	DC
Dallas	DC
Phoenix	DC
Salt Lake City	DC

Table G-9 (cont'd.)

Purchases By Manufacturing Plant Location (Firm)/ Purchases By Supplier Location

Manufacturing Plant Location: Monterrey Supplier Location: Reynosa

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.0073	70,496.6	71,011.2	902.2	71,913.4
102	Belts	1.9966	17,940.7	35,820.3	71.8	35,892.1
103	Compressors	45.6000	7,617.7	347,364.8	2,437.3	349,802.1
104	Copper Components	.9687	22,068.8	21,378.1	282.4	21,660.5
105	Cord Sets	1.9213	14,232.6	27,345.1	145.7	27,490.8
106	Corrugated Packaging	1.8540	24,992.8	46,336.7	3,198.6	49,535.2
107	Fasteners	.0085	3,909,539.8	33,231.1	325.2	33,556.3
108	Door Gaskets	7.2960	7,617.7	55,578.4	1,949.8	57,528.2
109	Knobs	.2390	98,946.7	23,648.3	79.1	23,727.4
110	1 Speed Motors	16.7078	4,710.8	78,706.3	904.3	79,610.6
111	2 Speed Motors	22.5720	6,615.0	149,312.7	1,693.2	151,005.8
112	Paint (Powder)	3.0870	7,967.5	24,595.8	102.0	24,697.8
113	Plastic Components	2.9672	24,992.8	74,158.6	479.8	74,638.4
114	Polypropylene Resin	.3337	409,239.8	136,563.3	5,237.5	141,800.8
115	Pumps	5.2661	6,615.0	34,835.0	84.7	34,919.6
116	Relays	6.2423	14,232.6	88,844.2	113.8	88,958.0
117	Steel	.2600	2,045,285.6	531,774.3	26,175.6	557,949.8
118	Switches	.6906	112,305.8	77,558.4	143.7	77,702.1
119	Timers/Motors	6.7396	44,938.9	302,869.9	57.5	302,927.4
120	Wiring Harnesses	4.9065	24,992.8	122,627.2	639.7	123,266.9
121	Misc. Electronics	5.8931	24,992.8	147,285.1	96.0	147,381.0
122	Washer MP	39.8056	6,615.0	263,312.1	2,539.7	265,851.8
123	Dryer MP	33.9691	4,710.8	160,019.9	60.3	160,080.2
124	Range MP	155.3526	6,049.5	939,797.8	7,355.0	947,152.8
125	Refrigerator MP	97.1380	7,617.7	739,963.3	5,849.4	745,812.7
Total:				4,533,937.5	60,924.3	4,594,861.8

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Monterrey

Item	Quantity	Purchased Materials/	Mfg. Labor/	Transfer Handling/	Mfg. VC/	Total Mfg. VC	
No. Description	(000)	Unit (\$)	Unit (\$)	Unit (\$)	Unit (\$)	(\$ 000)	
201 Washers	6,615.0	140.38	4.24	1.40	146.02	965,947.4	
202 Dryers	4,710.8	117.50	3.89	1.40	122.79	578,432.7	
203 Ranges	6,049.5	214.63	5.49	1.40	221.52	1,340,065.1	
204 Refrigerators	7,617.7	238.17	8.06	1.40	247.63	1,886,388.4	
Total:		24,992.8			VC Total:	4,770,833.6	
						FC Total:	1,499,298.6
						Plant Total:	6,270,132.2
Firm Total:		24,992.8			Firm VC Total:	4,770,833.6	
						Firm FC Total:	1,499,298.6
						Firm MFG Total:	6,270,132.2

Table G-9 (cont'd.)

Source Of Finished Products By Distribution Center Location /
Total Cost For Distribution Center Operations

<u>DC Location</u>	<u>Description</u>	<u>Mfg.</u> <u>Source</u>	<u>Units</u> <u>(000)</u>	<u>Variable</u> <u>Labor</u> <u>(\$ 000)</u>	<u>Inv.</u> <u>CC.</u> <u>(\$ 000)</u>	<u>Fixed</u> <u>Cost</u> <u>(\$ 000)</u>	<u>Product</u> <u>DC Total</u> <u>(\$ 000)</u>
Toronto	Washers	MEX	320.5	1,506.1	2,229.2		3,735.3
	Dryers	MEX	268.3	1,261.0	1,555.4		2,816.4
	Ranges	MEX	277.5	1,304.0	2,605.6		3,909.6
	Refrigerators	MEX	333.4	1,567.0	3,662.5		5,229.5
	Total:		1,199.6	5,638.1	10,052.7	1,830.0	15,690.8
						DC Total:	17,520.8
Regina	Washers	MEX	97.2	413.9	675.8		1,089.7
	Dryers	MEX	80.4	342.3	465.8		808.1
	Ranges	MEX	84.5	360.0	793.6		1,153.5
	Refrigerators	MEX	101.8	433.5	1,117.8		1,551.2
	Total:		363.8	1,549.6	3,052.9	1,520.0	4,602.5
						DC Total:	6,122.5
Monterrey	Washers	MEX	17.4	48.6	120.7		169.3
	Dryers	MEX	7.0	19.5	40.3		59.8
	Ranges	MEX	34.2	95.8	321.2		416.9
	Refrigerators	MEX	30.4	85.0	333.4		418.4
	Total:		88.9	248.8	815.6	100.0	1,064.4
						DC Total:	1,164.4
Mexico City	Washers	MEX	3.4	9.4	23.3		32.7
	Dryers	MEX	1.3	3.6	7.5		11.2
	Ranges	MEX	6.7	18.6	62.5		81.1
	Refrigerators	MEX	5.9	16.4	64.3		80.6
	Total:		17.2	48.0	157.6	20.0	205.6
						DC Total:	225.6
Newark	Washers	MEX	1,149.7	5,368.9	7,997.5		13,366.4
	Dryers	MEX	814.1	3,801.6	4,719.1		8,520.7
	Ranges	MEX	1,049.7	4,901.9	9,857.5		14,759.4
	Refrigerators	MEX	1,327.0	6,196.9	14,577.1		20,774.0
	Total:		4,340.3	20,269.2	37,151.2	1,830.0	57,420.4
						DC Total:	59,250.4
Kansas City	Washers	MEX	308.7	1,330.5	2,147.5		3,478.0
	Dryers	MEX	216.9	934.8	1,257.4		2,192.2
	Ranges	MEX	282.7	1,218.2	2,654.4		3,872.7
	Refrigerators	MEX	357.9	1,542.3	3,931.1		5,473.5
	Total:		1,166.1	5,025.9	9,990.4	1,640.0	15,016.3
						DC Total:	16,656.3
Atlanta	Washers	MEX	1,412.6	6,173.1	9,826.7		15,999.8
	Dryers	MEX	992.3	4,336.4	5,752.4		10,088.8
	Ranges	MEX	1,292.4	5,647.8	12,137.2		17,785.0
	Refrigerators	MEX	1,637.3	7,155.0	17,986.4		25,141.4
	Total:		5,334.6	23,312.2	45,702.7	1,300.0	69,014.9
						DC Total:	70,314.9
Memphis	Washers	MEX	1,387.7	5,814.5	9,653.5		15,467.9
	Dryers	MEX	974.8	4,084.2	5,650.7		9,734.9
	Ranges	MEX	1,269.8	5,320.5	11,925.0		17,245.4
	Refrigerators	MEX	1,608.3	6,738.8	17,667.8		24,406.6
	Total:		5,240.6	21,957.9	44,897.0	1,600.0	66,854.9
						DC Total:	68,454.9

Table G-9 (cont'd.)

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Dallas	Washers	MEX	708.5	2,947.2	4,928.3		7,875.5
	Dryers	MEX	497.7	2,070.4	2,885.2		4,955.6
	Ranges	MEX	648.4	2,697.3	6,089.3		8,786.6
	Refrigerators	MEX	821.3	3,416.4	9,021.8		12,438.2
	Total:		2,675.8	11,131.3	22,924.5	1,600.0	34,055.9
						DC Total:	35,655.9
Phoenix	Washers	MEX	810.9	3,275.8	5,640.7		8,916.5
	Dryers	MEX	569.7	2,301.4	3,302.3		5,603.7
	Ranges	MEX	742.1	2,997.9	6,968.8		9,966.6
	Refrigerators	MEX	940.0	3,797.4	10,325.7		14,123.1
	Total:		3,062.5	12,372.5	26,237.4	1,600.0	38,609.9
						DC Total:	40,209.9
Salt Lake City	Washers	MEX	398.7	1,706.4	2,773.5		4,480.0
	Dryers	MEX	288.5	1,234.8	1,672.5		2,907.2
	Ranges	MEX	361.7	1,548.1	3,396.8		4,944.9
	Refrigerators	MEX	454.7	1,946.1	4,995.1		6,941.2
	Total:		1,503.6	6,435.4	12,837.9	1,670.0	19,273.3
						DC Total:	20,943.3
Firm DC Total:							336,518.9

Total Cost For Transfer Point Operations

<u>TP Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Transfer Cost (\$ 000)</u>
Nuevo Laredo	Washers	MEX	5,384.7	8,561.7
	Dryers	MEX	3,844.4	6,112.5
	Ranges	MEX	4,904.9	7,798.7
	Refrigerators	MEX	6,186.8	15,467.0
	Total:		20,320.7	37,939.9
Ciudad Juarez	Washers	MEX	1,209.6	1,923.2
	Dryers	MEX	858.2	1,364.5
	Ranges	MEX	1,103.8	1,755.0
	Refrigerators	MEX	1,394.7	3,486.6
	Total:		4,566.1	8,529.2

Firm Transfer Point Total: 46,469.1

Table G-9 (cont'd.)

Market Areas Serviced By Distribution Center Location

Distribution Center: Toronto Market Areas (14):

A1B-St Jo, B2V-Halif, C1A-Charl, H9P-Montr, J8X-Ottaw, J9X-Rouyn, K7K-Kings, L2M-St. C, L4N-Barri, L4V-Toron, N2B-Kitch, N5Y-Londo, N8N-Winds, P3A-Sudbu

Distribution Center: Regina Market Areas (9):

587-Minot, P7A-Thund, P9N-Kenor, R2X-Winni, S4P-Regin, S7K-Saska, T2H-Calga, T5J-Edmon, V1H-Princ

Distribution Center: Monterrey Market Areas (56):

MX1001-Ti, MX1002-Me, MX1003-En, MX1004-Ba, MX1005-Ba, MX1006-Se, MX1007-He, MX1008-Ca, MX1009-Ci, MX1010-N, MX1011-Ch, MX1012-S, MX1013-N, MX1014-Mo, MX1015-Sa, MX1016-To, MX1017-NN, MX1018-Mo, MX1019-SN, MX1020-NL, MX1021-Re, MX1022-Ma, MX1023-CO, MX1024-ST, MX1025-SL, MX1026-N, MX1027-S, MX1028-ND, MX1029-Du, MX1030-LM, MX1031-Cu, MX1032-Ma, MX1033-Na, MX1034-SJ, MX1035-Gu, MX1036-NJ, MX1037-Ag, MX1038-Le, MX1039-Ir, MX1040-Ce, MX1041-Ou, MX1042-Hi, MX1043-NV, MX1044-Ja, MX1045-Or, MX1046-Ve, MX1048-Pu, MX1049-Tl, MX1050-Me, MX1051-Me, MX1052-Mo, MX1053-E, MX1055-Co, MX1060-Ca, MX1061-Yu, MX1062-Qu

Distribution Center: Mexico City Market Areas (6):

MX1047-Co, MX1054-W, MX1056-Gu, MX1057-Oa, MX1058-Ch, MX1059-Ta

Distribution Center: Newark Market Areas (34):

011-Sprng, 016-Worch, 021-Bosto, 029-Provd, 031-Manch, 041-Portl, 047-Bango, 054-Burln, 061-Hartf, 065-NewHa, 069-Stamf, 071-Newar, 089-NewBr, 106-WhitP, 112-Brook, 122-Alban, 126-Pough, 132-Syrac, 139-Bingp, 141-Buffa, 146-Rochs, 181-Allen, 187-Wlks-, 194-Phila, 196-Readi, 198-Wilmn, 497-SStMa, E1C-Monct, E2H-Saint, G1A-Quebe, G5H-Rimou, G6G-Thet, G8V-Trois, J1E-Sherb

Distribution Center: Kansas City Market Areas (15):

503-DesMo, 511-Sioux, 543-Green, 546-EauCl, 554-Minea, 558-Dulut, 559-Rochs, 571-Sioux, 581-Fargo, 641-Kanss, 645-St.Jo, 666-Topek, 681-Omaha, 685-Linco, 691-N.Pla

Distribution Center: Atlanta Market Areas (45):

081-Camde, 152-Pitts, 158-Du Bo, 159-Johns, 165-Erie,, 171-Harrs, 200-Washn, 212-Balti, 215-Cumbr, 229-Harsn, 232-Richm, 235-Norfo, 240-Roano, 253-Charl, 265-Clrks, 274-Green, 276-Ralei, 282-Charl, 283-Fayet, 288-Ashev, 292-Colmb, 294-Charl, 296-Grenv, 303-Atlan, 306-Athen, 309-Augus, 312-Macon, 314-Savan, 317-Alban, 319-Colum, 322-Jacks, 323-Talla, 328-Orlan, 331-Miami, 334-W.Plm, 336-Tampa, 339-FtMye, 352-Birmg, 359-Gadstd, 361-Montg, 366-Mobil, 374-Chata, 376-Johns, 379-Knoxv, 405-Lexin

Distribution Center: Memphis Market Areas (47):

354-Tusca, 356-Hunts, 372-Nashv, 381-Memph, 383-Jacks, 387-Grenv, 388-Tupel, 392-Jacks, 393-Merid, 402-Louis, 421-Bowln, 432-Colum, 436-Toled, 441-Cleвл, 442-Akron, 445-Young, 449-Mansf, 452-Cncin, 454-Dayto, 458-Lima,, 462-Indan, 466-South, 468-Ft.Wa, 473-Munci, 474-Blomn, 477-Evans, 482-Detro, 485-Flint, 486-Sagin, 489-Lansi, 495-GrndR, 520-Dubuq, 528-Daven, 532-Milwa, 537-Madis, 606-Chica, 611-Rockf, 612-RockI, 616-Peori, 618-Champ, 627-Sprin, 631-StLou, 634-Hanni, 638-CapeG, 701-NewOr, 708-BatrR, 722-Litle

Distribution Center: Dallas Market Areas (31):

648-Jopli, 658-Sprin, 672-Wichi, 678-Dodge, 711-Shrev, 712-Monro, 713-Alexn, 727-Fayet, 729-Ft.Sm, 731-OklaC, 741-Tulsa, 745-Mcals, 752-Dalla, 755-Texar, 757-Tyler, 761-Ft.Wo, 763-Wicht, 767-Waco,, 769-SanAn, 770-Houst, 777-Beaum, 782-SanAn, 784-CorpC, 787-Austi, 791-Amari, 794-Lubb,, 796-Abile, 802-Denve, 810-Puebl, 871-Albuq, 881-Roswe

Distribution Center: Phoenix Market Areas (12):

799-El Pa, 850-Phoen, 857-Tucso, 891-LasVe, 900-LosAn, 921-SanDi, 924-SanBe, 933-Bakrs, 937-Fresn, 946-Oakla, 952-Stock, 958-Sacra

Distribution Center: Salt Lake City Market Areas (23):

577-Rapid, 591-Billi, 594-Great, 596-Helen, 598-Misou, 815-GrndJ, 820-Cheye, 832-Pocat, 837-Boise, 841-Sltlk, 846-Provo, 895-Reno,, 960-Reddi, 972-Portl, 973-Salem, 975-Medfo, 981-Seatt, 982-Evere, 984-Tacom, 989-Yakim, 992-Spoka, 993-Walaw, V3M-Vanco

Table G-10

RQB4A Results: North American Sourcing Series - Separate Countries

Summary

<u>Finished Product Demand</u>	<u>(000)</u>
Total Units	24,992.8

<u>Cost Information</u>	<u>(\$000)</u>
Total Purchase Cost	5,092,347.4
Total Manufacturing Cost	7,866,507.5
Total Distribution Center Cost	347,993.2
Total Transportation Cost	543,646.1
Total System Cost	8,702,374.4

<u>Transportation Cost Detail</u>	<u>(\$000)</u>
Inbound Freight:	55,772.4
Internal Transfer Freight:	145,160.6
Customer Freight:	342,713.1
Total Transportation Cost:	543,646.1

<u>Facilities Utilized</u>	<u>Type</u>
Woodstock	S
Reynosa	S
Fort Wayne	S
Toronto	M
Monterrey	M
Indianapolis	M
Nuevo Laredo	TP
Cuidad Juarez	TP
Montreal	DC
Toronto	DC
Edmonton	DC
Monterrey	DC
Mexico City	DC
Worcester	DC
Indianapolis	DC
Atlanta	DC
Dallas	DC
Los Angeles	DC
Salt Lake City	DC

Table G-10 (cont'd.)

Purchases By Manufacturing Plant Location

Manufacturing Plant Location: Toronto

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.1630	5,073.2	5,900.1	87.8	5,987.9
102	Belts	2.4367	1,481.1	3,609.0	8.0	3,617.0
103	Compressors	50.4000	543.1	27,369.7	235.0	27,604.7
104	Copper Components	1.0574	1,583.7	1,674.6	27.4	1,702.0
105	Cord Sets	2.2799	1,065.1	2,428.3	14.8	2,443.1
106	Corrugated Packaging	2.2860	1,954.2	4,467.3	338.3	4,805.6
107	Fasteners	.0101	308,976.4	3,120.7	34.8	3,155.4
108	Door Gaskets	8.0640	543.1	4,379.2	18.8	4,398.0
109	Knobs	.2510	7,595.2	1,906.4	8.2	1,914.6
110	1 Speed Motors	18.4666	437.0	8,069.9	113.5	8,183.4
111	2 Speed Motors	24.9480	522.1	13,024.1	180.7	13,204.8
112	Paint (Powder)	3.2648	614.7	2,006.8	10.6	2,017.5
113	Plastic Components	3.5484	1,954.2	6,934.3	50.7	6,985.0
114	Polypropylene Resin	.3624	30,385.8	11,011.8	526.0	11,537.8
115	Pumps	6.0667	522.1	3,167.1	9.0	3,176.2
116	Relays	7.0689	1,065.1	7,529.1	11.5	7,540.6
117	Steel	.2829	162,405.4	45,944.5	2,811.3	48,755.8
118	Switches	.7554	8,961.0	6,769.1	15.5	6,784.6
119	Timers/Motors	7.2964	3,477.3	25,371.8	6.0	25,377.8
120	Wiring Harnesses	6.0776	1,954.2	11,876.8	67.7	11,944.5
121	Misc. Electronics	6.4461	1,954.2	12,597.0	10.2	12,607.1
122	Washer MP	46.0068	522.1	24,017.8	271.1	24,289.0
123	Dryer MP	39.2610	437.0	17,157.1	7.6	17,164.6
124	Range MP	177.6261	452.1	80,304.8	743.5	81,048.2
125	Refrigerator MP	114.1256	543.1	61,975.9	564.0	62,539.9
Total:				392,613.2	6,172.1	398,785.2

Manufacturing Plant Location: Monterrey

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.0073	341.4	343.9	4.4	348.3
102	Belts	1.9966	49.7	99.1	.2	99.3
103	Compressors	45.6000	36.2	1,650.7	11.6	1,662.3
104	Copper Components	.9687	110.9	107.4	1.4	108.9
105	Cord Sets	1.9213	56.9	109.3	.6	109.9
106	Corrugated Packaging	1.8540	106.0	196.5	13.6	210.1
107	Fasteners	.0085	16,672.1	141.7	1.4	143.1
108	Door Gaskets	7.2960	36.2	264.1	.9	265.0
109	Knobs	.2390	518.7	124.0	.4	124.4
110	1 Speed Motors	16.7078	8.3	137.8	1.6	139.4
111	2 Speed Motors	22.5720	20.7	467.2	5.3	472.5
112	Paint (Powder)	3.0870	29.5	91.1	.4	91.5
113	Plastic Components	2.9672	106.0	314.5	2.0	316.6
114	Polypropylene Resin	.3337	1,694.5	565.4	21.7	587.1
115	Pumps	5.2661	20.7	109.0	.3	109.3
116	Relays	6.2423	56.9	355.2	.5	355.6
117	Steel	.2600	8,487.2	2,206.7	108.6	2,315.3
118	Switches	.6906	490.7	338.8	.6	339.5
119	Timers/Motors	6.7396	186.7	1,257.9	.2	1,258.2
120	Wiring Harnesses	4.9065	106.0	520.1	2.7	522.8
121	Misc. Electronics	5.8931	106.0	624.7	.4	625.1
122	Washer MP	39.8056	20.7	824.0	8.0	831.9
123	Dryer MP	33.9691	8.3	280.2	.1	280.4
124	Range MP	155.3526	40.9	6,346.2	49.7	6,395.8
125	Refrigerator MP	97.1380	36.2	3,516.4	27.8	3,544.2
Total:				20,992.2	264.3	21,256.5

Note: Manufacturing plants source from domestic supplier location unless otherwise indicated in the following manner. C - Canada, M - Mexico, US - United States.

Table G-10 (cont'd.)

Manufacturing Plant Location: Indianapolis

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	1.1500	65,082.0	74,844.3	968.4	75,812.7
102	Belts	2.4000	16,409.9	39,383.8	69.1	39,452.9
103	Compressors	50.0000	7,038.4	351,920.0	2,167.8	354,087.8
104	Copper Components	1.0500	20,374.3	21,393.0	215.2	21,608.1
105	Cord Sets	2.2500	13,110.6	29,498.9	120.0	29,618.8
106	Corrugated Packaging	2.2500	22,932.6	51,598.4	2,825.3	54,423.7
107	Fasteners	.0100	3,583,891.3	35,838.9	287.0	36,125.9
108	Door Gaskets	8.0000	7,038.4	56,307.2	173.4	56,480.6
109	Knobs	.2500	90,832.9	22,708.2	99.5	22,807.7
110	1 Speed Motors	18.3200	4,265.5	78,144.0	788.3	78,932.2
111	2 Speed Motors	24.7500	6,072.2	150,287.0	1,496.2	151,783.1
112	Paint (Powder)	3.2500	7,323.3	23,800.9	70.9	23,871.7
113	Plastic Components	3.5000	22,932.6	80,264.1	602.7	80,866.8
114	Polypropylene Resin	.3600	377,159.5	135,777.4	3,982.8	139,760.2
115	Pumps	6.0000	6,072.2	36,433.2	90.4	36,523.6
116	Relays	7.0000	13,110.6	91,774.2	110.5	91,884.7
117	Steel	.2810	1,874,393.0	526,704.4	16,494.7	543,199.1
118	Switches	.7500	102,854.1	77,140.6	138.7	77,279.2
119	Timers/Motors	7.2500	41,274.9	299,243.0	55.6	299,298.7
120	Wiring Harnesses	5.9800	22,932.6	137,136.9	524.7	137,661.6
121	Misc. Electronics	6.4000	22,932.6	146,768.6	92.7	146,861.4
122	Washer MP	45.4900	6,072.2	276,224.4	3,191.6	279,415.9
123	Dryer MP	38.8200	4,265.5	165,586.7	74.7	165,661.4
124	Range MP	175.7700	5,556.5	976,666.0	7,854.7	984,520.7
125	Refrigerator MP	112.7100	7,038.4	793,298.1	6,841.3	800,139.4
Total:				4,678,742.0	49,336.0	4,728,078.0

Total Purchase Expenditure For Each Purchased Item And Total Purchases For The Firm

Item No.	Description	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	70,497	81,088.3	1,060.6	82,148.9
102	Belts	17,941	43,091.9	77.3	43,169.2
103	Compressors	7,618	380,940.4	2,414.4	383,354.9
104	Copper Components	22,069	23,175.0	244.0	23,419.0
105	Cord Sets	14,233	32,036.5	135.3	32,171.8
106	Corrugated Packaging	24,993	56,262.2	3,177.2	59,439.3
107	Fasteners	3,909,540	39,101.3	323.2	39,424.4
108	Door Gaskets	7,618	60,950.5	193.2	61,143.6
109	Knobs	98,947	24,738.6	108.1	24,846.7
110	1 Speed Motors	4,711	86,351.7	903.3	87,255.0
111	2 Speed Motors	6,615	163,778.3	1,682.2	165,460.5
112	Paint (Powder)	7,968	25,898.8	81.9	25,980.7
113	Plastic Components	24,993	87,512.9	655.4	88,168.3
114	Polypropylene Resin	409,240	147,354.7	4,530.5	151,885.2
115	Pumps	6,615	39,709.3	99.7	39,809.0
116	Relays	14,233	99,658.5	122.4	99,780.9
117	Steel	2,045,286	574,855.6	19,414.6	594,270.2
118	Switches	112,306	84,248.6	154.8	84,403.3
119	Timers/Motors	44,939	325,872.7	61.9	325,934.6
120	Wiring Harnesses	24,993	149,533.9	595.1	150,129.0
121	Misc. Electronics	24,993	159,990.3	103.3	160,093.6
122	Washer MP	6,615	301,066.2	3,470.6	304,536.8
123	Dryer MP	4,711	183,024.0	82.4	183,106.4
124	Range MP	6,049	1,063,316.9	8,647.8	1,071,964.7
125	Refrigerator MP	7,618	858,790.4	7,433.2	866,223.5
Total:			5,092,347.4	55,772.4	5,148,119.7

Table G-10 (cont'd.)

Purchases By Supplier Location

Supplier Location: Woodstock

Item No.	Description	Unit Price (\$)	Quantity (000)	Total Purchases (\$ 000)
101	Aluminum Components	1.1630	5,073.2	5,900.1
102	Belts	2.4367	1,481.1	3,609.0
103	Compressors	50.4000	543.1	27,369.7
104	Copper Components	1.0574	1,583.7	1,674.6
105	Cord Sets	2.2799	1,065.1	2,428.3
106	Corrugated Packaging	2.2860	1,954.2	4,467.3
107	Fasteners	.0101	308,976.4	3,120.7
108	Door Gaskets	8.0640	543.1	4,379.2
109	Knobs	.2510	7,595.2	1,906.4
110	1 Speed Motors	18.4666	437.0	8,069.9
111	2 Speed Motors	24.9480	522.1	13,024.1
112	Paint (Powder)	3.2648	614.7	2,006.8
113	Plastic Components	3.5484	1,954.2	6,934.3
114	Polypropylene Resin	.3624	30,385.8	11,011.8
115	Pumps	6.0667	522.1	3,167.1
116	Relays	7.0689	1,065.1	7,529.1
117	Steel	.2829	162,405.4	45,944.5
118	Switches	.7554	8,961.0	6,769.1
119	Timers/Motors	7.2964	3,477.3	25,371.8
120	Wiring Harnesses	6.0776	1,954.2	11,876.8
121	Misc. Electronics	6.4461	1,954.2	12,597.0
122	Washer MP	46.0068	522.1	24,017.8
123	Dryer MP	39.2610	437.0	17,157.1
124	Range MP	177.6261	452.1	80,304.8
125	Refrigerator MP	114.1256	543.1	61,975.9
Total:			545,022.1	392,613.2

Supplier Location: Reynosa

Item No.	Description	Unit Price (\$)	Quantity (000)	Total Purchases (\$ 000)
101	Aluminum Components	1.0073	341.4	343.9
102	Belts	1.9966	49.7	99.1
103	Compressors	45.6000	36.2	1,650.7
104	Copper Components	.9687	110.9	107.4
105	Cord Sets	1.9213	56.9	109.3
106	Corrugated Packaging	1.8540	106.0	196.5
107	Fasteners	.0085	16,672.1	141.7
108	Door Gaskets	7.2960	36.2	264.1
109	Knobs	.2390	518.7	124.0
110	1 Speed Motors	16.7078	8.3	137.8
111	2 Speed Motors	22.5720	20.7	467.2
112	Paint (Powder)	3.0870	29.5	91.1
113	Plastic Components	2.9672	106.0	314.5
114	Polypropylene Resin	.3337	1,694.5	565.4
115	Pumps	5.2661	20.7	109.0
116	Relays	6.2423	56.9	355.2
117	Steel	.2600	8,487.2	2,206.7
118	Switches	.6906	490.7	338.8
119	Timers/Motors	6.7396	186.7	1,257.9
120	Wiring Harnesses	4.9065	106.0	520.1
121	Misc. Electronics	5.8931	106.0	624.7
122	Washer MP	39.8056	20.7	824.0
123	Dryer MP	33.9691	8.3	280.2
124	Range MP	155.3526	40.9	6,346.2
125	Refrigerator MP	97.1380	36.2	3,516.4
Total:			29,347.0	20,992.2

Table G-10 (cont'd.)

Supplier Location: Fort Wayne

Item No.	Description	Unit Price (\$)	Quantity (000)	Total Purchases (\$ 000)
101	Aluminum Components	1.1500	65,082.0	74,844.3
102	Belts	2.4000	16,409.9	39,383.8
103	Compressors	50.0000	7,038.4	351,920.0
104	Copper Components	1.0500	20,374.3	21,393.0
105	Cord Sets	2.2500	13,110.6	29,498.9
106	Corrugated Packaging	2.2500	22,932.6	51,598.4
107	Fasteners	.0100	3,583,891.3	35,838.9
108	Door Gaskets	8.0000	7,038.4	56,307.2
109	Knobs	.2500	90,832.9	22,708.2
110	1 Speed Motors	18.3200	4,265.5	78,144.0
111	2 Speed Motors	24.7500	6,072.2	150,287.0
112	Paint (Powder)	3.2500	7,323.3	23,800.9
113	Plastic Components	3.5000	22,932.6	80,264.1
114	Polypropylene Resin	.3600	377,159.5	135,777.4
115	Pumps	6.0000	6,072.2	36,433.2
116	Relays	7.0000	13,110.6	91,774.2
117	Steel	.2810	1,874,393.0	526,704.4
118	Switches	.7500	102,854.1	77,140.6
119	Timers/Motors	7.2500	41,274.9	299,243.0
120	Wiring Harnesses	5.9800	22,932.6	137,136.9
121	Misc. Electronics	6.4000	22,932.6	146,768.6
122	Washer MP	45.4900	6,072.2	276,224.4
123	Dryer MP	38.8200	4,265.5	165,586.7
124	Range MP	175.7700	5,556.5	976,666.0
125	Refrigerator MP	112.7100	7,038.4	793,298.1
Total:			6,350,966.1	4,678,742.0

Table G-10 (cont'd.)

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Toronto

Item	Quantity	Purchased	Mfg.	Transfer		Total
<u>No. Description</u>	<u>(000)</u>	<u>Materials/</u>	<u>Labor/</u>	<u>Handling/</u>	<u>Mfg. VC/</u>	<u>Mfg. VC</u>
		<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>(\$ 000)</u>
201 Washers	522.1	159.17	38.15	2.35	199.67	104,238.6
202 Dryers	437.0	132.59	30.48	2.35	165.42	72,290.0
203 Ranges	452.1	244.32	49.38	2.35	296.05	133,845.2
204 Refrigerators	543.1	271.22	72.51	2.35	346.08	187,941.0
Total:	1,954.2		255.00		VC Total:	498,314.8
			57.44		FC Total:	112,239.7
			312.43		Plant Total:	610,554.5

Manufacturing Plant Location: Monterrey

Item	Quantity	Purchased	Mfg.	Transfer		Total
<u>No. Description</u>	<u>(000)</u>	<u>Materials/</u>	<u>Labor/</u>	<u>Handling/</u>	<u>Mfg. VC/</u>	<u>Mfg. VC</u>
		<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>(\$ 000)</u>
201 Washers	20.7	140.39	4.24	1.40	146.03	3,022.7
202 Dryers	8.3	117.50	3.89	1.40	122.79	1,013.0
203 Ranges	40.9	214.63	5.49	1.40	221.52	9,049.0
204 Refrigerators	36.2	237.94	8.06	1.40	247.40	8,956.0
Total:	106.0		207.93		VC Total:	22,040.8
			60.27		FC Total:	6,388.5
			268.20		Plant Total:	28,429.3

Manufacturing Plant Location: Indianapolis

Item	Quantity	Purchased	Mfg.	Transfer		Total
<u>No. Description</u>	<u>(000)</u>	<u>Materials/</u>	<u>Labor/</u>	<u>Handling/</u>	<u>Mfg. VC/</u>	<u>Mfg. VC</u>
		<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>(\$ 000)</u>
201 Washers	6,072.2	156.63	35.32	2.50	194.45	1,180,765.7
202 Dryers	4,265.5	130.36	28.22	2.50	161.08	687,093.5
203 Ranges	5,556.5	240.83	45.72	2.50	289.05	1,606,120.2
204 Refrigerators	7,038.4	267.49	67.14	2.50	337.13	2,372,873.9
Total:	22,932.6		254.96		VC Total:	5,846,853.3
			60.21		FC Total:	1,380,670.4
			315.16		Plant Total:	7,227,523.7
Firm Total:	24,992.8		254.76		Firm VC Total:	6,367,208.9
			59.99		Firm FC Total:	1,499,298.6
			314.75		Firm MFG Total:	7,866,507.5

Table G-10 (cont'd.)

Source Of Finished Products By Distribution Center Location /
Total Cost For Distribution Center Operations

<u>DC Location</u>	<u>Description</u>	<u>Mfg. Source</u>	<u>Units (000)</u>	<u>Variable Labor (\$ 000)</u>	<u>Inv. CC. (\$ 000)</u>	<u>Fixed Cost (\$ 000)</u>	<u>Product DC Total (\$ 000)</u>
Montreal	Washers	CAN	140.8	662.9	979.1		1,642.1
	Dryers	CAN	117.9	555.3	683.5		1,238.8
	Ranges	CAN	121.9	574.2	1,144.8		1,718.9
	Refrigerators	CAN	146.5	689.8	1,608.8		2,298.6
	Total:		527.0	2,482.2	4,416.2	1,670.0	6,898.4
						DC Total:	8,568.4
Toronto	Washers	CAN	230.9	1,085.0	1,605.9		2,690.9
	Dryers	CAN	193.3	908.3	1,120.3		2,028.6
	Ranges	CAN	199.9	939.5	1,877.3		2,816.8
	Refrigerators	CAN	240.2	1,128.9	2,638.7		3,767.6
	Total:		864.2	4,061.7	7,242.2	1,830.0	11,303.9
						DC Total:	13,133.9
Edmonton	Washers	CAN	150.5	704.1	1,046.6		1,750.7
	Dryers	CAN	125.9	589.0	729.6		1,318.5
	Ranges	CAN	130.3	609.8	1,223.7		1,833.5
	Refrigerators	CAN	156.4	732.0	1,718.1		2,450.1
	Total:		563.0	2,634.8	4,718.0	1,640.0	7,352.8
						DC Total:	8,992.8
Monterrey	Washers	MEX	17.4	48.6	120.7		169.3
	Dryers	MEX	7.0	19.5	40.3		59.8
	Ranges	MEX	34.2	95.8	321.2		416.9
	Refrigerators	MEX	30.4	85.0	333.4		418.4
	Total:		88.9	248.8	815.6	100.0	1,064.4
						DC Total:	1,164.4
Mexico City	Washers	MEX	3.4	9.4	23.3		32.7
	Dryers	MEX	1.3	3.6	7.5		11.2
	Ranges	MEX	6.7	18.6	62.5		81.1
	Refrigerators	MEX	5.9	16.4	64.3		80.6
	Total:		17.2	48.0	157.6	20.0	205.6
						DC Total:	225.6
Worcester	Washers	US	371.3	1,644.6	2,582.6		4,227.2
	Dryers	US	260.8	1,155.1	1,511.6		2,666.7
	Ranges	US	339.7	1,504.9	3,190.2		4,695.1
	Refrigerators	US	430.3	1,906.2	4,727.0		6,633.3
	Total:		1,402.0	6,210.9	12,011.4	1,670.0	18,222.3
						DC Total:	19,892.3
Indianapolis	Washers	US	3,283.7	16,418.3	22,842.6		39,260.8
	Dryers	US	2,306.7	11,533.3	13,371.8		24,905.0
	Ranges	US	3,004.8	15,024.0	28,218.7		43,242.7
	Refrigerators	US	3,806.1	19,030.5	41,811.6		60,842.1
	Total:		12,401.2	62,006.0	106,244.7	1,750.0	168,250.7
						DC Total:	170,000.7
Atlanta	Washers	US	676.1	2,954.3	4,702.9		7,657.3
	Dryers	US	474.8	2,074.9	2,752.4		4,827.3
	Ranges	US	618.5	2,702.8	5,808.5		8,511.3
	Refrigerators	US	783.5	3,423.7	8,606.5		12,030.2
	Total:		2,552.8	11,155.7	21,870.3	1,300.0	33,026.1
						DC Total:	34,326.1

Table G-10 (cont'd.)

<u>DC Location</u>	<u>Description</u>	<u>Mfg.</u> <u>Source</u>	<u>Units</u> <u>(000)</u>	<u>Variable</u> <u>Labor</u> <u>(\$ 000)</u>	<u>Inv.</u> <u>CC.</u> <u>(\$ 000)</u>	<u>Fixed</u> <u>Cost</u> <u>(\$ 000)</u>	<u>Product</u> <u>DC Total</u> <u>(\$ 000)</u>
Dallas	Washers	US	612.8	2,549.0	4,262.6		6,811.6
	Dryers	US	430.5	1,790.9	2,495.6		4,286.5
	Ranges	US	560.9	2,333.1	5,267.1		7,600.2
	Refrigerators	US	710.4	2,955.3	7,804.0		10,759.3
	Total:		2,314.5	9,628.3	19,829.3	1,600.0	29,457.6
						DC Total:	31,057.6
Los Angeles	Washers	US	698.7	3,619.0	4,860.1		8,479.1
	Dryers	US	490.9	2,542.6	2,845.5		5,388.1
	Ranges	US	639.4	3,311.8	6,004.3		9,316.1
	Refrigerators	US	810.0	4,195.5	8,897.6		13,093.2
	Total:		2,638.8	13,669.0	22,607.5	1,830.0	36,276.5
						DC Total:	38,106.5
Salt Lake City	Washers	US	429.9	1,839.8	2,990.2		4,830.0
	Dryers	US	302.0	1,292.4	1,750.4		3,042.8
	Ranges	US	393.3	1,683.3	3,693.6		5,376.9
	Refrigerators	US	498.2	2,132.3	5,472.9		7,605.2
	Total:		1,623.3	6,947.7	13,907.2	1,670.0	20,854.9
						DC Total:	22,524.9
						Firm DC Total:	347,993.2

Table G-10 - (cont'd.)

Market Areas Serviced By Distribution Center Location

Distribution Center: Montreal Market Areas (10):

C1A-Charl, E1C-Monct, E2H-Saint, G1A-Quebe, G5H-Rimou, G6G-Thetf, G8V-Trois, H9P-Montr, J1E-Sherb, J9X-Rouyn

Distribution Center: Toronto Market Areas (13):

A1B-St Jo, B2V-Halif, J8X-Ottaw, K7K-Kings, L2M-St. C, L4N-Barri, L4V-Toron, N2B-Kitch, N5Y-Londo, N8M-Winds, P3A-Sudbu, P7A-Thund, P9N-Kenor

Distribution Center: Edmonton Market Areas (7):

R2X-Winni, S4P-Regin, S7K-Saska, T2H-Calga, T5J-Edmon, V1H-Princ, V3M-Vanco,

Distribution Center: Monterrey Market Areas (56):

MX1001-Ti, MX1002-Me, MX1003-En, MX1004-Ba, MX1005-Ba, MX1006-Se, MX1007-He, MX1008-Ca, MX1009-Ci, MX1010-N, MX1011-Ch, MX1012-S, MX1013-N, MX1014-Mo, MX1015-Sa, MX1016-To, MX1017-WN, MX1018-Mo, MX1019-SN, MX1020-NL, MX1021-Re, MX1022-Ma, MX1023-CO, MX1024-ST, MX1025-SL, MX1026-N, MX1027-S, MX1028-ND, MX1029-Du, MX1030-LM, MX1031-Cu, MX1032-Ma, MX1033-Na, MX1034-SJ, MX1035-Gu, MX1036-WJ, MX1037-Ag, MX1038-Le, MX1039-Ir, MX1040-Ce, MX1041-Qu, MX1042-Hi, MX1043-NV, MX1044-Ja, MX1045-Or, MX1046-Ve, MX1048-Pu, MX1049-Tl, MX1050-Me, MX1051-Me, MX1052-Mo, MX1053-E, MX1055-Co, MX1060-Ca, MX1061-Yu, MX1062-Qu

Distribution Center: Mexico City Market Areas (6):

MX1047-Co, MX1054-W, MX1056-Gu, MX1057-Oa, MX1058-Ch, MX1059-Ta

Distribution Center: Worcester Market Areas (13):

011-Sprng, 016-Worch, 021-Bosto, 029-Provd, 031-Manch, 041-Portl, 047-Bango, 054-Burln, 061-Hartf, 065-NewHa, 069-Stamf, 122-Alban, 126-Pough

Distribution Center: Indianapolis Market Areas (107):

071-Newar, 081-Camde, 089-NewBr, 106-WhitP, 112-Brook, 132-Syrac, 139-Bingp, 141-Buffa, 146-Rochs, 152-Pitts, 158-Du Bo, 159-Johns, 165-Erie,, 171-Harrs, 181-Allen, 187-Wlks-, 194-Phila, 196-Readi, 198-Wilmn, 200-Washn, 212-Balti, 215-Cumbr, 229-Harsn, 232-Richm, 235-Norfo, 240-Roano, 253-Charl, 265-Clrks, 274-Green, 276-Ralei, 282-Charl, 283-Fayet, 288-Ashev, 352-Birmg, 354-Tusca, 356-Hunts, 366-Mobil, 372-Nashv, 374-Chata, 376-Johns, 379-Knoxv, 381-Memph, 383-Jacks, 387-Grenv, 388-Tupel, 392-Jacks, 393-Merid, 402-Louis, 405-Lexin, 421-BowlN, 432-Colum, 436-Toled, 441-Clevl, 442-Akron, 445-Young, 449-Mansf, 452-Cncin, 454-Dayto, 458-Lima,, 462-Indan, 466-South, 468-Ft.Wa, 473-Munci, 474-Blomn, 477-Evans, 482-Detro, 485-Flint, 486-Sagin, 489-Lansi, 495-GrndR, 497-SStMa, 503-DesMo, 511-Sioux, 520-Dubuq, 528-Daven, 532-Milwa, 537-Madis, 543-Green, 546-EauCl, 554-Minea, 558-Dulut, 559-Rochs, 571-Sioux, 581-Fargo, 587-Minot, 606-Chica, 611-Rockf, 612-Rockl, 616-Peori, 618-Champ, 627-Sprin, 631-StLou, 634-Hanni, 638-CapeG, 641-Kanss, 645-St.Jo, 648-Jopli, 658-Sprin, 666-Topek, 672-Wichi, 681-Omaha, 685-Linco, 712-Monro, 722-Litle, 727-Fayet, 729-Ft.Sm, 741-Tulsa

Distribution Center: Atlanta Market Areas (22):

292-Colmb, 294-Charl, 296-Grenv, 303-Atlan, 306-Athen, 309-Augus, 312-Macon, 314-Savan, 317-Alban, 319-Colum, 322-Jacks, 323-Talla, 328-Orlan, 331-Miami, 334-W.Plm, 336-Tampa, 339-FtMye, 359-Gadsd, 361-Montg, 701-NewOr, 708-BatnR, 713-Alexn

Distribution Center: Dallas Market Areas (24):

678-Dodge, 711-Shrev, 731-OklaC, 745-Mcals, 752-Dalla, 755-Texar, 757-Tyler, 761-Ft.Wo, 763-Wicht, 767-Waco,, 769-SanAn, 770-Houst, 777-Beaum, 782-SanAn, 784-CorpC, 787-Austi, 791-Amari, 794-Lubbo, 796-Abile, 799-El Pa, 802-Denve, 810-Puebl, 871-Albuq, 881-Roswe

Distribution Center: Los Angeles Market Areas (9):

900-LosAn, 921-SanDi, 924-SanBe, 933-Bakrs, 937-Fresn, 946-Oakla, 952-Stock, 958-Sacra, 960-Reddi

Distribution Center: Salt Lake City Market Areas (25):

577-Rapid, 591-Billi, 594-Great, 596-Helen, 598-Misou, 691-N.Pla, 815-GrndJ, 820-Cheye, 832-Pocat, 837-Boise, 841-StLk, 846-Provo, 850-Phoen, 857-Tucso, 891-LasVe, 895-Reno,, 972-Portl, 973-Salem, 975-Medfo, 981-Seatt, 982-Evere, 984-Tacom, 989-Yakim, 992-Spoka, 993-WalaW

Table G-11

RQB4B Results: North American Sourcing Series - Initial Integration

Summary

<u>Finished Product Demand</u>	<u>(000)</u>
Total Units	24,992.8

<u>Cost Information</u>	<u>(\$000)</u>
Total Purchase Cost	4,748,573.3
Total Manufacturing Cost	7,816,161.1
Total Distribution Center Cost	347,993.2
Total Transportation Cost	837,073.7
Total System Cost	8,652,028.0

<u>Transportation Cost Detail</u>	<u>(\$000)</u>
Inbound Freight:	349,200.0
Internal Transfer Freight:	145,160.6
Customer Freight:	342,713.1

Total Transportation Cost:	837,073.7
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<u>Facilities Utilized</u>	<u>Type</u>
Woodstock	S
Reynosa	S
Fort Wayne	S
Toronto	M
Monterrey	M
Indianapolis	M
Nuevo Laredo	TP
Cuidad Juarez	TP

Table G-11 (cont'd.)

Purchases By Manufacturing Plant Location

Manufacturing Plant Location: Toronto

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.1630	5,073.2	5,900.1	87.8	5,987.9
102	Belts	M 1.9966	1,481.1	2,957.2	556.1	3,513.2
103	Compressors	50.4000	543.1	27,369.7	235.0	27,604.7
104	Copper Components	1.0574	1,583.7	1,674.6	27.4	1,702.0
105	Cord Sets	2.2799	1,065.1	2,428.3	14.8	2,443.1
106	Corrugated Packaging	2.2860	1,954.2	4,467.3	338.3	4,805.6
107	Fasteners	.0101	308,976.4	3,120.7	34.8	3,155.4
108	Door Gaskets	8.0640	543.1	4,379.2	18.8	4,398.0
109	Knobs	.2510	7,595.2	1,906.4	8.2	1,914.6
110	1 Speed Motors	18.4666	437.0	8,069.9	113.5	8,183.4
111	2 Speed Motors	24.9480	522.1	13,024.1	180.7	13,204.8
112	Paint (Powder)	3.2648	614.7	2,006.8	10.6	2,017.5
113	Plastic Components	3.5484	1,954.2	6,934.3	50.7	6,985.0
114	Polypropylene Resin	.3624	30,385.8	11,011.8	526.0	11,537.8
115	Pumps	M 5.2661	522.1	2,749.2	388.6	3,137.8
116	Relays	7.0689	1,065.1	7,529.1	11.5	7,540.6
117	Steel	.2829	162,405.4	45,944.5	2,811.3	48,755.8
118	Switches	.7554	8,961.0	6,769.1	15.5	6,784.6
119	Timers/Motors	7.2964	3,477.3	25,371.8	6.0	25,377.8
120	Wiring Harnesses	M 4.9065	1,954.2	9,588.3	1,881.1	11,469.4
121	Misc. Electronics	6.4461	1,954.2	12,597.0	10.2	12,607.1
122	Washer MP	46.0068	522.1	24,017.8	271.1	24,289.0
123	Dryer MP	39.2610	437.0	17,157.1	7.6	17,164.6
124	Range MP	177.6261	452.1	80,304.8	743.5	81,048.2
125	Refrigerator MP	114.1256	543.1	61,975.9	564.0	62,539.9
Total:				389,254.8	8,913.1	398,168.0

Manufacturing Plant Location: Monterrey

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.0073	341.4	343.9	4.4	348.3
102	Belts	1.9966	49.7	99.1	.2	99.3
103	Compressors	45.6000	36.2	1,650.7	11.6	1,662.3
104	Copper Components	.9687	110.9	107.4	1.4	108.9
105	Cord Sets	1.9213	56.9	109.3	.6	109.9
106	Corrugated Packaging	1.8540	106.0	196.5	13.6	210.1
107	Fasteners	.0085	16,672.1	141.7	1.4	143.1
108	Door Gaskets	7.2960	36.2	264.1	.9	265.0
109	Knobs	.2390	518.7	124.0	.4	124.4
110	1 Speed Motors	16.7078	8.3	137.8	1.6	139.4
111	2 Speed Motors	22.5720	20.7	467.2	5.3	472.5
112	Paint (Powder)	3.0870	29.5	91.1	.4	91.5
113	Plastic Components	2.9672	106.0	314.5	2.0	316.6
114	Polypropylene Resin	.3337	1,694.5	565.4	21.7	587.1
115	Pumps	5.2661	20.7	109.0	.3	109.3
116	Relays	6.2423	56.9	355.2	.5	355.6
117	Steel	.2600	8,487.2	2,206.7	108.6	2,315.3
118	Switches	.6906	490.7	338.8	.6	339.5
119	Timers/Motors	6.7396	186.7	1,257.9	.2	1,258.2
120	Wiring Harnesses	4.9065	106.0	520.1	2.7	522.8
121	Misc. Electronics	5.8931	106.0	624.7	.4	625.1
122	Washer MP	39.8056	20.7	824.0	8.0	831.9
123	Dryer MP	33.9691	8.3	280.2	.1	280.4
124	Range MP	155.3526	40.9	6,346.2	49.7	6,395.8
125	Refrigerator MP	97.1380	36.2	3,516.4	27.8	3,544.2
Total:				20,992.2	264.3	21,256.5

Note: Manufacturing plants source from domestic supplier location unless otherwise indicated in the following manner. C - Canada, M - Mexico, US - United States.

Table G-11 (cont'd.)

Manufacturing Plant Location: Indianapolis

Item No.	Description	Unit	Quantity	Total Purchases	Trans. Cost	Delivered Cost
		Price(\$)	(000)	(\$ 000)	(\$ 000)	(\$ 000)
101	Aluminum Components	1.1500	65,082.0	74,844.3	968.4	75,812.7
102	Belts	M 1.9966	16,409.9	32,764.0	3,579.5	36,343.5
103	Compressors	50.0000	7,038.4	351,920.0	2,167.8	354,087.8
104	Copper Components	1.0500	20,374.3	21,393.0	215.2	21,608.1
105	Cord Sets	M 1.9213	13,110.6	25,189.4	3,062.2	28,251.6
106	Corrugated Packaging	2.2500	22,932.6	51,598.4	2,825.3	54,423.7
107	Fasteners	.0100	3,583,891.3	35,838.9	287.0	36,125.9
108	Door Gaskets	8.0000	7,038.4	56,307.2	173.4	56,480.6
109	Knobs	.2500	90,832.9	22,708.2	99.5	22,807.7
110	1 Speed Motors	18.3200	4,265.5	78,144.0	788.3	78,932.2
111	2 Speed Motors	24.7500	6,072.2	150,287.0	1,496.2	151,783.1
112	Paint (Powder)	3.2500	7,323.3	23,800.9	70.9	23,871.7
113	Plastic Components	M 2.9672	22,932.6	68,045.6	9,274.6	77,320.2
114	Polypropylene Resin	.3600	377,159.5	135,777.4	3,982.8	139,760.2
115	Pumps	M 5.2661	6,072.2	31,976.8	3,581.4	35,558.2
116	Relays	M 6.2423	13,110.6	81,840.3	8,668.3	90,508.6
117	Steel	.2810	1,874,393.0	526,704.4	16,494.7	543,199.1
118	Switches	.7500	102,854.1	77,140.6	138.7	77,279.2
119	Timers/Motors	7.2500	41,274.9	299,243.0	55.6	299,298.7
120	Wiring Harnesses	M 4.9065	22,932.6	112,518.8	13,627.9	126,146.7
121	Misc. Electronics	6.4000	22,932.6	146,768.6	92.7	146,861.4
122	Washer MP	M 39.8056	6,072.2	241,707.6	37,225.4	278,933.0
123	Dryer MP	M 33.9691	4,265.5	144,895.2	14,795.8	159,691.0
124	Range MP	M 155.3526	5,556.5	863,216.7	119,466.4	982,683.2
125	Refrigerator MP	M 97.1380	7,038.4	683,696.1	96,884.6	780,580.7
Total:				4,338,326.3	340,022.5	4,678,348.8

Total Purchase Expenditure For Each Purchased Item And Total Purchases For The Firm

Item No.	Description	Quantity	Total Purchases	Trans. Cost	Delivered Cost
		(000)	(\$ 000)	(\$ 000)	(\$ 000)
101	Aluminum Components	70,497	81,088.3	1,060.6	82,148.9
102	Belts	17,941	35,820.3	4,135.7	39,956.0
103	Compressors	7,618	380,940.4	2,414.4	383,354.9
104	Copper Components	22,069	23,175.0	244.0	23,419.0
105	Cord Sets	14,233	27,727.0	3,077.5	30,804.6
106	Corrugated Packaging	24,993	56,262.2	3,177.2	59,439.3
107	Fasteners	3,909,540	39,101.3	323.2	39,424.4
108	Door Gaskets	7,618	60,950.5	193.2	61,143.6
109	Knobs	98,947	24,738.6	108.1	24,846.7
110	1 Speed Motors	4,711	86,351.7	903.3	87,255.0
111	2 Speed Motors	6,615	163,778.3	1,682.2	165,460.5
112	Paint (Powder)	7,968	25,898.8	81.9	25,980.7
113	Plastic Components	24,993	75,294.4	9,327.4	84,621.8
114	Polypropylene Resin	409,240	147,354.7	4,530.5	151,885.2
115	Pumps	6,615	34,835.0	3,970.3	38,805.3
116	Relays	14,233	89,724.6	8,680.3	98,404.9
117	Steel	2,045,286	574,855.6	19,414.6	594,270.2
118	Switches	112,306	84,248.6	154.8	84,403.3
119	Timers/Motors	44,939	325,872.7	61.9	325,934.6
120	Wiring Harnesses	24,993	122,627.2	15,511.7	138,138.8
121	Misc. Electronics	24,993	159,990.3	103.3	160,093.6
122	Washer MP	6,615	266,549.4	37,504.5	304,053.9
123	Dryer MP	4,711	162,332.5	14,803.5	177,135.9
124	Range MP	6,049	949,867.6	120,259.6	1,070,127.2
125	Refrigerator MP	7,618	749,188.4	97,476.4	846,664.8
Total:			4,748,573.3	349,200.0	5,097,773.3

Table G-11 (cont'd.)

Purchases By Supplier Location

Supplier Location: Woodstock

Item No.	Description	Unit Price (\$)	Quantity (000)	Total Purchases (\$ 000)
101	Aluminum Components	1.1630	5,073.2	5,900.1
102	Belts	2.4367	.0	.0
103	Compressors	50.4000	543.1	27,369.7
104	Copper Components	1.0574	1,583.7	1,674.6
105	Cord Sets	2.2799	1,065.1	2,428.3
106	Corrugated Packaging	2.2860	1,954.2	4,467.3
107	Fasteners	.0101	308,976.4	3,120.7
108	Door Gaskets	8.0640	543.1	4,379.2
109	Knobs	.2510	7,595.2	1,906.4
110	1 Speed Motors	18.4666	437.0	8,069.9
111	2 Speed Motors	24.9480	522.1	13,024.1
112	Paint (Powder)	3.2648	614.7	2,006.8
113	Plastic Components	3.5484	1,954.2	6,934.3
114	Polypropylene Resin	.3624	30,385.8	11,011.8
115	Pumps	6.0667	.0	.0
116	Relays	7.0689	1,065.1	7,529.1
117	Steel	.2829	162,405.4	45,944.5
118	Switches	.7554	8,961.0	6,769.1
119	Timers/Motors	7.2964	3,477.3	25,371.8
120	Wiring Harnesses	6.0776	.0	.0
121	Misc. Electronics	6.4461	1,954.2	12,597.0
122	Washer MP	46.0068	522.1	24,017.8
123	Dryer MP	39.2610	437.0	17,157.1
124	Range MP	177.6261	452.1	80,304.8
125	Refrigerator MP	114.1256	543.1	61,975.9
Total:			541,064.8	373,960.2

Supplier Location: Reynosa

Item No.	Description	Unit Price (\$)	Quantity (000)	Total Purchases (\$ 000)
101	Aluminum Components	1.0073	341.4	343.9
102	Belts	1.9966	17,940.7	35,820.3
103	Compressors	45.6000	36.2	1,650.7
104	Copper Components	.9687	110.9	107.4
105	Cord Sets	1.9213	13,167.5	25,298.7
106	Corrugated Packaging	1.8540	106.0	196.5
107	Fasteners	.0085	16,672.1	141.7
108	Door Gaskets	7.2960	36.2	264.1
109	Knobs	.2390	518.7	124.0
110	1 Speed Motors	16.7078	8.3	137.8
111	2 Speed Motors	22.5720	20.7	467.2
112	Paint (Powder)	3.0870	29.5	91.1
113	Plastic Components	2.9672	23,038.6	68,360.1
114	Polypropylene Resin	.3337	1,694.5	565.4
115	Pumps	5.2661	6,615.0	34,835.0
116	Relays	6.2423	13,167.5	82,195.5
117	Steel	.2600	8,487.2	2,206.7
118	Switches	.6906	490.7	338.8
119	Timers/Motors	6.7396	186.7	1,257.9
120	Wiring Harnesses	4.9065	24,992.8	122,627.2
121	Misc. Electronics	5.8931	106.0	624.7
122	Washer MP	39.8056	6,092.9	242,531.5
123	Dryer MP	33.9691	4,273.8	145,175.4
124	Range MP	155.3526	5,597.4	869,562.9
125	Refrigerator MP	97.1380	7,074.6	687,212.5
Total:			150,805.5	2,322,137.3

Table G-11 (cont'd.)

Supplier Location: Fort Wayne

Item	Unit	Quantity	Total
No. Description	Price (\$)	(000)	Purchases (\$ 000)
101 Aluminum Components	1.1500	65,082.0	74,844.3
102 Belts	2.4000	.0	.0
103 Compressors	50.0000	7,038.4	351,920.0
104 Copper Components	1.0500	20,374.3	21,393.0
105 Cord Sets	2.2500	.0	.0
106 Corrugated Packaging	2.2500	22,932.6	51,598.4
107 Fasteners	.0100	3,583,891.3	35,838.9
108 Door Gaskets	8.0000	7,038.4	56,307.2
109 Knobs	.2500	90,832.9	22,708.2
110 1 Speed Motors	18.3200	4,265.5	78,144.0
111 2 Speed Motors	24.7500	6,072.2	150,287.0
112 Paint (Powder)	3.2500	7,323.3	23,800.9
113 Plastic Components	3.5000	.0	.0
114 Polypropylene Resin	.3600	377,159.5	135,777.4
115 Pumps	6.0000	.0	.0
116 Relays	7.0000	.0	.0
117 Steel	.2810	1,874,393.0	526,704.4
118 Switches	.7500	102,854.1	77,140.6
119 Timers/Motors	7.2500	41,274.9	299,243.0
120 Wiring Harnesses	5.9800	.0	.0
121 Misc. Electronics	6.4000	22,932.6	146,768.6
122 Washer MP	45.4900	.0	.0
123 Dryer MP	38.8200	.0	.0
124 Range MP	175.7700	.0	.0
125 Refrigerator MP	112.7100	.0	.0
Total:		6,233,465.0	2,052,475.8

Table G-11 (cont'd.)

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Toronto

Item	Quantity	Purchased	Mfg.	Transfer		Total
No. Description	(000)	Materials/ Unit (\$)	Labor/ Unit (\$)	Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Mfg. VC (\$ 000)
201 Washers	522.1	158.71	38.15	2.35	199.21	104,000.1
202 Dryers	437.0	132.28	30.48	2.35	165.11	72,153.2
203 Ranges	452.1	244.08	49.38	2.35	295.81	133,735.3
204 Refrigerators	543.1	270.98	72.51	2.35	345.84	187,809.0
Total:	1,954.2		254.68		VC Total:	497,697.5
			57.44		FC Total:	112,239.7
			312.12		Plant Total:	609,937.2

Manufacturing Plant Location: Monterrey

Item	Quantity	Purchased	Mfg.	Transfer		Total
No. Description	(000)	Materials/ Unit (\$)	Labor/ Unit (\$)	Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Mfg. VC (\$ 000)
201 Washers	20.7	140.39	4.24	1.40	146.03	3,022.7
202 Dryers	8.3	117.50	3.89	1.40	122.79	1,013.0
203 Ranges	40.9	214.63	5.49	1.40	221.52	9,049.0
204 Refrigerators	36.2	237.94	8.06	1.40	247.40	8,956.0
Total:	106.0		207.93		VC Total:	22,040.8
			60.27		FC Total:	6,388.5
			268.20		Plant Total:	28,429.3

Manufacturing Plant Location: Indianapolis

Item	Quantity	Purchased	Mfg.	Transfer		Total
No. Description	(000)	Materials/ Unit (\$)	Labor/ Unit (\$)	Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Mfg. VC (\$ 000)
201 Washers	6,072.2	155.15	35.32	2.50	192.97	1,171,757.7
202 Dryers	4,265.5	128.12	28.22	2.50	158.84	677,513.4
203 Ranges	5,556.5	239.85	45.72	2.50	288.07	1,600,633.3
204 Refrigerators	7,038.4	263.85	67.14	2.50	333.49	2,347,219.8
Total:	22,932.6		252.79		VC Total:	5,797,124.2
			60.21		FC Total:	1,380,670.4
			313.00		Plant Total:	7,177,794.6
Firm Total:	24,992.8		252.75		Firm VC Total:	6,316,862.5
			59.99		Firm FC Total:	1,499,298.6
			312.74		Firm MFG Total:	7,816,161.1

Table G-12

RQB4C Results: North American Sourcing Series - 50 Percent Reduction In Tariffs

Summary

<u>Finished Product Demand</u>	<u>(000)</u>
Total Units	24,992.8

<u>Cost Information</u>	<u>(\$000)</u>
Total Purchase Cost	4,738,872.8
Total Manufacturing Cost	7,814,969.7
Total Distribution Center Cost	347,993.2
Total Transportation Cost	845,582.8
Total System Cost	8,650,836.6

<u>Transportation Cost Detail</u>	<u>(\$000)</u>
Inbound Freight:	357,709.1
Internal Transfer Freight:	145,160.6
Customer Freight:	342,713.1

Total Transportation Cost:	845,582.8
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<u>Facilities Utilized</u>	<u>Type</u>
Woodstock	S
Reynosa	S
Fort Wayne	S
Toronto	M
Monterrey	M
Indianapolis	M
Nuevo Laredo	TP
Cuidad Juarez	TP

Table G-12 (cont'd.)

Purchases By Manufacturing Plant Location

Manufacturing Plant Location: Toronto

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.1630	5,073.2	5,900.1	87.8	5,987.9
102	Belts	M 1.9966	1,481.1	2,957.2	445.2	3,402.3
103	Compressors	50.4000	543.1	27,369.7	235.0	27,604.7
104	Copper Components	1.0574	1,583.7	1,674.6	27.4	1,702.0
105	Cord Sets	1.9213	1,065.1	2,046.4	336.3	2,382.7
106	Corrugated Packaging	2.2860	1,954.2	4,467.3	338.3	4,805.6
107	Fasteners	M .0085	308,976.4	2,626.3	505.4	3,131.7
108	Door Gaskets	8.0640	543.1	4,379.2	18.8	4,398.0
109	Knobs	.2510	7,595.2	1,906.4	8.2	1,914.6
110	1 Speed Motors	18.4666	437.0	8,069.9	113.5	8,183.4
111	2 Speed Motors	24.9480	522.1	13,024.1	180.7	13,204.8
112	Paint (Powder)	3.2648	614.7	2,006.8	10.6	2,017.5
113	Plastic Components	M 2.9672	1,954.2	5,798.5	1,126.3	6,924.8
114	Polypropylene Resin	.3624	30,385.8	11,011.8	526.0	11,537.8
115	Pumps	M 5.2661	522.1	2,749.2	354.3	3,103.5
116	Relays	7.0689	1,065.1	7,529.1	11.5	7,540.6
117	Steel	.2829	162,405.4	45,944.5	2,811.3	48,755.8
118	Switches	.7554	8,961.0	6,769.1	15.5	6,784.6
119	Timers/Motors	7.2964	3,477.3	25,371.8	6.0	25,377.8
120	Wiring Harnesses	M 4.9065	1,954.2	9,588.3	1,569.5	11,157.7
121	Misc. Electronics	6.4461	1,954.2	12,597.0	10.2	12,607.1
122	Washer MP	46.0068	522.1	24,017.8	271.1	24,289.0
123	Dryer MP	M 33.9691	437.0	14,844.5	2,120.8	16,965.3
124	Range MP	177.6261	452.1	80,304.8	743.5	81,048.2
125	Refrigerator MP	114.1256	543.1	61,975.9	564.0	62,539.9
Total:				384,930.2	12,437.3	397,367.5

Manufacturing Plant Location: Monterrey

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.0073	341.4	343.9	4.4	348.3
102	Belts	1.9966	49.7	99.1	.2	99.3
103	Compressors	45.6000	36.2	1,650.7	11.6	1,662.3
104	Copper Components	.9687	110.9	107.4	1.4	108.9
105	Cord Sets	1.9213	56.9	109.3	.6	109.9
106	Corrugated Packaging	1.8540	106.0	196.5	13.6	210.1
107	Fasteners	.0085	16,672.1	141.7	1.4	143.1
108	Door Gaskets	7.2960	36.2	264.1	.9	265.0
109	Knobs	.2390	518.7	124.0	.4	124.4
110	1 Speed Motors	16.7078	8.3	137.8	1.6	139.4
111	2 Speed Motors	22.5720	20.7	467.2	5.3	472.5
112	Paint (Powder)	3.0870	29.5	91.1	.4	91.5
113	Plastic Components	2.9672	106.0	314.5	2.0	316.6
114	Polypropylene Resin	.3337	1,694.5	565.4	21.7	587.1
115	Pumps	5.2661	20.7	109.0	.3	109.3
116	Relays	6.2423	56.9	355.2	.5	355.6
117	Steel	.2600	8,487.2	2,206.7	108.6	2,315.3
118	Switches	.6906	490.7	338.8	.6	339.5
119	Timers/Motors	6.7396	186.7	1,257.9	.2	1,258.2
120	Wiring Harnesses	4.9065	106.0	520.1	2.7	522.8
121	Misc. Electronics	5.8931	106.0	624.7	.4	625.1
122	Washer MP	39.8056	20.7	824.0	8.0	831.9
123	Dryer MP	33.9691	8.3	280.2	.1	280.4
124	Range MP	155.3526	40.9	6,346.2	49.7	6,395.8
125	Refrigerator MP	97.1380	36.2	3,516.4	27.8	3,544.2
Total:				20,992.2	264.3	21,256.5

Note: Manufacturing plants source from domestic supplier location unless otherwise indicated in the following manner. C - Canada, M - Mexico, US - United States.

Table G-12 (cont'd.)

Manufacturing Plant Location: Indianapolis

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.1500	65,082.0	74,844.3	968.4	75,812.7
102	Belts	M 1.9966	16,409.9	32,764.0	3,579.5	36,343.5
103	Compressors	50.0000	7,038.4	351,920.0	2,167.8	354,087.8
104	Copper Components	1.0500	20,374.3	21,393.0	215.2	21,608.1
105	Cord Sets	M 1.9213	13,110.6	25,189.4	3,062.2	28,251.6
106	Corrugated Packaging	2.2500	22,932.6	51,598.4	2,825.3	54,423.7
107	Fasteners	M .0085	3,583,891.3	30,463.1	5,271.9	35,735.0
108	Door Gaskets	8.0000	7,038.4	56,307.2	173.4	56,480.6
109	Knobs	.2500	90,832.9	22,708.2	99.5	22,807.7
110	1 Speed Motors	18.3200	4,265.5	78,144.0	788.3	78,932.2
111	2 Speed Motors	24.7500	6,072.2	150,287.0	1,496.2	151,783.1
112	Paint (Powder)	3.2500	7,323.3	23,800.9	70.9	23,871.7
113	Plastic Components	M 2.9672	22,932.6	68,045.6	9,274.6	77,320.2
114	Polypropylene Resin	.3600	377,159.5	135,777.4	3,982.8	139,760.2
115	Pumps	M 5.2661	6,072.2	31,976.8	3,581.4	35,558.2
116	Relays	M 6.2423	13,110.6	81,840.3	8,668.3	90,508.6
117	Steel	.2810	1,874,393.0	526,704.4	16,494.7	543,199.1
118	Switches	.7500	102,854.1	77,140.6	138.7	77,279.2
119	Timers/Motors	7.2500	41,274.9	299,243.0	55.6	299,298.7
120	Wiring Harnesses	M 4.9065	22,932.6	112,518.8	13,627.9	126,146.7
121	Misc. Electronics	6.4000	22,932.6	146,768.6	92.7	146,861.4
122	Washer MP	M 39.8056	6,072.2	241,707.6	37,225.4	278,933.0
123	Dryer MP	M 33.9691	4,265.5	144,895.2	14,795.8	159,691.0
124	Range MP	M 155.3526	5,556.5	863,216.7	119,466.4	982,683.2
125	Refrigerator MP	M 97.1380	7,038.4	683,696.1	96,884.6	780,580.7
Total:				4,332,950.4	345,007.5	4,677,957.9

Total Purchase Expenditure For Each Purchased Item And Total Purchases For The Firm

Item No.	Description	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	70,497	81,088.3	1,060.6	82,148.9
102	Belts	17,941	35,820.3	4,024.8	39,845.1
103	Compressors	7,618	380,940.4	2,414.4	383,354.9
104	Copper Components	22,069	23,175.0	244.0	23,419.0
105	Cord Sets	14,233	27,345.1	3,399.1	30,744.2
106	Corrugated Packaging	24,993	56,262.2	3,177.2	59,439.3
107	Fasteners	3,909,540	33,231.1	5,778.8	39,009.9
108	Door Gaskets	7,618	60,950.5	193.2	61,143.6
109	Knobs	98,947	24,738.6	108.1	24,846.7
110	1 Speed Motors	4,711	86,351.7	903.3	87,255.0
111	2 Speed Motors	6,615	163,778.3	1,682.2	165,460.5
112	Paint (Powder)	7,968	25,898.8	81.9	25,980.7
113	Plastic Components	24,993	74,158.6	10,402.9	84,561.6
114	Polypropylene Resin	409,240	147,354.7	4,530.5	151,885.2
115	Pumps	6,615	34,835.0	3,936.0	38,771.0
116	Relays	14,233	89,724.6	8,680.3	98,404.9
117	Steel	2,045,286	574,855.6	19,414.6	594,270.2
118	Switches	112,306	84,248.6	154.8	84,403.3
119	Timers/Motors	44,939	325,872.7	61.9	325,934.6
120	Wiring Harnesses	24,993	122,627.2	15,200.0	137,827.2
121	Misc. Electronics	24,993	159,990.3	103.3	160,093.6
122	Washer MP	6,615	266,549.4	37,504.5	304,053.9
123	Dryer MP	4,711	160,019.9	16,916.7	176,936.6
124	Range MP	6,049	949,867.6	120,259.6	1,070,127.2
125	Refrigerator MP	7,618	749,188.4	97,476.4	846,664.8
Total:			4,738,872.8	357,709.1	5,096,581.9

Table G-12 (cont'd.)

Purchases By Supplier Location

Supplier Location: Woodstock

Item No.	Description	Unit Price (\$)	Quantity (000)	Total Purchases (\$ 000)
101	Aluminum Components	1.1630	5,073.2	5,900.1
102	Belts	2.4367	.0	.0
103	Compressors	50.4000	543.1	27,369.7
104	Copper Components	1.0574	1,583.7	1,674.6
105	Cord Sets	2.2799	.0	.0
106	Corrugated Packaging	2.2860	1,954.2	4,467.3
107	Fasteners	.0101	.0	.0
108	Door Gaskets	8.0640	543.1	4,379.2
109	Knobs	.2510	7,595.2	1,906.4
110	1 Speed Motors	18.4666	437.0	8,069.9
111	2 Speed Motors	24.9480	522.1	13,024.1
112	Paint (Powder)	3.2648	614.7	2,006.8
113	Plastic Components	3.5484	.0	.0
114	Polypropylene Resin	.3624	30,385.8	11,011.8
115	Pumps	6.0667	.0	.0
116	Relays	7.0689	1,065.1	7,529.1
117	Steel	.2829	162,405.4	45,944.5
118	Switches	.7554	8,961.0	6,769.1
119	Timers/Motors	7.2964	3,477.3	25,371.8
120	Wiring Harnesses	6.0776	.0	.0
121	Misc. Electronics	6.4461	1,954.2	12,597.0
122	Washer MP	46.0068	522.1	24,017.8
123	Dryer MP	39.2610	.0	.0
124	Range MP	177.6261	452.1	80,304.8
125	Refrigerator MP	114.1256	543.1	61,975.9
Total:			228,632.1	344,319.9

Supplier Location: Reynosa

Item No.	Description	Unit Price (\$)	Quantity (000)	Total Purchases (\$ 000)
101	Aluminum Components	1.0073	341.4	343.9
102	Belts	1.9966	17,940.7	35,820.3
103	Compressors	45.6000	36.2	1,650.7
104	Copper Components	.9687	110.9	107.4
105	Cord Sets	1.9213	14,232.6	27,345.1
106	Corrugated Packaging	1.8540	106.0	196.5
107	Fasteners	.0085	3,909,539.8	33,231.1
108	Door Gaskets	7.2960	36.2	264.1
109	Knobs	.2390	518.7	124.0
110	1 Speed Motors	16.7078	8.3	137.8
111	2 Speed Motors	22.5720	20.7	467.2
112	Paint (Powder)	3.0870	29.5	91.1
113	Plastic Components	2.9672	24,992.8	74,158.6
114	Polypropylene Resin	.3337	1,694.5	565.4
115	Pumps	5.2661	6,615.0	34,835.0
116	Relays	6.2423	13,167.5	82,195.5
117	Steel	.2600	8,487.2	2,206.7
118	Switches	.6906	490.7	338.8
119	Timers/Motors	6.7396	186.7	1,257.9
120	Wiring Harnesses	4.9065	24,992.8	122,627.2
121	Misc. Electronics	5.8931	106.0	624.7
122	Washer MP	39.8056	6,092.9	242,531.5
123	Dryer MP	33.9691	4,710.8	160,019.9
124	Range MP	155.3526	5,597.4	869,562.9
125	Refrigerator MP	97.1380	7,074.6	687,212.5
Total:			4,047,129.5	2,377,916.1

Table G-12 (cont'd.)

Supplier Location: Fort Wayne

Item No.	Description	Unit Price (\$)	Quantity (000)	Total Purchases (\$ 000)
101	Aluminum Components	1.1500	65,082.0	74,844.3
102	Belts	2.4000	.0	.0
103	Compressors	50.0000	7,038.4	351,920.0
104	Copper Components	1.0500	20,374.3	21,393.0
105	Cord Sets	2.2500	.0	.0
106	Corrugated Packaging	2.2500	22,932.6	51,598.4
107	Fasteners	.0100	.0	.0
108	Door Gaskets	8.0000	7,038.4	56,307.2
109	Knobs	.2500	90,832.9	22,708.2
110	1 Speed Motors	18.3200	4,265.5	78,144.0
111	2 Speed Motors	24.7500	6,072.2	150,287.0
112	Paint (Powder)	3.2500	7,323.3	23,800.9
113	Plastic Components	3.5000	.0	.0
114	Polypropylene Resin	.3600	377,159.5	135,777.4
115	Pumps	6.0000	.0	.0
116	Relays	7.0000	.0	.0
117	Steel	.2810	1,874,393.0	526,704.4
118	Switches	.7500	102,854.1	77,140.6
119	Timers/Motors	7.2500	41,274.9	299,243.0
120	Wiring Harnesses	5.9800	.0	.0
121	Misc. Electronics	6.4000	22,932.6	146,768.6
122	Washer MP	45.4900	.0	.0
123	Dryer MP	38.8200	.0	.0
124	Range MP	175.7700	.0	.0
125	Refrigerator MP	112.7100	.0	.0
Total:			2,649,573.7	2,016,636.9

Table G-12 (cont'd.)

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Toronto

Item	Quantity	Purchased	Mfg.	Transfer		Total
<u>No. Description</u>	<u>(000)</u>	<u>Materials/</u>	<u>Labor/</u>	<u>Handling/</u>	<u>Mfg. VC/</u>	<u>Mfg. VC</u>
		<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>(\$ 000)</u>
201 Washers	522.1	158.24	38.15	2.35	198.74	103,752.8
202 Dryers	437.0	131.54	30.48	2.35	164.37	71,831.7
203 Ranges	452.1	243.87	49.38	2.35	295.60	133,642.6
204 Refrigerators	543.1	270.73	72.51	2.35	345.59	187,669.9
Total:	1,954.2		254.27		VC Total:	496,897.1
			57.44		FC Total:	112,239.7
			311.71		Plant Total:	609,136.8

Manufacturing Plant Location: Monterrey

Item	Quantity	Purchased	Mfg.	Transfer		Total
<u>No. Description</u>	<u>(000)</u>	<u>Materials/</u>	<u>Labor/</u>	<u>Handling/</u>	<u>Mfg. VC/</u>	<u>Mfg. VC</u>
		<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>(\$ 000)</u>
201 Washers	20.7	140.39	4.24	1.40	146.03	3,022.7
202 Dryers	8.3	117.50	3.89	1.40	122.79	1,013.0
203 Ranges	40.9	214.63	5.49	1.40	221.52	9,049.0
204 Refrigerators	36.2	237.94	8.06	1.40	247.40	8,956.0
Total:	106.0		207.93		VC Total:	22,040.8
			60.27		FC Total:	6,388.5
			268.20		Plant Total:	28,429.3

Manufacturing Plant Location: Indianapolis

Item	Quantity	Purchased	Mfg.	Transfer		Total
<u>No. Description</u>	<u>(000)</u>	<u>Materials/</u>	<u>Labor/</u>	<u>Handling/</u>	<u>Mfg. VC/</u>	<u>Mfg. VC</u>
		<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>(\$ 000)</u>
201 Washers	6,072.2	155.13	35.32	2.50	192.95	1,171,659.7
202 Dryers	4,265.5	128.10	28.22	2.50	158.82	677,426.8
203 Ranges	5,556.5	239.82	45.72	2.50	288.04	1,600,517.6
204 Refrigerators	7,038.4	263.83	67.14	2.50	333.47	2,347,129.2
Total:	22,932.6		252.77		VC Total:	5,796,733.3
			60.21		FC Total:	1,380,670.4
			312.98		Plant Total:	7,177,403.7
Firm Total:	24,992.8		252.70		Firm VC Total:	6,315,671.1
			59.99		Firm FC Total:	1,499,298.6
			312.69		Firm MFG Total:	7,814,969.7

Table G-13

RQB4D Results: North American Sourcing Series - 100 Percent Reduction In Tariffs

Summary

<u>Finished Product Demand</u>	<u>(000)</u>
Total Units	24,992.8

<u>Cost Information</u>	<u>(\$000)</u>
Total Purchase Cost	4,718,697.4
Total Manufacturing Cost	7,810,857.3
Total Distribution Center Cost	347,993.2
Total Transportation Cost	861,645.8
Total System Cost	8,646,724.2

<u>Transportation Cost Detail</u>	<u>(\$000)</u>
Inbound Freight:	373,772.1
Internal Transfer Freight:	145,160.6
Customer Freight:	342,713.1

Total Transportation Cost:	861,645.8
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<u>Facilities Utilized</u>	<u>Type</u>
Woodstock	S
Reynosa	S
Fort Wayne	S
Toronto	M
Monterrey	M
Indianapolis	M
Nuevo Laredo	TP
Cuidad Juarez	TP

Table G-13 (cont'd.)

Purchases By Manufacturing Plant Location

Manufacturing Plant Location: Toronto

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.1630	5,073.2	5,900.1	87.8	5,987.9
102	Belts M	1.9966	1,481.1	2,957.2	334.3	3,291.4
103	Compressors	50.4000	543.1	27,369.7	235.0	27,604.7
104	Copper Components	1.0574	1,583.7	1,674.6	27.4	1,702.0
105	Cord Sets M	1.9213	1,065.1	2,046.4	269.8	2,316.2
106	Corrugated Packaging	2.2860	1,954.2	4,467.3	338.3	4,805.6
107	Fasteners M	.0085	308,976.4	2,626.3	420.1	3,046.4
108	Door Gaskets	8.0640	543.1	4,379.2	18.8	4,398.0
109	Knobs	.2510	7,595.2	1,906.4	8.2	1,914.6
110	1 Speed Motors	18.4666	437.0	8,069.9	113.5	8,183.4
111	2 Speed Motors	24.9480	522.1	13,024.1	180.7	13,204.8
112	Paint (Powder)	3.2648	614.7	2,006.8	10.6	2,017.5
113	Plastic Components M	2.9672	1,954.2	5,798.5	865.4	6,663.9
114	Polypropylene Resin	.3624	30,385.8	11,011.8	526.0	11,537.8
115	Pumps M	5.2661	522.1	2,749.2	319.9	3,069.1
116	Relays M	6.2423	1,065.1	6,648.7	720.3	7,369.0
117	Steel	.2829	162,405.4	45,944.5	2,811.3	48,755.8
118	Switches	.7554	8,961.0	6,769.1	15.5	6,784.6
119	Timers/Motors	7.2964	3,477.3	25,371.8	6.0	25,377.8
120	Wiring Harnesses M	4.9065	1,954.2	9,588.3	1,257.8	10,846.1
121	Misc. Electronics	6.4461	1,954.2	12,597.0	10.2	12,607.1
122	Washer MP	46.0068	522.1	24,017.8	271.1	24,289.0
123	Dryer MP M	33.9691	437.0	14,844.5	1,527.0	16,371.5
124	Range MP M	155.3526	452.1	70,234.9	10,708.1	80,943.0
125	Refrigerator MP M	97.1380	543.1	52,750.8	8,361.4	61,112.2
Total:				364,754.8	29,444.7	394,199.5

Manufacturing Plant Location: Monterrey

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.0073	341.4	343.9	4.4	348.3
102	Belts	1.9966	49.7	99.1	.2	99.3
103	Compressors	45.6000	36.2	1,650.7	11.6	1,662.3
104	Copper Components	.9687	110.9	107.4	1.4	108.9
105	Cord Sets	1.9213	56.9	109.3	.6	109.9
106	Corrugated Packaging	1.8540	106.0	196.5	13.6	210.1
107	Fasteners	.0085	16,672.1	141.7	1.4	143.1
108	Door Gaskets	7.2960	36.2	264.1	.9	265.0
109	Knobs	.2390	518.7	124.0	.4	124.4
110	1 Speed Motors	16.7078	8.3	137.8	1.6	139.4
111	2 Speed Motors	22.5720	20.7	467.2	5.3	472.5
112	Paint (Powder)	3.0870	29.5	91.1	.4	91.5
113	Plastic Components	2.9672	106.0	314.5	2.0	316.6
114	Polypropylene Resin	.3337	1,694.5	565.4	21.7	587.1
115	Pumps	5.2661	20.7	109.0	.3	109.3
116	Relays	6.2423	56.9	355.2	.5	355.6
117	Steel	.2600	8,487.2	2,206.7	108.6	2,315.3
118	Switches	.6906	490.7	338.8	.6	339.5
119	Timers/Motors	6.7396	186.7	1,257.9	.2	1,258.2
120	Wiring Harnesses	4.9065	106.0	520.1	2.7	522.8
121	Misc. Electronics	5.8931	106.0	624.7	.4	625.1
122	Washer MP	39.8056	20.7	824.0	8.0	831.9
123	Dryer MP	33.9691	8.3	280.2	.1	280.4
124	Range MP	155.3526	40.9	6,346.2	49.7	6,395.8
125	Refrigerator MP	97.1380	36.2	3,516.4	27.8	3,544.2
Total:				20,992.2	264.3	21,256.5

Note: Manufacturing plants source from domestic supplier location unless otherwise indicated in the following manner. C - Canada, M - Mexico, US - United States.

Table G-13 (cont'd.)

Manufacturing Plant Location: Indianapolis

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.1500	65,082.0	74,844.3	968.4	75,812.7
102	Belts	M 1.9966	16,409.9	32,764.0	3,579.5	36,343.5
103	Compressors	50.0000	7,038.4	351,920.0	2,167.8	354,087.8
104	Copper Components	1.0500	20,374.3	21,393.0	215.2	21,608.1
105	Cord Sets	M 1.9213	13,110.6	25,189.4	3,062.2	28,251.6
106	Corrugated Packaging	2.2500	22,932.6	51,598.4	2,825.3	54,423.7
107	Fasteners	M .0085	3,583,891.3	30,463.1	4,327.5	34,790.6
108	Door Gaskets	8.0000	7,038.4	56,307.2	173.4	56,480.6
109	Knobs	.2500	90,832.9	22,708.2	99.5	22,807.7
110	1 Speed Motors	18.3200	4,265.5	78,144.0	788.3	78,932.2
111	2 Speed Motors	24.7500	6,072.2	150,287.0	1,496.2	151,783.1
112	Paint (Powder)	3.2500	7,323.3	23,800.9	70.9	23,871.7
113	Plastic Components	M 2.9672	22,932.6	68,045.6	9,274.6	77,320.2
114	Polypropylene Resin	.3600	377,159.5	135,777.4	3,982.8	139,760.2
115	Pumps	M 5.2661	6,072.2	31,976.8	3,581.4	35,558.2
116	Relays	M 6.2423	13,110.6	81,840.3	8,668.3	90,508.6
117	Steel	.2810	1,874,393.0	526,704.4	16,494.7	543,199.1
118	Switches	.7500	102,854.1	77,140.6	138.7	77,279.2
119	Timers/Motors	7.2500	41,274.9	299,243.0	55.6	299,298.7
120	Wiring Harnesses	M 4.9065	22,932.6	112,518.8	13,627.9	126,146.7
121	Misc. Electronics	6.4000	22,932.6	146,768.6	92.7	146,861.4
122	Washer MP	M 39.8056	6,072.2	241,707.6	37,225.4	278,933.0
123	Dryer MP	M 33.9691	4,265.5	144,895.2	14,795.8	159,691.0
124	Range MP	M 155.3526	5,556.5	863,216.7	119,466.4	982,683.2
125	Refrigerator MP	M 97.1380	7,038.4	683,696.1	96,884.6	780,580.7
Total:				4,332,950.4	344,063.1	4,677,013.5

Total Purchase Expenditure For Each Purchased Item And Total Purchases For The Firm

Item No.	Description	Quantity (000)	Total Purchases (\$ 000)	Trans. Cost (\$ 000)	Delivered Cost (\$ 000)
101	Aluminum Components	70,497	81,088.3	1,060.6	82,148.9
102	Belts	17,941	35,820.3	3,913.9	39,734.2
103	Compressors	7,618	380,940.4	2,414.4	383,354.9
104	Copper Components	22,069	23,175.0	244.0	23,419.0
105	Cord Sets	14,233	27,345.1	3,332.6	30,677.7
106	Corrugated Packaging	24,993	56,262.2	3,177.2	59,439.3
107	Fasteners	3,909,540	33,231.1	4,749.0	37,980.1
108	Door Gaskets	7,618	60,950.5	193.2	61,143.6
109	Knobs	98,947	24,738.6	108.1	24,846.7
110	1 Speed Motors	4,711	86,351.7	903.3	87,255.0
111	2 Speed Motors	6,615	163,778.3	1,682.2	165,460.5
112	Paint (Powder)	7,968	25,898.8	81.9	25,980.7
113	Plastic Components	24,993	74,158.6	10,142.0	84,300.6
114	Polypropylene Resin	409,240	147,354.7	4,530.5	151,885.2
115	Pumps	6,615	34,835.0	3,901.6	38,736.6
116	Relays	14,233	88,844.2	9,389.1	98,233.2
117	Steel	2,045,286	574,855.6	19,414.6	594,270.2
118	Switches	112,306	84,248.6	154.8	84,403.3
119	Timers/Motors	44,939	325,872.7	61.9	325,934.6
120	Wiring Harnesses	24,993	122,627.2	14,888.4	137,515.6
121	Misc. Electronics	24,993	159,990.3	103.3	160,093.6
122	Washer MP	6,615	266,549.4	37,504.5	304,053.9
123	Dryer MP	4,711	160,019.9	16,322.9	176,342.8
124	Range MP	6,049	939,797.8	130,224.2	1,070,022.0
125	Refrigerator MP	7,618	739,963.3	105,273.8	845,237.1
Total:			4,718,697.4	373,772.1	5,092,469.5

Table G-13 (cont'd.)

Purchases By Supplier Location

Supplier Location: Woodstock

Item No.	Description	Unit Price (\$)	Quantity (000)	Total Purchases (\$ 000)
101	Aluminum Components	1.1630	5,073.2	5,900.1
102	Belts	2.4367	.0	.0
103	Compressors	50.4000	543.1	27,369.7
104	Copper Components	1.0574	1,583.7	1,674.6
105	Cord Sets	2.2799	.0	.0
106	Corrugated Packaging	2.2860	1,954.2	4,467.3
107	Fasteners	.0101	.0	.0
108	Door Gaskets	8.0640	543.1	4,379.2
109	Knobs	.2510	7,595.2	1,906.4
110	1 Speed Motors	18.4666	437.0	8,069.9
111	2 Speed Motors	24.9480	522.1	13,024.1
112	Paint (Powder)	3.2648	614.7	2,006.8
113	Plastic Components	3.5484	.0	.0
114	Polypropylene Resin	.3624	30,385.8	11,011.8
115	Pumps	6.0667	.0	.0
116	Relays	7.0689	.0	.0
117	Steel	.2829	162,405.4	45,944.5
118	Switches	.7554	8,961.0	6,769.1
119	Timers/Motors	7.2964	3,477.3	25,371.8
120	Wiring Harnesses	6.0776	.0	.0
121	Misc. Electronics	6.4461	1,954.2	12,597.0
122	Washer MP	46.0068	522.1	24,017.8
123	Dryer MP	39.2610	.0	.0
124	Range MP	177.6261	.0	.0
125	Refrigerator MP	114.1256	.0	.0
Total:			226,571.8	194,510.1

Supplier Location: Reynosa

Item No.	Description	Unit Price (\$)	Quantity (000)	Total Purchases (\$ 000)
101	Aluminum Components	1.0073	341.4	343.9
102	Belts	1.9966	17,940.7	35,820.3
103	Compressors	45.6000	36.2	1,650.7
104	Copper Components	.9687	110.9	107.4
105	Cord Sets	1.9213	14,232.6	27,345.1
106	Corrugated Packaging	1.8540	106.0	196.5
107	Fasteners	.0085	3,909,539.8	33,231.1
108	Door Gaskets	7.2960	36.2	264.1
109	Knobs	.2390	518.7	124.0
110	1 Speed Motors	16.7078	8.3	137.8
111	2 Speed Motors	22.5720	20.7	467.2
112	Paint (Powder)	3.0870	29.5	91.1
113	Plastic Components	2.9672	24,992.8	74,158.6
114	Polypropylene Resin	.3337	1,694.5	565.4
115	Pumps	5.2661	6,615.0	34,835.0
116	Relays	6.2423	14,232.6	88,844.2
117	Steel	.2600	8,487.2	2,206.7
118	Switches	.6906	490.7	338.8
119	Timers/Motors	6.7396	186.7	1,257.9
120	Wiring Harnesses	4.9065	24,992.8	122,627.2
121	Misc. Electronics	5.8931	106.0	624.7
122	Washer MP	39.8056	6,092.9	242,531.5
123	Dryer MP	33.9691	4,710.8	160,019.9
124	Range MP	155.3526	6,049.5	939,797.8
125	Refrigerator MP	97.1380	7,617.7	739,963.3
Total:			4,049,189.7	2,507,550.4

Table G-13 (cont'd.)

Supplier Location: Fort Wayne

Item No.	Description	Unit Price (\$)	Quantity (000)	Total Purchases (\$ 000)
101	Aluminum Components	1.1500	65,082.0	74,844.3
102	Belts	2.4000	.0	.0
103	Compressors	50.0000	7,038.4	351,920.0
104	Copper Components	1.0500	20,374.3	21,393.0
105	Cord Sets	2.2500	.0	.0
106	Corrugated Packaging	2.2500	22,932.6	51,598.4
107	Fasteners	.0100	.0	.0
108	Door Gaskets	8.0000	7,038.4	56,307.2
109	Knobs	.2500	90,832.9	22,708.2
110	1 Speed Motors	18.3200	4,265.5	78,144.0
111	2 Speed Motors	24.7500	6,072.2	150,287.0
112	Paint (Powder)	3.2500	7,323.3	23,800.9
113	Plastic Components	3.5000	.0	.0
114	Polypropylene Resin	.3600	377,159.5	135,777.4
115	Pumps	6.0000	.0	.0
116	Relays	7.0000	.0	.0
117	Steel	.2810	1,874,393.0	526,704.4
118	Switches	.7500	102,854.1	77,140.6
119	Timers/Motors	7.2500	41,274.9	299,243.0
120	Wiring Harnesses	5.9800	.0	.0
121	Misc. Electronics	6.4000	22,932.6	146,768.6
122	Washer MP	45.4900	.0	.0
123	Dryer MP	38.8200	.0	.0
124	Range MP	175.7700	.0	.0
125	Refrigerator MP	112.7100	.0	.0
Total:			2,649,573.7	2,016,636.9

Table G-13 (cont'd.)

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Toronto

Item	Quantity	Purchased	Mfg.	Transfer		Total
<u>No. Description</u>	<u>(000)</u>	<u>Materials/</u>	<u>Labor/</u>	<u>Handling/</u>	<u>Mfg. VC/</u>	<u>Mfg. VC</u>
		<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>(\$ 000)</u>
201 Washers	522.1	157.47	38.15	2.35	197.97	103,349.2
202 Dryers	437.0	129.77	30.48	2.35	162.60	71,054.8
203 Ranges	452.1	243.30	49.38	2.35	295.03	133,381.1
204 Refrigerators	543.1	267.55	72.51	2.35	342.41	185,944.0
Total:	1,954.2		252.65		VC Total:	493,729.0
			57.44		FC Total:	112,239.7
			310.09		Plant Total:	605,968.7

Manufacturing Plant Location: Monterrey

Item	Quantity	Purchased	Mfg.	Transfer		Total
<u>No. Description</u>	<u>(000)</u>	<u>Materials/</u>	<u>Labor/</u>	<u>Handling/</u>	<u>Mfg. VC/</u>	<u>Mfg. VC</u>
		<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>(\$ 000)</u>
201 Washers	20.7	140.39	4.24	1.40	146.03	3,022.7
202 Dryers	8.3	117.50	3.89	1.40	122.79	1,013.0
203 Ranges	40.9	214.63	5.49	1.40	221.52	9,049.0
204 Refrigerators	36.2	237.94	8.06	1.40	247.40	8,956.0
Total:	106.0		207.93		VC Total:	22,040.8
			60.27		FC Total:	6,388.5
			268.20		Plant Total:	28,429.3

Manufacturing Plant Location: Indianapolis

Item	Quantity	Purchased	Mfg.	Transfer		Total
<u>No. Description</u>	<u>(000)</u>	<u>Materials/</u>	<u>Labor/</u>	<u>Handling/</u>	<u>Mfg. VC/</u>	<u>Mfg. VC</u>
		<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>(\$ 000)</u>
201 Washers	6,072.2	155.10	35.32	2.50	192.92	1,171,422.9
202 Dryers	4,265.5	128.05	28.22	2.50	158.77	677,217.8
203 Ranges	5,556.5	239.77	45.72	2.50	287.99	1,600,237.9
204 Refrigerators	7,038.4	263.80	67.14	2.50	333.44	2,346,910.3
Total:	22,932.6		252.73		VC Total:	5,795,788.9
			60.21		FC Total:	1,380,670.4
			312.94		Plant Total:	7,176,459.3
Firm Total:	24,992.8		252.54		Firm VC Total:	6,311,558.7
			59.99		Firm FC Total:	1,499,298.6
			312.52		Firm MFG Total:	7,810,857.3

Table G-14

RQB4E Results: North American Sourcing Series - 25 Percent Reduction In Cross-Border Transaction Costs

Summary

<u>Finished Product Demand</u>	<u>(000)</u>
Total Units	24,992.8

<u>Cost Information</u>	<u>(\$000)</u>
Total Purchase Cost	4,689,278.1
Total Manufacturing Cost	7,755,171.2
Total Distribution Center Cost	347,993.2
Total Transportation Cost	835,379.0
Total System Cost	8,591,038.1

<u>Transportation Cost Detail</u>	<u>(\$000)</u>
Inbound Freight:	347,505.3
Internal Transfer Freight:	145,160.6
Customer Freight:	342,713.1
Total Transportation Cost:	835,379.0

<u>Facilities Utilized</u>	<u>Type</u>
Woodstock	S
Reynosa	S
Fort Wayne	S
Toronto	M
Monterrey	M
Indianapolis	M
Nuevo Laredo	TP
Cuidad Juarez	TP

Table G-14 (cont'd.)

Purchases By Manufacturing Plant Location

Manufacturing Plant Location: Toronto

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.1630	5,073.2	5,900.1	87.8	5,987.9
102	Belts M	1.9966	1,481.1	2,957.2	482.1	3,439.3
103	Compressors	50.4000	543.1	27,369.7	235.0	27,604.7
104	Copper Components	1.0574	1,583.7	1,674.6	27.4	1,702.0
105	Cord Sets M	1.9213	1,065.1	2,046.4	351.7	2,398.1
106	Corrugated Packaging	2.2860	1,954.2	4,467.3	338.3	4,805.6
107	Fasteners M	.0085	308,976.4	2,626.3	525.1	3,151.4
108	Door Gaskets	8.0640	543.1	4,379.2	18.8	4,398.0
109	Knobs	.2510	7,595.2	1,906.4	8.2	1,914.6
110	1 Speed Motors	18.4666	437.0	8,069.9	113.5	8,183.4
111	2 Speed Motors	24.9480	522.1	13,024.1	180.7	13,204.8
112	Paint (Powder)	3.2648	614.7	2,006.8	10.6	2,017.5
113	Plastic Components	3.5484	1,954.2	6,934.3	50.7	6,985.0
114	Polypropylene Resin	.3624	30,385.8	11,011.8	526.0	11,537.8
115	Pumps M	5.2661	522.1	2,749.2	319.9	3,069.1
116	Relays	7.0689	1,065.1	7,529.1	11.5	7,540.6
117	Steel	.2829	162,405.4	45,944.5	2,811.3	48,755.8
118	Switches	.7554	8,961.0	6,769.1	15.5	6,784.6
119	Timers/Motors	7.2964	3,477.3	25,371.8	6.0	25,377.8
120	Wiring Harnesses M	4.9065	1,954.2	9,588.3	1,641.4	11,229.7
121	Misc. Electronics	6.4461	1,954.2	12,597.0	10.2	12,607.1
122	Washer MP	46.0068	522.1	24,017.8	271.1	24,289.0
123	Dryer MP	39.2610	437.0	17,157.1	7.6	17,164.6
124	Range MP	177.6261	452.1	80,304.8	743.5	81,048.2
125	Refrigerator MP	114.1256	543.1	61,975.9	564.0	62,539.9
Total:				388,378.5	9,358.1	397,736.6

Manufacturing Plant Location: Monterrey

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.0073	341.4	343.9	4.4	348.3
102	Belts	1.9966	49.7	99.1	.2	99.3
103	Compressors	45.6000	36.2	1,650.7	11.6	1,662.3
104	Copper Components	.9687	110.9	107.4	1.4	108.9
105	Cord Sets	1.9213	56.9	109.3	.6	109.9
106	Corrugated Packaging	1.8540	106.0	196.5	13.6	210.1
107	Fasteners	.0085	16,672.1	141.7	1.4	143.1
108	Door Gaskets	7.2960	36.2	264.1	.9	265.0
109	Knobs	.2390	518.7	124.0	.4	124.4
110	1 Speed Motors	16.7078	8.3	137.8	1.6	139.4
111	2 Speed Motors	22.5720	20.7	467.2	5.3	472.5
112	Paint (Powder)	3.0870	29.5	91.1	.4	91.5
113	Plastic Components	2.9672	106.0	314.5	2.0	316.6
114	Polypropylene Resin	.3337	1,694.5	565.4	21.7	587.1
115	Pumps	5.2661	20.7	109.0	.3	109.3
116	Relays	6.2423	56.9	355.2	.5	355.6
117	Steel	.2600	8,487.2	2,206.7	108.6	2,315.3
118	Switches	.6906	490.7	338.8	.6	339.5
119	Timers/Motors	6.7396	186.7	1,257.9	.2	1,258.2
120	Wiring Harnesses	4.9065	106.0	520.1	2.7	522.8
121	Misc. Electronics	5.8931	106.0	624.7	.4	625.1
122	Washer MP	39.8056	20.7	824.0	8.0	831.9
123	Dryer MP	33.9691	8.3	280.2	.1	280.4
124	Range MP	155.3526	40.9	6,346.2	49.7	6,395.8
125	Refrigerator MP	97.1380	36.2	3,516.4	27.8	3,544.2
Total:				20,992.2	264.3	21,256.5

Note: Manufacturing plants source from domestic supplier location unless otherwise indicated in the following manner. C - Canada, M - Mexico, US - United States.

Item No.	Description	Unit	Price(\$)	Quantity (0000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	M	1.0073	65,082.0	65,557.1	9,030.1	74,587.1
102	Belts	M	1.9966	16,409.9	32,764.0	3,760.3	35,524.4
103	Compressors		50.0000	7,038.4	351,920.0	2,167.8	354,087.8
104	Copper Components		1.0500	20,374.3	21,393.0	215.2	21,608.1
105	Cord Sets	M	1.9213	13,110.6	25,189.4	2,432.5	27,621.9
106	Corrugated Packaging		2.2500	22,932.6	51,598.4	2,825.3	54,423.7
107	Fasteners	M	.0085	3,583,891.3	30,463.1	5,454.8	35,917.9
108	Door Gaskets	M	7.2960	7,038.4	51,352.2	4,625.6	55,977.8
109	Knobs		.2500	90,832.9	22,708.2	99.5	22,807.7
110	1 Speed Motors		18.3200	4,265.5	78,144.0	788.3	78,932.2
111	2 Speed Motors		24.7500	6,072.2	150,287.0	1,496.2	151,783.1
112	Paint (Powder)		3.2500	7,323.3	23,800.9	70.9	23,871.7
113	Plastic Components	M	2.9672	22,932.6	68,045.6	7,573.6	75,619.2
114	Polypropylene Resin		.3600	377,159.5	135,777.4	3,982.8	139,760.2
115	Pumps	M	5.2661	6,072.2	31,976.8	2,782.0	34,758.8
116	Relays	M	6.2423	13,110.6	81,840.3	6,622.3	88,462.6
117	Steel		.2810	1,874,393.0	526,704.4	16,494.7	543,199.1
118	Switches	M	.6906	102,854.1	71,031.0	5,935.2	76,966.2
119	Timers/Motors	M	6.7396	41,274.9	278,176.3	21,107.2	299,283.5
120	Wiring Harnesses	M	4.9065	22,932.6	112,518.8	10,814.5	123,333.3
121	Misc. Electronics	M	5.8931	22,932.6	135,144.1	10,542.3	145,686.4
122	Washer MP	M	39.8056	6,072.2	241,707.6	31,188.5	272,896.0
123	Dryer MP	M	33.9691	4,265.5	144,895.2	11,173.4	156,068.6
124	Range MP	M	155.3526	5,556.5	863,216.7	97,940.0	961,156.7
125	Refrigerator MP	M	97.1380	7,038.4	683,696.1	79,760.1	763,456.2
				Total:	4,279,907.4	337,882.9	4,617,790.3

Item	Quantity	Total Purchases	Trans. Cost	Delivered Cost
No. Description	(000)	(\$ 000)	(\$ 000)	(\$ 000)
101 Aluminum Components	70,497	71,801.1	9,122.2	80,923.3
102 Belts	17,941	35,820.3	3,242.7	39,063.0
103 Compressors	7,618	380,940.4	2,414.4	383,354.9
104 Copper Components	22,069	23,175.0	244.0	23,419.0
105 Cord Sets	14,233	27,345.1	2,784.7	30,129.8
106 Corrugated Packaging	24,993	56,262.2	3,177.2	59,439.3
107 Fasteners	3,909,540	33,231.1	5,981.3	39,212.4
108 Door Gaskets	7,618	55,995.4	4,645.4	60,640.8
109 Knobs	98,947	24,738.6	108.1	24,846.7
110 1 Speed Motors	4,711	86,351.7	903.3	87,255.0
111 2 Speed Motors	6,615	163,778.3	1,682.2	165,460.5
112 Paint (Powder)	7,968	25,898.8	81.9	25,980.7
113 Plastic Components	24,993	75,294.4	7,626.3	82,920.8
114 Polypropylene Resin	409,240	147,354.7	4,530.5	151,885.2
115 Pumps	6,615	34,835.0	3,102.2	37,937.2
116 Relays	14,233	89,724.6	6,634.3	96,358.9
117 Steel	2,045,286	574,855.6	19,414.6	594,270.2
118 Switches	112,306	78,139.0	5,951.3	84,090.4
119 Timers/Motors	44,939	304,806.0	21,113.4	325,919.4
120 Wiring Harnesses	24,993	122,627.2	12,458.6	135,085.8
121 Misc. Electronics	24,993	148,365.7	10,552.9	158,918.6
122 Washer MP	6,615	266,549.4	31,467.5	298,016.9
123 Dryer MP	4,711	162,332.5	11,181.1	173,513.6
124 Range MP	6,049	949,867.6	98,733.2	1,048,600.8
125 Refrigerator MP	7,618	749,188.4	80,352.0	829,540.4
Total:		4,689,278.1	347,505.3	5,036,783.4

Table G-14 (cont'd.)

Purchases By Supplier Location

Supplier Location: Woodstock

Item No.	Description	Unit Price (\$)	Quantity (000)	Total Purchases (\$ 000)
101	Aluminum Components	1.1630	5,073.2	5,900.1
102	Belts	2.4367	.0	.0
103	Compressors	50.4000	543.1	27,369.7
104	Copper Components	1.0574	1,583.7	1,674.6
105	Cord Sets	2.2799	.0	.0
106	Corrugated Packaging	2.2860	1,954.2	4,467.3
107	Fasteners	.0101	.0	.0
108	Door Gaskets	8.0640	543.1	4,379.2
109	Knobs	.2510	7,595.2	1,906.4
110	1 Speed Motors	18.4666	437.0	8,069.9
111	2 Speed Motors	24.9480	522.1	13,024.1
112	Paint (Powder)	3.2648	614.7	2,006.8
113	Plastic Components	3.5484	1,954.2	6,934.3
114	Polypropylene Resin	.3624	30,385.8	11,011.8
115	Pumps	6.0667	.0	.0
116	Relays	7.0689	1,065.1	7,529.1
117	Steel	.2829	162,405.4	45,944.5
118	Switches	.7554	8,961.0	6,769.1
119	Timers/Motors	7.2964	3,477.3	25,371.8
120	Wiring Harnesses	6.0776	.0	.0
121	Misc. Electronics	6.4461	1,954.2	12,597.0
122	Washer MP	46.0068	522.1	24,017.8
123	Dryer MP	39.2610	437.0	17,157.1
124	Range MP	177.6261	452.1	80,304.8
125	Refrigerator MP	114.1256	543.1	61,975.9
Total:			231,023.3	368,411.2

Supplier Location: Reynosa

Item No.	Description	Unit Price (\$)	Quantity (000)	Total Purchases (\$ 000)
101	Aluminum Components	1.0073	65,423.4	65,901.0
102	Belts	1.9966	17,940.7	35,820.3
103	Compressors	45.6000	36.2	1,650.7
104	Copper Components	.9687	110.9	107.4
105	Cord Sets	1.9213	14,232.6	27,345.1
106	Corrugated Packaging	1.8540	106.0	196.5
107	Fasteners	.0085	3,909,539.8	33,231.1
108	Door Gaskets	7.2960	7,074.6	51,616.3
109	Knobs	.2390	518.7	124.0
110	1 Speed Motors	16.7078	8.3	137.8
111	2 Speed Motors	22.5720	20.7	467.2
112	Paint (Powder)	3.0870	29.5	91.1
113	Plastic Components	2.9672	23,038.6	68,360.1
114	Polypropylene Resin	.3337	1,694.5	565.4
115	Pumps	5.2661	6,615.0	34,835.0
116	Relays	6.2423	13,167.5	82,195.5
117	Steel	.2600	8,487.2	2,206.7
118	Switches	.6906	103,344.8	71,369.9
119	Timers/Motors	6.7396	41,461.6	279,434.3
120	Wiring Harnesses	4.9065	24,992.8	122,627.2
121	Misc. Electronics	5.8931	23,038.6	135,768.8
122	Washer MP	39.8056	6,092.9	242,531.5
123	Dryer MP	33.9691	4,273.8	145,175.4
124	Range MP	155.3526	5,597.4	869,562.9
125	Refrigerator MP	97.1380	7,074.6	687,212.5
Total:			4,283,920.2	2,958,533.8

Table G-14 (cont'd.)

Supplier Location: Fort Wayne

Item No.	Description	Unit Price (\$)	Quantity (000)	Total Purchases (\$ 000)
101	Aluminum Components	1.1500	.0	.0
102	Belts	2.4000	.0	.0
103	Compressors	50.0000	7,038.4	351,920.0
104	Copper Components	1.0500	20,374.3	21,393.0
105	Cord Sets	2.2500	.0	.0
106	Corrugated Packaging	2.2500	22,932.6	51,598.4
107	Fasteners	.0100	.0	.0
108	Door Gaskets	8.0000	.0	.0
109	Knobs	.2500	90,832.9	22,708.2
110	1 Speed Motors	18.3200	4,265.5	78,144.0
111	2 Speed Motors	24.7500	6,072.2	150,287.0
112	Paint (Powder)	3.2500	7,323.3	23,800.9
113	Plastic Components	3.5000	.0	.0
114	Polypropylene Resin	.3600	377,159.5	135,777.4
115	Pumps	6.0000	.0	.0
116	Relays	7.0000	.0	.0
117	Steel	.2810	1,874,393.0	526,704.4
118	Switches	.7500	.0	.0
119	Timers/Motors	7.2500	.0	.0
120	Wiring Harnesses	5.9800	.0	.0
121	Misc. Electronics	6.4000	.0	.0
122	Washer MP	45.4900	.0	.0
123	Dryer MP	38.8200	.0	.0
124	Range MP	175.7700	.0	.0
125	Refrigerator MP	112.7100	.0	.0
Total:			2,410,391.7	1,362,333.2

Table G-14 (cont'd.)

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Toronto

Item No. Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201 Washers	522.1	158.32	38.15	2.35	198.82	103,792.2
202 Dryers	437.0	132.11	30.48	2.35	164.94	72,076.7
203 Ranges	452.1	243.95	49.38	2.35	295.68	133,678.7
204 Refrigerators	543.1	270.81	72.51	2.35	345.67	187,718.6
Total:	1,954.2		254.46 57.44 311.90		VC Total: FC Total: Plant Total:	497,266.2 112,239.7 609,505.9

Manufacturing Plant Location: Monterrey

Item No. Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201 Washers	20.7	140.39	4.24	1.40	146.03	3,022.7
202 Dryers	8.3	117.50	3.89	1.40	122.79	1,013.0
203 Ranges	40.9	214.63	5.49	1.40	221.52	9,049.0
204 Refrigerators	36.2	237.94	8.06	1.40	247.40	8,956.0
Total:	106.0		207.93 60.27 268.20		VC Total: FC Total: Plant Total:	22,040.8 6,388.5 28,429.3

Manufacturing Plant Location: Indianapolis

Item No. Description	Quantity (000)	Purchased Materials/ Unit (\$)	Mfg. Labor/ Unit (\$)	Transfer Handling/ Unit (\$)	Mfg. VC/ Unit (\$)	Total Mfg. VC (\$ 000)
201 Washers	6,072.2	153.44	35.32	2.50	191.26	1,161,380.5
202 Dryers	4,265.5	126.94	28.22	2.50	157.66	672,492.8
203 Ranges	5,556.5	235.67	45.72	2.50	283.89	1,577,441.7
204 Refrigerators	7,038.4	260.73	67.14	2.50	330.37	2,325,250.7
Total:	22,932.6		250.15 60.21 310.35		VC Total: FC Total: Plant Total:	5,736,565.7 1,380,670.4 7,117,236.1
Firm Total:	24,992.8		250.31 59.99 310.30		Firm VC Total: Firm FC Total: Firm MFG Total:	6,255,872.6 1,499,298.6 7,755,171.2

Table G-15

RQB4F Results: North American Sourcing Series - 50 Percent Reduction In Cross-Border Transaction Costs

Summary

<u>Finished Product Demand</u>	<u>(000)</u>
Total Units	24,992.8

<u>Cost Information</u>	<u>(\$000)</u>
Total Purchase Cost	4,634,758.8
Total Manufacturing Cost	7,672,139.3
Total Distribution Center Cost	347,993.2
Total Transportation Cost	806,866.5
Total System Cost	8,508,006.2

<u>Transportation Cost Detail</u>	<u>(\$000)</u>
Inbound Freight:	318,992.8
Internal Transfer Freight:	145,160.6
Customer Freight:	342,713.1

Total Transportation Cost:	806,866.5
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<u>Facilities Utilized</u>	<u>Type</u>
Woodstock	S
Reynosa	S
Fort Wayne	S
Toronto	M
Monterrey	M
Indianapolis	M
Nuevo Laredo	TP
Cuidad Juarez	TP

Table G-15 (cont'd.)

Purchases By Manufacturing Plant Location

Manufacturing Plant Location: Toronto

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.1630	5,073.2	5,900.1	87.8	5,987.9
102	Belts M	1.9966	1,481.1	2,957.2	408.2	3,365.4
103	Compressors	50.4000	543.1	27,369.7	235.0	27,604.7
104	Copper Components	1.0574	1,583.7	1,674.6	27.4	1,702.0
105	Cord Sets	1.9213	1,065.1	2,046.4	300.5	2,346.9
106	Corrugated Packaging	2.2860	1,954.2	4,467.3	338.3	4,805.6
107	Fasteners M	.0085	308,976.4	2,626.3	459.5	3,085.8
108	Door Gaskets	8.0640	543.1	4,379.2	18.8	4,398.0
109	Knobs	.2510	7,595.2	1,906.4	8.2	1,914.6
110	1 Speed Motors	18.4666	437.0	8,069.9	113.5	8,183.4
111	2 Speed Motors	24.9480	522.1	13,024.1	180.7	13,204.8
112	Paint (Powder)	3.2648	614.7	2,006.8	10.6	2,017.5
113	Plastic Components M	2.9672	1,954.2	5,798.5	1,097.3	6,895.8
114	Polypropylene Resin	.3624	30,385.8	11,011.8	526.0	11,537.8
115	Pumps M	5.2661	522.1	2,749.2	251.2	3,000.4
116	Relays	7.0689	1,065.1	7,529.1	11.5	7,540.6
117	Steel	.2829	162,405.4	45,944.5	2,811.3	48,755.8
118	Switches	.7554	8,961.0	6,769.1	15.5	6,784.6
119	Timers/Motors	7.2964	3,477.3	25,371.8	6.0	25,377.8
120	Wiring Harnesses M	4.9065	1,954.2	9,588.3	1,401.6	10,989.9
121	Misc. Electronics	6.4461	1,954.2	12,597.0	10.2	12,607.1
122	Washer MP	46.0068	522.1	24,017.8	271.1	24,289.0
123	Dryer MP M	33.9691	437.0	14,844.5	1,972.4	16,816.8
124	Range MP	177.6261	452.1	80,304.8	743.5	81,048.2
125	Refrigerator MP	114.1256	543.1	61,975.9	564.0	62,539.9
Total:				384,930.2	11,870.2	396,800.4

Manufacturing Plant Location: Monterrey

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.0073	341.4	343.9	4.4	348.3
102	Belts	1.9966	49.7	99.1	.2	99.3
103	Compressors	45.6000	36.2	1,650.7	11.6	1,662.3
104	Copper Components	.9687	110.9	107.4	1.4	108.9
105	Cord Sets	1.9213	56.9	109.3	.6	109.9
106	Corrugated Packaging	1.8540	106.0	196.5	13.6	210.1
107	Fasteners	.0085	16,672.1	141.7	1.4	143.1
108	Door Gaskets	7.2960	36.2	264.1	.9	265.0
109	Knobs	.2390	518.7	124.0	.4	124.4
110	1 Speed Motors	16.7078	8.3	137.8	1.6	139.4
111	2 Speed Motors	22.5720	20.7	467.2	5.3	472.5
112	Paint (Powder)	3.0870	29.5	91.1	.4	91.5
113	Plastic Components	2.9672	106.0	314.5	2.0	316.6
114	Polypropylene Resin	.3337	1,694.5	565.4	21.7	587.1
115	Pumps	5.2661	20.7	109.0	.3	109.3
116	Relays	6.2423	56.9	355.2	.5	355.6
117	Steel	.2600	8,487.2	2,206.7	108.6	2,315.3
118	Switches	.6906	490.7	338.8	.6	339.5
119	Timers/Motors	6.7396	186.7	1,257.9	.2	1,258.2
120	Wiring Harnesses	4.9065	106.0	520.1	2.7	522.8
121	Misc. Electronics	5.8931	106.0	624.7	.4	625.1
122	Washer MP	39.8056	20.7	824.0	8.0	831.9
123	Dryer MP	33.9691	8.3	280.2	.1	280.4
124	Range MP	155.3526	40.9	6,346.2	49.7	6,395.8
125	Refrigerator MP	97.1380	36.2	3,516.4	27.8	3,544.2
Total:				20,992.2	264.3	21,256.5

Note: Manufacturing plants source from domestic supplier location unless otherwise indicated in the following manner. C - Canada, M - Mexico, US - United States.

Table G-15 (cont'd.)

Manufacturing Plant Location: Indianapolis

Item No.	Description	Unit	Quantity	Total Purch.	Trans.	Delivered
		Price(\$)	(000)	(\$ 000)	Cost(\$ 000)	Cost(\$000)
101	Aluminum Components	M 1.0073	65,082.0	65,557.1	7,391.3	72,948.4
102	Belts	M 1.9966	16,409.9	32,764.0	1,941.3	34,705.3
103	Compressors	M 45.6000	7,038.4	320,951.0	25,725.2	346,676.2
104	Copper Components	1.0500	20,374.3	21,393.0	215.2	21,608.1
105	Cord Sets	M 1.9213	13,110.6	25,189.4	1,802.8	26,992.1
106	Corrugated Packaging	2.2500	22,932.6	51,598.4	2,825.3	54,423.7
107	Fasteners	.0085	3,583,891.3	30,463.1	4,693.3	35,156.4
108	Door Gaskets	M 7.2960	7,038.4	51,352.2	3,341.8	54,694.0
109	Knobs	.2500	90,832.9	22,708.2	99.5	22,807.7
110	1 Speed Motors	M 16.7078	4,265.5	71,267.1	7,084.1	78,351.2
111	2 Speed Motors	M 22.5720	6,072.2	137,061.7	13,532.4	150,594.1
112	Paint (Powder)	3.2500	7,323.3	23,800.9	70.9	23,871.7
113	Plastic Components	M 2.9672	22,932.6	68,045.6	5,872.2	73,917.8
114	Polypropylene Resin	.3600	377,159.5	135,777.4	3,982.8	139,760.2
115	Pumps	M 5.2661	6,072.2	31,976.8	1,982.6	33,959.4
116	Relays	M 6.2423	13,110.6	81,840.3	4,576.3	86,416.6
117	Steel	.2810	1,874,393.0	526,704.4	16,494.7	543,199.1
118	Switches	M .6906	102,854.1	71,031.0	4,159.4	75,190.4
119	Timers/Motors	M 6.7396	41,274.9	278,176.3	14,152.7	292,329.1
120	Wiring Harnesses	M 4.9065	22,932.6	112,518.8	8,001.6	120,520.4
121	Misc. Electronics	M 5.8931	22,932.6	135,144.1	7,163.7	142,307.8
122	Washer MP	M 39.8056	6,072.2	241,707.6	25,153.3	266,860.9
123	Dryer MP	M 33.9691	4,265.5	144,895.2	7,551.0	152,446.2
124	Range MP	M 155.3526	5,556.5	863,216.7	76,413.6	939,630.3
125	Refrigerator MP	M 97.1380	7,038.4	683,696.1	62,631.5	746,327.6
Total:				4,228,836.4	306,858.2	4,535,694.6

Total Purchase Expenditure For Each Purchased Item And Total Purchases For The Firm

Item No.	Description	Quantity	Total Purchases	Trans. Cost	Delivered Cost
		(000)	(\$ 000)	(\$ 000)	(\$ 000)
101	Aluminum Components	70,497	71,801.1	7,483.5	79,284.6
102	Belts	17,941	35,820.3	2,349.7	38,170.0
103	Compressors	7,618	349,971.5	25,971.8	375,943.2
104	Copper Components	22,069	23,175.0	244.0	23,419.0
105	Cord Sets	14,233	27,345.1	2,103.9	29,448.9
106	Corrugated Packaging	24,993	56,262.2	3,177.2	59,439.3
107	Fasteners	3,909,540	33,231.1	5,154.2	38,385.2
108	Door Gaskets	7,618	55,995.4	3,361.5	59,357.0
109	Knobs	98,947	24,738.6	108.1	24,846.7
110	1 Speed Motors	4,711	79,474.9	7,199.1	86,674.0
111	2 Speed Motors	6,615	150,553.0	13,718.4	164,271.5
112	Paint (Powder)	7,968	25,898.8	81.9	25,980.7
113	Plastic Components	24,993	74,158.6	6,971.6	81,130.2
114	Polypropylene Resin	409,240	147,354.7	4,530.5	151,885.2
115	Pumps	6,615	34,835.0	2,234.1	37,069.1
116	Relays	14,233	89,724.6	4,588.2	94,312.8
117	Steel	2,045,286	574,855.6	19,414.6	594,270.2
118	Switches	112,306	78,139.0	4,175.5	82,314.6
119	Timers/Motors	44,939	304,806.0	14,159.0	318,965.0
120	Wiring Harnesses	24,993	122,627.2	9,405.9	132,033.1
121	Misc. Electronics	24,993	148,365.7	7,174.3	155,540.0
122	Washer MP	6,615	266,549.4	25,432.4	291,981.8
123	Dryer MP	4,711	160,019.9	9,523.5	169,543.4
124	Range MP	6,049	949,867.6	77,206.7	1,027,074.3
125	Refrigerator MP	7,618	749,188.4	63,223.3	812,411.7
Total:			4,634,758.8	318,992.8	4,953,751.5

Table G-15 (cont'd.)

Purchases By Supplier Location

Supplier Location: Woodstock

Item No.	Description	Unit Price (\$)	Quantity (000)	Total Purchases (\$ 000)
101	Aluminum Components	1.1630	5,073.2	5,900.1
102	Belts	2.4367	.0	.0
103	Compressors	50.4000	543.1	27,369.7
104	Copper Components	1.0574	1,583.7	1,674.6
105	Cord Sets	2.2799	.0	.0
106	Corrugated Packaging	2.2860	1,954.2	4,467.3
107	Fasteners	.0101	.0	.0
108	Door Gaskets	8.0640	543.1	4,379.2
109	Knobs	.2510	7,595.2	1,906.4
110	1 Speed Motors	18.4666	437.0	8,069.9
111	2 Speed Motors	24.9480	522.1	13,024.1
112	Paint (Powder)	3.2648	614.7	2,006.8
113	Plastic Components	3.5484	.0	.0
114	Polypropylene Resin	.3624	30,385.8	11,011.8
115	Pumps	6.0667	.0	.0
116	Relays	7.0689	1,065.1	7,529.1
117	Steel	.2829	162,405.4	45,944.5
118	Switches	.7554	8,961.0	6,769.1
119	Timers/Motors	7.2964	3,477.3	25,371.8
120	Wiring Harnesses	6.0776	.0	.0
121	Misc. Electronics	6.4461	1,954.2	12,597.0
122	Washer MP	46.0068	522.1	24,017.8
123	Dryer MP	39.2610	.0	.0
124	Range MP	177.6261	452.1	80,304.8
125	Refrigerator MP	114.1256	543.1	61,975.9
Total:			228,632.1	344,319.9

Supplier Location: Reynosa

Item No.	Description	Unit Price (\$)	Quantity (000)	Total Purchases (\$ 000)
101	Aluminum Components	1.0073	65,423.4	65,901.0
102	Belts	1.9966	17,940.7	35,820.3
103	Compressors	45.6000	7,074.6	322,601.8
104	Copper Components	.9687	110.9	107.4
105	Cord Sets	1.9213	14,232.6	27,345.1
106	Corrugated Packaging	1.8540	106.0	196.5
107	Fasteners	.0085	3,909,539.8	33,231.1
108	Door Gaskets	7.2960	7,074.6	51,616.3
109	Knobs	.2390	518.7	124.0
110	1 Speed Motors	16.7078	4,273.8	71,405.0
111	2 Speed Motors	22.5720	6,092.9	137,528.9
112	Paint (Powder)	3.0870	29.5	91.1
113	Plastic Components	2.9672	24,992.8	74,158.6
114	Polypropylene Resin	.3337	1,694.5	565.4
115	Pumps	5.2661	6,615.0	34,835.0
116	Relays	6.2423	13,167.5	82,195.5
117	Steel	.2600	8,487.2	2,206.7
118	Switches	.6906	103,344.8	71,369.9
119	Timers/Motors	6.7396	41,461.6	279,434.3
120	Wiring Harnesses	4.9065	24,992.8	122,627.2
121	Misc. Electronics	5.8931	23,038.6	135,768.8
122	Washer MP	39.8056	6,092.9	242,531.5
123	Dryer MP	33.9691	4,710.8	160,019.9
124	Range MP	155.3526	5,597.4	869,562.9
125	Refrigerator MP	97.1380	7,074.6	687,212.5
Total:			4,303,687.5	3,508,456.6

Table G-15 (cont'd.)

Supplier Location: Fort Wayne

Item No.	Description	Unit Price (\$)	Quantity (000)	Total Purchases (\$ 000)
101	Aluminum Components	1.1500	.0	.0
102	Belts	2.4000	.0	.0
103	Compressors	50.0000	.0	.0
104	Copper Components	1.0500	20,374.3	21,393.0
105	Cord Sets	2.2500	.0	.0
106	Corrugated Packaging	2.2500	22,932.6	51,598.4
107	Fasteners	.0100	.0	.0
108	Door Gaskets	8.0000	.0	.0
109	Knobs	.2500	90,832.9	22,708.2
110	1 Speed Motors	18.3200	.0	.0
111	2 Speed Motors	24.7500	.0	.0
112	Paint (Powder)	3.2500	7,323.3	23,800.9
113	Plastic Components	3.5000	.0	.0
114	Polypropylene Resin	.3600	377,159.5	135,777.4
115	Pumps	6.0000	.0	.0
116	Relays	7.0000	.0	.0
117	Steel	.2810	1,874,393.0	526,704.4
118	Switches	.7500	.0	.0
119	Timers/Motors	7.2500	.0	.0
120	Wiring Harnesses	5.9800	.0	.0
121	Misc. Electronics	6.4000	.0	.0
122	Washer MP	45.4900	.0	.0
123	Dryer MP	38.8200	.0	.0
124	Range MP	175.7700	.0	.0
125	Refrigerator MP	112.7100	.0	.0
Total:			2,393,015.6	781,982.2

Table G-15 (cont'd.)

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Toronto

Item	Quantity	Purchased	Mfg.	Transfer		Total
<u>No. Description</u>	<u>(000)</u>	<u>Materials/</u>	<u>Labor/</u>	<u>Handling/</u>	<u>Mfg. VC/</u>	<u>Mfg. VC</u>
		<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>(\$ 000)</u>
201 Washers	522.1	157.84	38.15	2.35	198.34	103,542.0
202 Dryers	437.0	131.05	30.48	2.35	163.88	71,616.3
203 Ranges	452.1	243.75	49.38	2.35	295.48	133,584.3
204 Refrigerators	543.1	270.57	72.51	2.35	345.43	187,587.5
Total:	1,954.2		253.98		VC Total:	496,330.0
			57.44		FC Total:	112,239.7
			311.42		Plant Total:	608,569.7

Manufacturing Plant Location: Monterrey

Item	Quantity	Purchased	Mfg.	Transfer		Total
<u>No. Description</u>	<u>(000)</u>	<u>Materials/</u>	<u>Labor/</u>	<u>Handling/</u>	<u>Mfg. VC/</u>	<u>Mfg. VC</u>
		<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>(\$ 000)</u>
201 Washers	20.7	140.39	4.24	1.40	146.03	3,022.7
202 Dryers	8.3	117.50	3.89	1.40	122.79	1,013.0
203 Ranges	40.9	214.63	5.49	1.40	221.52	9,049.0
204 Refrigerators	36.2	237.94	8.06	1.40	247.40	8,956.0
Total:	106.0		207.93		VC Total:	22,040.8
			60.27		FC Total:	6,388.5
			268.20		Plant Total:	28,429.3

Manufacturing Plant Location: Indianapolis

Item	Quantity	Purchased	Mfg.	Transfer		Total
<u>No. Description</u>	<u>(000)</u>	<u>Materials/</u>	<u>Labor/</u>	<u>Handling/</u>	<u>Mfg. VC/</u>	<u>Mfg. VC</u>
		<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>(\$ 000)</u>
201 Washers	6,072.2	151.19	35.32	2.50	189.01	1,147,707.0
202 Dryers	4,265.5	125.08	28.22	2.50	155.80	664,560.6
203 Ranges	5,556.5	231.10	45.72	2.50	279.32	1,552,029.7
204 Refrigerators	7,038.4	255.74	67.14	2.50	325.38	2,290,172.7
Total:	22,932.6		246.57		VC Total:	5,654,470.0
			60.21		FC Total:	1,380,670.4
			306.77		Plant Total:	7,035,140.4
Firm Total:	24,992.8		246.98		Firm VC Total:	6,172,840.7
			59.99		Firm FC Total:	1,499,298.6
			306.97		Firm MFG Total:	7,672,139.3

Table G-16

RQB4G Results: North American Sourcing Series - Free Trade Agreement Partial Implementation

Summary

<u>Finished Product Demand</u>	(000)
Total Units	24,992.8

<u>Cost Information</u>	(\$000)
Total Purchase Cost	4,675,724.3
Total Manufacturing Cost	7,752,168.9
Total Distribution Center Cost	347,993.2
Total Transportation Cost	845,930.5
Total System Cost	8,588,035.8

<u>Transportation Cost Detail</u>	(\$000)
Inbound Freight:	358,056.8
Internal Transfer Freight:	145,160.6
Customer Freight:	342,713.1

Total Transportation Cost:	845,930.5
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<u>Facilities Utilized</u>	<u>Type</u>
Woodstock	S
Reynosa	S
Fort Wayne	S
Toronto	M
Monterrey	M
Indianapolis	M
Nuevo Laredo	TP
Ciudad Juarez	TP

Table G-16 (cont'd.)

Purchases By Manufacturing Plant Location

Manufacturing Plant Location: Toronto

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.1630	5,073.2	5,900.1	87.8	5,987.9
102	Belts M	1.9966	1,481.1	2,957.2	371.2	3,328.4
103	Compressors	50.4000	543.1	27,369.7	235.0	27,604.7
104	Copper Components	1.0574	1,583.7	1,674.6	27.4	1,702.0
105	Cord Sets M	1.9213	1,065.1	2,046.4	285.2	2,331.5
106	Corrugated Packaging	2.2860	1,954.2	4,467.3	338.3	4,805.6
107	Fasteners M	.0085	308,976.4	2,626.3	439.8	3,066.1
108	Door Gaskets	8.0640	543.1	4,379.2	18.8	4,398.0
109	Knobs	.2510	7,595.2	1,906.4	8.2	1,914.6
110	1 Speed Motors	18.4666	437.0	8,069.9	113.5	8,183.4
111	2 Speed Motors	24.9480	522.1	13,024.1	180.7	13,204.8
112	Paint (Powder)	3.2648	614.7	2,006.8	10.6	2,017.5
113	Plastic Components M	2.9672	1,954.2	5,798.5	981.4	6,779.9
114	Polypropylene Resin	.3624	30,385.8	11,011.8	526.0	11,537.8
115	Pumps M	5.2661	522.1	2,749.2	285.6	3,034.7
116	Relays M	6.2423	1,065.1	6,648.7	853.3	7,502.0
117	Steel	.2829	162,405.4	45,944.5	2,811.3	48,755.8
118	Switches	.7554	8,961.0	6,769.1	15.5	6,784.6
119	Timers/Motors	7.2964	3,477.3	25,371.8	6.0	25,377.8
120	Wiring Harnesses M	4.9065	1,954.2	9,588.3	1,329.7	10,918.0
121	Misc. Electronics	6.4461	1,954.2	12,597.0	10.2	12,607.1
122	Washer MP	46.0068	522.1	24,017.8	271.1	24,289.0
123	Dryer MP M	33.9691	437.0	14,844.5	1,749.7	16,594.2
124	Range MP	177.6261	452.1	80,304.8	743.5	81,048.2
125	Refrigerator MP M	97.1380	543.1	52,750.8	9,154.2	61,905.0
Total:				374,824.6	20,854.0	395,678.6

Manufacturing Plant Location: Monterrey

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.0073	341.4	343.9	4.4	348.3
102	Belts	1.9966	49.7	99.1	.2	99.3
103	Compressors	45.6000	36.2	1,650.7	11.6	1,662.3
104	Copper Components	.9687	110.9	107.4	1.4	108.9
105	Cord Sets	1.9213	56.9	109.3	.6	109.9
106	Corrugated Packaging	1.8540	106.0	196.5	13.6	210.1
107	Fasteners	.0085	16,672.1	141.7	1.4	143.1
108	Door Gaskets	7.2960	36.2	264.1	.9	265.0
109	Knobs	.2390	518.7	124.0	.4	124.4
110	1 Speed Motors	16.7078	8.3	137.8	1.6	139.4
111	2 Speed Motors	22.5720	20.7	467.2	5.3	472.5
112	Paint (Powder)	3.0870	29.5	91.1	.4	91.5
113	Plastic Components	2.9672	106.0	314.5	2.0	316.6
114	Polypropylene Resin	.3337	1,694.5	565.4	21.7	587.1
115	Pumps	5.2661	20.7	109.0	.3	109.3
116	Relays	6.2423	56.9	355.2	.5	355.6
117	Steel	.2600	8,487.2	2,206.7	108.6	2,315.3
118	Switches	.6906	490.7	338.8	.6	339.5
119	Timers/Motors	6.7396	186.7	1,257.9	.2	1,258.2
120	Wiring Harnesses	4.9065	106.0	520.1	2.7	522.8
121	Misc. Electronics	5.8931	106.0	624.7	.4	625.1
122	Washer MP	39.8056	20.7	824.0	8.0	831.9
123	Dryer MP	33.9691	8.3	280.2	.1	280.4
124	Range MP	155.3526	40.9	6,346.2	49.7	6,395.8
125	Refrigerator MP	97.1380	36.2	3,516.4	27.8	3,544.2
Total:				20,992.2	264.3	21,256.5

Note: Manufacturing plants source from domestic supplier location unless otherwise indicated in the following manner. C - Canada, M - Mexico, US - United States.

Table G-16 (cont'd.)

Manufacturing Plant Location: Indianapolis

Item No.	Description	Unit	Quantity	Total Purch.	Trans.	Delivered
		Price(\$)	(000)	(\$ 000)	Cost(\$ 000)	Cost(\$000)
101	Aluminum Components	M	1.0073	65,082.0	65,557.1	9,030.1
102	Belts	M	1.9966	16,409.9	32,764.0	2,760.3
103	Compressors		50.0000	7,038.4	351,920.0	2,167.8
104	Copper Components		1.0500	20,374.3	21,393.0	215.2
105	Cord Sets	M	1.9213	13,110.6	25,189.4	2,432.5
106	Corrugated Packaging		2.2500	22,932.6	51,598.4	2,825.3
107	Fasteners	M	.0085	3,583,891.3	30,463.1	4,510.4
108	Door Gaskets	M	7.2960	7,038.4	51,352.2	4,625.6
109	Knobs		.2500	90,832.9	22,708.2	99.5
110	1 Speed Motors		18.3200	4,265.5	78,144.0	788.3
111	2 Speed Motors		24.7500	6,072.2	150,287.0	1,496.2
112	Paint (Powder)		3.2500	7,323.3	23,800.9	70.9
113	Plastic Components	M	2.9672	22,932.6	68,045.6	7,573.6
114	Polypropylene Resin		.3600	377,159.5	135,777.4	3,982.8
115	Pumps	M	5.2661	6,072.2	31,976.8	2,782.0
116	Relays	M	6.2423	13,110.6	81,840.3	6,622.3
117	Steel		.2810	1,874,393.0	526,704.4	16,494.7
118	Switches	M	.6906	102,854.1	71,031.0	5,935.2
119	Timers/Motors	M	6.7396	41,274.9	278,176.3	21,107.2
120	Wiring Harnesses	M	4.9065	22,932.6	112,518.8	10,814.5
121	Misc. Electronics	M	5.8931	22,932.6	135,144.1	10,542.3
122	Washer MP	M	39.8056	6,072.2	241,707.6	31,188.5
123	Dryer MP	M	33.9691	4,265.5	144,895.2	11,173.4
124	Range MP	M	155.3526	5,556.5	863,216.7	97,940.0
125	Refrigerator MP	M	97.1380	7,038.4	683,696.1	79,760.1

Total: 4,279,907.4 336,938.5 4,616,845.9

Total Purchase Expenditure For Each Purchased Item And Total Purchases For The Firm

Item No.	Description	Quantity	Total Purchases	Trans. Cost	Delivered Cost
		(000)	(\$ 000)	(\$ 000)	(\$ 000)
101	Aluminum Components	70,497	71,801.1	9,122.2	80,923.3
102	Belts	17,941	35,820.3	3,131.8	38,952.1
103	Compressors	7,618	380,940.4	2,414.4	383,354.9
104	Copper Components	22,069	23,175.0	244.0	23,419.0
105	Cord Sets	14,233	27,345.1	2,718.2	30,063.3
106	Corrugated Packaging	24,993	56,262.2	3,177.2	59,439.3
107	Fasteners	3,909,540	33,231.1	4,951.6	38,182.7
108	Door Gaskets	7,618	55,995.4	4,645.4	60,640.8
109	Knobs	98,947	24,738.6	108.1	24,846.7
110	1 Speed Motors	4,711	86,351.7	903.3	87,255.0
111	2 Speed Motors	6,615	163,778.3	1,682.2	165,460.5
112	Paint (Powder)	7,968	25,898.8	81.9	25,980.7
113	Plastic Components	24,993	74,158.6	8,557.0	82,715.6
114	Polypropylene Resin	409,240	147,354.7	4,530.5	151,885.2
115	Pumps	6,615	34,835.0	3,067.8	37,902.8
116	Relays	14,233	88,844.2	7,476.1	96,320.2
117	Steel	2,045,286	574,855.6	19,414.6	594,270.2
118	Switches	112,306	78,139.0	5,951.3	84,090.4
119	Timers/Motors	44,939	304,806.0	21,113.4	325,919.4
120	Wiring Harnesses	24,993	122,627.2	12,146.9	134,774.1
121	Misc. Electronics	24,993	148,365.7	10,552.9	158,918.6
122	Washer MP	6,615	266,549.4	31,467.5	298,016.9
123	Dryer MP	4,711	160,019.9	12,923.2	172,943.1
124	Range MP	6,049	949,867.6	98,733.2	1,048,600.8
125	Refrigerator MP	7,618	739,963.3	88,942.1	828,905.4
Total:			4,675,724.3	358,056.8	5,033,781.0

Table G-16 (cont'd.)

Purchases By Supplier Location

Supplier Location: Woodstock

Item No.	Description	Unit Price (\$)	Quantity (000)	Total Purchases (\$ 000)
101	Aluminum Components	1.1630	5,073.2	5,900.1
102	Belts	2.4367	.0	.0
103	Compressors	50.4000	543.1	27,369.7
104	Copper Components	1.0574	1,583.7	1,674.6
105	Cord Sets	2.2799	.0	.0
106	Corrugated Packaging	2.2860	1,954.2	4,467.3
107	Fasteners	.0101	.0	.0
108	Door Gaskets	8.0640	543.1	4,379.2
109	Knobs	.2510	7,595.2	1,906.4
110	1 Speed Motors	18.4666	437.0	8,069.9
111	2 Speed Motors	24.9480	522.1	13,024.1
112	Paint (Powder)	3.2648	614.7	2,006.8
113	Plastic Components	3.5484	.0	.0
114	Polypropylene Resin	.3624	30,385.8	11,011.8
115	Pumps	6.0667	.0	.0
116	Relays	7.0689	.0	.0
117	Steel	.2829	162,405.4	45,944.5
118	Switches	.7554	8,961.0	6,769.1
119	Timers/Motors	7.2964	3,477.3	25,371.8
120	Wiring Harnesses	6.0776	.0	.0
121	Misc. Electronics	6.4461	1,954.2	12,597.0
122	Washer MP	46.0068	522.1	24,017.8
123	Dryer MP	39.2610	.0	.0
124	Range MP	177.6261	452.1	80,304.8
125	Refrigerator MP	114.1256	.0	.0
Total:			227,023.9	274,814.9

Supplier Location: Reynosa

Item No.	Description	Unit Price (\$)	Quantity (000)	Total Purchases (\$ 000)
101	Aluminum Components	1.0073	65,423.4	65,901.0
102	Belts	1.9966	17,940.7	35,820.3
103	Compressors	45.6000	36.2	1,650.7
104	Copper Components	.9687	110.9	107.4
105	Cord Sets	1.9213	14,232.6	27,345.1
106	Corrugated Packaging	1.8540	106.0	196.5
107	Fasteners	.0085	3,909,539.8	33,231.1
108	Door Gaskets	7.2960	7,074.6	51,616.3
109	Knobs	.2390	518.7	124.0
110	1 Speed Motors	16.7078	8.3	137.8
111	2 Speed Motors	22.5720	20.7	467.2
112	Paint (Powder)	3.0870	29.5	91.1
113	Plastic Components	2.9672	24,992.8	74,158.6
114	Polypropylene Resin	.3337	1,694.5	565.4
115	Pumps	5.2661	6,615.0	34,835.0
116	Relays	6.2423	14,232.6	88,844.2
117	Steel	.2600	8,487.2	2,206.7
118	Switches	.6906	103,344.8	71,369.9
119	Timers/Motors	6.7396	41,461.6	279,434.3
120	Wiring Harnesses	4.9065	24,992.8	122,627.2
121	Misc. Electronics	5.8931	23,038.6	135,768.8
122	Washer MP	39.8056	6,092.9	242,531.5
123	Dryer MP	33.9691	4,710.8	160,019.9
124	Range MP	155.3526	5,597.4	869,562.9
125	Refrigerator MP	97.1380	7,617.7	739,963.3
Total:			4,287,919.6	3,038,576.2

Table G-16 (cont'd.)

Supplier Location: Fort Wayne

Item No.	Description	Unit Price (\$)	Quantity (000)	Total Purchases (\$ 000)
101	Aluminum Components	1.1500	.0	.0
102	Belts	2.4000	.0	.0
103	Compressors	50.0000	7,038.4	351,920.0
104	Copper Components	1.0500	20,374.3	21,393.0
105	Cord Sets	2.2500	.0	.0
106	Corrugated Packaging	2.2500	22,932.6	51,598.4
107	Fasteners	.0100	.0	.0
108	Door Gaskets	8.0000	.0	.0
109	Knobs	.2500	90,832.9	22,708.2
110	1 Speed Motors	18.3200	4,265.5	78,144.0
111	2 Speed Motors	24.7500	6,072.2	150,287.0
112	Paint (Powder)	3.2500	7,323.3	23,800.9
113	Plastic Components	3.5000	.0	.0
114	Polypropylene Resin	.3600	377,159.5	135,777.4
115	Pumps	6.0000	.0	.0
116	Relays	7.0000	.0	.0
117	Steel	.2810	1,874,393.0	526,704.4
118	Switches	.7500	.0	.0
119	Timers/Motors	7.2500	.0	.0
120	Wiring Harnesses	5.9800	.0	.0
121	Misc. Electronics	6.4000	.0	.0
122	Washer MP	45.4900	.0	.0
123	Dryer MP	38.8200	.0	.0
124	Range MP	175.7700	.0	.0
125	Refrigerator MP	112.7100	.0	.0
Total:			2,410,391.7	1,362,333.2

Table G-16 (cont'd.)

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Toronto

Item	Quantity	Purchased	Mfg.	Transfer		Total
<u>No. Description</u>	<u>(000)</u>	<u>Materials/</u>	<u>Labor/</u>	<u>Handling/</u>	<u>Mfg. VC/</u>	<u>Mfg. VC</u>
		<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>(\$ 000)</u>
201 Washers	522.1	157.70	38.15	2.35	198.20	103,468.7
202 Dryers	437.0	130.41	30.48	2.35	163.24	71,335.5
203 Ranges	452.1	243.64	49.38	2.35	295.37	133,535.3
204 Refrigerators	543.1	269.25	72.51	2.35	344.11	186,868.7
Total:	1,954.2		253.41		VC Total:	495,208.2
			57.44		FC Total:	112,239.7
			310.84		Plant Total:	607,447.9

Manufacturing Plant Location: Monterrey

Item	Quantity	Purchased	Mfg.	Transfer		Total
<u>No. Description</u>	<u>(000)</u>	<u>Materials/</u>	<u>Labor/</u>	<u>Handling/</u>	<u>Mfg. VC/</u>	<u>Mfg. VC</u>
		<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>(\$ 000)</u>
201 Washers	20.7	140.39	4.24	1.40	146.03	3,022.7
202 Dryers	8.3	117.50	3.89	1.40	122.79	1,013.0
203 Ranges	40.9	214.63	5.49	1.40	221.52	9,049.0
204 Refrigerators	36.2	237.94	8.06	1.40	247.40	8,956.0
Total:	106.0		207.93		VC Total:	22,040.8
			60.27		FC Total:	6,388.5
			268.20		Plant Total:	28,429.3

Manufacturing Plant Location: Indianapolis

Item	Quantity	Purchased	Mfg.	Transfer		Total
<u>No. Description</u>	<u>(000)</u>	<u>Materials/</u>	<u>Labor/</u>	<u>Handling/</u>	<u>Mfg. VC/</u>	<u>Mfg. VC</u>
		<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>(\$ 000)</u>
201 Washers	6,072.2	153.40	35.32	2.50	191.22	1,161,143.7
202 Dryers	4,265.5	126.89	28.22	2.50	157.61	672,283.7
203 Ranges	5,556.5	235.62	45.72	2.50	283.84	1,577,162.1
204 Refrigerators	7,038.4	260.70	67.14	2.50	330.34	2,325,031.9
Total:	22,932.6		250.11		VC Total:	5,735,621.3
			60.21		FC Total:	1,380,670.4
			310.31		Plant Total:	7,116,291.7
Firm Total:	24,992.8		250.19		Firm VC Total:	6,252,870.3
			59.99		Firm FC Total:	1,499,298.6
			310.18		Firm MFG Total:	7,752,168.9

Table G-17

RQB4H Results: North American Sourcing Series - Most Likely Case

Summary

<u>Finished Product Demand</u>	<u>(000)</u>
Total Units	25,116.5

<u>Cost Information</u>	<u>(\$000)</u>
Total Purchase Cost	4,624,753.8
Total Manufacturing Cost	7,685,475.0
Total Distribution Center Cost	349,585.3
Total Transportation Cost	826,838.9
Total System Cost	8,524,744.5

<u>Transportation Cost Detail</u>	<u>(\$000)</u>
Inbound Freight:	337,154.7
Internal Transfer Freight:	145,960.3
Customer Freight:	343,723.9
Total Transportation Cost:	826,838.9

<u>Facilities Utilized</u>	<u>Type</u>
Woodstock	S
Reynosa	S
Fort Wayne	S
Toronto	M
Monterrey	M
Indianapolis	M
Nuevo Laredo	TP
Ciudad Juarez	TP

Table G-17 (cont'd.)

Purchases By Manufacturing Plant Location

Manufacturing Plant Location: Toronto

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	M 1.0073	5,327.8	5,366.6	727.6	6,094.2
102	Belts	M 1.9966	1,555.1	3,104.9	195.7	3,300.6
103	Compressors	M 45.6000	570.3	26,005.7	2,418.1	28,423.7
104	Copper Components	1.0574	1,663.2	1,758.6	28.8	1,787.4
105	Cord Sets	M 1.9213	1,118.5	2,149.0	175.9	2,324.9
106	Corrugated Packaging	2.2860	2,052.0	4,690.9	355.2	5,046.1
107	Fasteners	M .0085	324,434.0	2,757.7	303.2	3,060.9
108	Door Gaskets	M 7.2960	570.3	4,160.9	297.5	4,458.4
109	Knobs	.2510	7,975.8	2,001.9	8.6	2,010.6
110	1 Speed Motors	M 16.7078	458.7	7,663.9	922.8	8,586.7
111	2 Speed Motors	M 22.5720	548.2	12,374.0	1,478.3	13,852.2
112	Paint (Powder)	3.2648	645.5	2,107.3	11.2	2,118.5
113	Plastic Components	M 2.9672	2,052.0	6,088.7	604.2	6,692.9
114	Polypropylene Resin	.3624	31,909.3	11,563.9	552.4	12,116.3
115	Pumps	M 5.2661	548.2	2,886.9	191.6	3,078.5
116	Relays	M 6.2423	1,118.5	6,982.0	407.3	7,389.3
117	Steel	.2829	170,528.7	48,242.6	2,952.0	51,194.5
118	Switches	M .6906	9,409.2	6,498.0	403.3	6,901.3
119	Timers/Motors	M 6.7396	3,651.3	24,608.3	1,260.8	25,869.1
120	Wiring Harnesses	M 4.9065	2,052.0	10,068.1	817.4	10,885.5
121	Misc. Electronics	M 5.8931	2,052.0	12,092.6	655.9	12,748.5
122	Washer MP	M 39.8056	548.2	21,821.4	2,691.9	24,513.3
123	Dryer MP	M 33.9691	458.7	15,581.6	823.8	16,405.4
124	Range MP	M 155.3526	474.8	73,761.4	7,566.9	81,328.4
125	Refrigerator MP	M 97.1380	570.3	55,397.8	6,005.6	61,403.4
Total:				369,734.8	31,855.8	401,590.6

Manufacturing Plant Location: Monterrey

Item No.	Description	Unit Price(\$)	Quantity (000)	Total Purch. (\$ 000)	Trans. Cost(\$ 000)	Delivered Cost(\$000)
101	Aluminum Components	1.0073	426.5	429.6	5.5	435.1
102	Belts	1.9966	61.1	121.9	.2	122.1
103	Compressors	45.6000	45.2	2,061.1	14.5	2,075.6
104	Copper Components	.9687	138.7	134.3	1.8	136.1
105	Cord Sets	1.9213	70.9	136.1	.7	136.9
106	Corrugated Packaging	1.8540	131.9	244.5	16.9	261.4
107	Fasteners	.0085	20,741.6	176.3	1.7	178.0
108	Door Gaskets	7.2960	45.2	329.8	1.2	330.9
109	Knobs	.2390	648.6	155.0	.5	155.5
110	1 Speed Motors	16.7078	9.8	162.9	1.9	164.8
111	2 Speed Motors	22.5720	25.7	579.0	6.6	585.5
112	Paint (Powder)	3.0870	36.7	113.1	.5	113.6
113	Plastic Components	2.9672	131.9	391.4	2.5	393.9
114	Polypropylene Resin	.3337	2,110.9	704.4	27.0	731.4
115	Pumps	5.2661	25.7	135.1	.3	135.4
116	Relays	6.2423	70.9	442.3	.6	442.8
117	Steel	.2600	10,551.4	2,743.4	135.0	2,878.4
118	Switches	.6906	610.6	421.7	.8	422.5
119	Timers/Motors	6.7396	232.1	1,563.9	.3	1,564.2
120	Wiring Harnesses	4.9065	131.9	647.2	3.4	650.5
121	Misc. Electronics	5.8931	131.9	777.3	.5	777.8
122	Washer MP	39.8056	25.7	1,021.0	9.9	1,030.9
123	Dryer MP	33.9691	9.8	331.2	.1	331.3
124	Range MP	155.3526	51.3	7,969.6	62.4	8,032.0
125	Refrigerator MP	97.1380	45.2	4,390.6	34.7	4,425.3
Total:				26,182.7	329.4	26,512.0

Note: Manufacturing plants source from domestic supplier location unless otherwise indicated in the following manner. C - Canada, M - Mexico, US - United States.

Table G-17 (cont'd.)

Manufacturing Plant Location: Indianapolis

Item No.	Description	Unit	Quantity	Total Purch.	Trans.	Delivered
		Price(\$)	(000)	(\$ 000)	Cost(\$ 000)	Cost(\$000)
101	Aluminum Components	M 1.0073	65,082.0	65,557.1	7,391.3	72,948.4
102	Belts	M 1.9966	16,409.9	32,764.0	1,941.3	34,705.3
103	Compressors	M 45.6000	7,038.4	320,951.0	25,725.2	346,676.2
104	Copper Components	1.0500	20,374.3	21,393.0	215.2	21,608.1
105	Cord Sets	M 1.9213	13,110.6	25,189.4	1,802.8	26,992.1
106	Corrugated Packaging	2.2500	22,932.6	51,598.4	2,825.3	54,423.7
107	Fasteners	M .0085	3,583,891.3	30,463.1	2,804.5	33,267.6
108	Door Gaskets	M 7.2960	7,038.4	51,352.2	3,341.8	54,694.0
109	Knobs	.2500	90,832.9	22,708.2	99.5	22,807.7
110	1 Speed Motors	M 16.7078	4,265.5	71,267.1	7,084.1	78,351.2
111	2 Speed Motors	M 22.5720	6,072.2	137,061.7	13,532.4	150,594.1
112	Paint (Powder)	3.2500	7,323.3	23,800.9	70.9	23,871.7
113	Plastic Components	M 2.9672	22,932.6	68,045.6	5,872.2	73,917.8
114	Polypropylene Resin	.3600	377,159.5	135,777.4	3,982.8	139,760.2
115	Pumps	M 5.2661	6,072.2	31,976.8	1,982.6	33,959.4
116	Relays	M 6.2423	13,110.6	81,840.3	4,576.3	86,416.6
117	Steel	.2810	1,874,393.0	526,704.4	16,494.7	543,199.1
118	Switches	M .6906	102,854.1	71,031.0	4,159.4	75,190.4
119	Timers/Motors	M 6.7396	41,274.9	278,176.3	14,152.7	292,329.1
120	Wiring Harnesses	M 4.9065	22,932.6	112,518.8	8,001.6	120,520.4
121	Misc. Electronics	M 5.8931	22,932.6	135,144.1	7,163.7	142,307.8
122	Washer MP	M 39.8056	6,072.2	241,707.6	25,153.3	266,860.9
123	Dryer MP	M 33.9691	4,265.5	144,895.2	7,551.0	152,446.2
124	Range MP	M 155.3526	5,556.5	863,216.7	76,413.6	939,630.3
125	Refrigerator MP	M 97.1380	7,038.4	683,696.1	62,631.5	746,327.6
Total:				4,228,836.4	304,969.5	4,533,805.8

Total Purchase Expenditure For Each Purchased Item And Total Purchases For The Firm

Item No.	Description	Quantity	Total Purchases	Trans. Cost	Delivered Cost
		(000)	(\$ 000)	(\$ 000)	(\$ 000)
101	Aluminum Components	70,836	71,353.3	8,124.4	79,477.7
102	Belts	18,026	35,990.8	2,137.3	38,128.1
103	Compressors	7,654	349,017.8	28,157.7	377,175.5
104	Copper Components	22,176	23,285.9	245.7	23,531.6
105	Cord Sets	14,300	27,474.5	1,979.4	29,453.9
106	Corrugated Packaging	25,117	56,533.8	3,197.4	59,731.2
107	Fasteners	3,929,067	33,397.1	3,109.5	36,506.5
108	Door Gaskets	7,654	55,842.9	3,640.4	59,483.3
109	Knobs	99,457	24,865.2	108.6	24,973.8
110	1 Speed Motors	4,734	79,093.9	8,008.8	87,102.6
111	2 Speed Motors	6,646	150,014.6	15,017.2	165,031.9
112	Paint (Powder)	8,005	26,021.3	82.5	26,103.8
113	Plastic Components	25,117	74,525.7	6,479.0	81,004.6
114	Polypropylene Resin	411,180	148,045.7	4,562.2	152,607.9
115	Pumps	6,646	34,998.8	2,174.6	37,173.3
116	Relays	14,300	89,264.6	4,984.2	94,248.7
117	Steel	2,055,473	577,690.4	19,581.7	597,272.0
118	Switches	112,874	77,950.7	4,563.5	82,514.2
119	Timers/Motors	45,158	304,348.5	15,413.9	319,762.4
120	Wiring Harnesses	25,117	123,234.1	8,822.3	132,056.4
121	Misc. Electronics	25,117	148,014.0	7,820.1	155,834.2
122	Washer MP	6,646	264,550.0	27,855.0	292,405.0
123	Dryer MP	4,734	160,808.0	8,374.9	169,182.9
124	Range MP	6,083	944,947.7	84,042.9	1,028,990.6
125	Refrigerator MP	7,654	743,484.5	68,671.8	812,156.3
Total:			4,624,753.8	337,154.7	4,961,908.5

Table G-17 (cont'd.)

Purchases By Supplier Location

Supplier Location: Woodstock

Item No.	Description	Unit Price (\$)	Quantity (000)	Total Purchases (\$ 000)
101	Aluminum Components	1.1630	.0	.0
102	Belts	2.4367	.0	.0
103	Compressors	50.4000	.0	.0
104	Copper Components	1.0574	1,663.2	1,758.6
105	Cord Sets	2.2799	.0	.0
106	Corrugated Packaging	2.2860	2,052.0	4,690.9
107	Fasteners	.0101	.0	.0
108	Door Gaskets	8.0640	.0	.0
109	Knobs	.2510	7,975.8	2,001.9
110	1 Speed Motors	18.4666	.0	.0
111	2 Speed Motors	24.9480	.0	.0
112	Paint (Powder)	3.2648	645.5	2,107.3
113	Plastic Components	3.5484	.0	.0
114	Polypropylene Resin	.3624	31,909.3	11,563.9
115	Pumps	6.0667	.0	.0
116	Relays	7.0689	.0	.0
117	Steel	.2829	170,528.7	48,242.6
118	Switches	.7554	.0	.0
119	Timers/Motors	7.2964	.0	.0
120	Wiring Harnesses	6.0776	.0	.0
121	Misc. Electronics	6.4461	.0	.0
122	Washer MP	46.0068	.0	.0
123	Dryer MP	39.2610	.0	.0
124	Range MP	177.6261	.0	.0
125	Refrigerator MP	114.1256	.0	.0
Total:			214,774.4	70,365.2

Supplier Location: Reynosa

Item No.	Description	Unit Price (\$)	Quantity (000)	Total Purchases (\$ 000)
101	Aluminum Components	1.0073	70,836.2	71,353.3
102	Belts	1.9966	18,026.1	35,990.8
103	Compressors	45.6000	7,653.9	349,017.8
104	Copper Components	.9687	138.7	134.3
105	Cord Sets	1.9213	14,300.0	27,474.5
106	Corrugated Packaging	1.8540	131.9	244.5
107	Fasteners	.0085	3,929,066.9	33,397.1
108	Door Gaskets	7.2960	7,653.9	55,842.9
109	Knobs	.2390	648.6	155.0
110	1 Speed Motors	16.7078	4,734.0	79,093.9
111	2 Speed Motors	22.5720	6,646.1	150,014.6
112	Paint (Powder)	3.0870	36.7	113.1
113	Plastic Components	2.9672	25,116.5	74,525.7
114	Polypropylene Resin	.3337	2,110.9	704.4
115	Pumps	5.2661	6,646.1	34,998.8
116	Relays	6.2423	14,300.0	89,264.6
117	Steel	.2600	10,551.4	2,743.4
118	Switches	.6906	112,873.9	77,950.7
119	Timers/Motors	6.7396	45,158.3	304,348.5
120	Wiring Harnesses	4.9065	25,116.5	123,234.1
121	Misc. Electronics	5.8931	25,116.5	148,014.0
122	Washer MP	39.8056	6,646.1	264,550.0
123	Dryer MP	33.9691	4,734.0	160,808.0
124	Range MP	155.3526	6,082.6	944,947.7
125	Refrigerator MP	97.1380	7,653.9	743,484.5
Total:			4,351,979.0	3,772,406.4

Table G-17 (cont'd.)

Supplier Location: Fort Wayne

Item No.	Description	Unit Price (\$)	Quantity (000)	Total Purchases (\$ 000)
Fort Wayne				
101	Aluminum Components	1.1500	.0	.0
102	Belts	2.4000	.0	.0
103	Compressors	50.0000	.0	.0
104	Copper Components	1.0500	20,374.3	21,393.0
105	Cord Sets	2.2500	.0	.0
106	Corrugated Packaging	2.2500	22,932.6	51,598.4
107	Fasteners	.0100	.0	.0
108	Door Gaskets	8.0000	.0	.0
109	Knobs	.2500	90,832.9	22,708.2
110	1 Speed Motors	18.3200	.0	.0
111	2 Speed Motors	24.7500	.0	.0
112	Paint (Powder)	3.2500	7,323.3	23,800.9
113	Plastic Components	3.5000	.0	.0
114	Polypropylene Resin	.3600	377,159.5	135,777.4
115	Pumps	6.0000	.0	.0
116	Relays	7.0000	.0	.0
117	Steel	.2810	1,874,393.0	526,704.4
118	Switches	.7500	.0	.0
119	Timers/Motors	7.2500	.0	.0
120	Wiring Harnesses	5.9800	.0	.0
121	Misc. Electronics	6.4000	.0	.0
122	Washer MP	45.4900	.0	.0
123	Dryer MP	38.8200	.0	.0
124	Range MP	175.7700	.0	.0
125	Refrigerator MP	112.7100	.0	.0
Total:			2,393,015.6	781,982.2

Table G-17 (cont'd.)

Finished Product Manufactured At Each Plant Location And Total For The Firm

Manufacturing Plant Location: Toronto

Item	Quantity	Purchased	Mfg.	Transfer		Total
<u>No. Description</u>	<u>(000)</u>	<u>Materials/</u>	<u>Labor/</u>	<u>Handling/</u>	<u>Mfg. VC/</u>	<u>Mfg. VC</u>
		<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>(\$ 000)</u>
201 Washers	548.2	153.74	38.15	2.35	194.24	106,481.7
202 Dryers	458.7	126.68	30.48	2.35	159.51	73,168.1
203 Ranges	474.8	234.42	49.38	2.35	286.15	135,863.4
204 Refrigerators	570.3	259.34	72.51	2.35	334.20	190,592.7
Total:	2,052.0		246.64		VC Total:	506,105.9
			54.70		FC Total:	112,239.7
			301.34		Plant Total:	618,345.6

Manufacturing Plant Location: Monterrey

Item	Quantity	Purchased	Mfg.	Transfer		Total
<u>No. Description</u>	<u>(000)</u>	<u>Materials/</u>	<u>Labor/</u>	<u>Handling/</u>	<u>Mfg. VC/</u>	<u>Mfg. VC</u>
		<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>(\$ 000)</u>
201 Washers	25.7	140.39	4.24	1.40	146.03	3,745.5
202 Dryers	9.8	117.50	3.89	1.40	122.79	1,197.2
203 Ranges	51.3	214.63	5.49	1.40	221.52	11,363.9
204 Refrigerators	45.2	237.94	8.06	1.40	247.40	11,182.6
Total:	131.9		208.41		VC Total:	27,489.3
			48.43		FC Total:	6,388.5
			256.84		Plant Total:	33,877.8

Manufacturing Plant Location: Indianapolis

Item	Quantity	Purchased	Mfg.	Transfer		Total
<u>No. Description</u>	<u>(000)</u>	<u>Materials/</u>	<u>Labor/</u>	<u>Handling/</u>	<u>Mfg. VC/</u>	<u>Mfg. VC</u>
		<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>Unit (\$)</u>	<u>(\$ 000)</u>
201 Washers	6,072.2	151.11	35.32	2.50	188.93	1,147,233.4
202 Dryers	4,265.5	124.98	28.22	2.50	155.70	664,142.4
203 Ranges	5,556.5	231.00	45.72	2.50	279.22	1,551,470.4
204 Refrigerators	7,038.4	255.68	67.14	2.50	325.32	2,289,735.0
Total:	22,932.6		246.49		VC Total:	5,652,581.2
			60.21		FC Total:	1,380,670.4
			306.69		Plant Total:	7,033,251.6
Firm Total:	25,116.5		246.30		Firm VC Total:	6,186,176.4
			59.69		Firm FC Total:	1,499,298.6
			305.99		Firm MFG Total:	7,685,475.0

LIST OF REFERENCES

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- A.T. Kearney, Inc. East Lansing, MI. Telephone interview, 1992.
- A.T. Kearney, Inc., Dialog Systems Division. Netsim II Documentation Manual. East Lansing, MI, 1990.
- Allen, Kathleen M. "The Role of Logistics in the Overseas Plant Selection Decision Process of United States-Based Multinational Corporations." Journal of Business Logistics (1991): Vol. 12, No. 2, 59-71.
- Almon, Clopper. Industrial Effects of Free Trade Agreement Between Mexico and the USA. Interindustry Economic Research Fund (INFORUN), College Park, MD: University of Maryland, September, 1990.
- Anderson, David L. "International Logistics Strategies for the 1980's." International Journal of Physical Distribution and Materials Management (1985): Vol. 15, No. 4, 5-19.
- Anderson, David L. Logistics Strategies for Competing in Global Markets. Temple, Barker and Sloane, Inc., 1988.
- Appliance Manufacturer, "1992 3-Part Market Profile", Vol.40, No.2, February 1992, pp. 35-42.
- Arcelus, F. J. "On the Selection of Industry Location Alternatives." Engineering Costs & Production Economics (Netherlands) (June 1989): Vol. 16, Iss. 3, 213-219.
- Association of Home Appliance Manufacturers, Chicago, IL. Telephone interview, March, 1992.
- Association of Home Appliance Manufacturers, Chicago, IL. Fax, March 30, 1992.
- Baer, M. Delal. "North American Free Trade." Foreign Affairs (Fall 1991): Vol. 70, Iss. 4, 132-149.
- Baker, Stephen, and Lee, Dinah, with Coy, Peter. "Assembly Lines Start Migrating From Asia to Mexico." Business Week, July 1, 1991, p. 43.

- Baker, Stephen, with Weiner, Elizabeth, and Borrus, Amy. "Mexico: A New Economic Era." Business Week, November 12, 1990, pp. 102-105, 108, 110.
- Ballou, Ronald H. "Heuristics: Rules of Thumb for Logistics Decision Making." Journal of Business Logistics (1989): Vol. 10, No. 1, 122-132.
- Ballou, Ronald H. "Information Considerations for Logistics Network Planning." International Journal of Physical Distribution and Materials Management (1987): Vol. 17, No. 7, 3-14.
- Ballou, Ronald H. "Quantitative Methods-What They Are and How You Can Use Them." Handling and Shipping, December 1967, pp. 39-43, in Bowersox, Donald J.; LaLonde, Bernard J.; and Smykay, Edward A., eds., Readings in Physical Distribution Management The Logistics of Marketing. London: The Macmillan Company, 235-242, 1969.
- Ballou, Ronald H. and House, Robert G. "Computer Methods in Physical Distribution Management." in Robeson, James F. and House, Robert G. The Distribution Handbook. New York: The Free Press, 1985.
- Baumol, William J. and Wolfe, Philip. "A Warehouse-Location Problem." Operations Research (March 1958): Vol. 6., 252-263.
- Belknap Data Solutions Ltd. Facility Location Decisions: Fortune Market Research Survey, New York: Time, Inc., 1977.
- Bender, Paul S. "Logistic System Design." in Robeson, James F. and House, Robert G., ed. The Distribution Handbook. New York: The Free Press, 1985.
- Bender, Paul S. "The Challenge of International Distribution." International Journal of Physical Distribution & Materials Management (UK) (1985): Vol. 15, Iss. 4, 20-25.
- Bender, Paul S. "The International Dimension of Physical Distribution Management." in Robeson, James F. and House, Robert G. The Distribution Handbook. New York: The Free Press, 1985.
- Bender, Paul S.; Brown, Richard W.; Isaac, Michael H.; and Shapiro, Jeremy F. "Improving Purchasing Productivity at IBM with a Normative Decision Support System." Interfaces (May-June 1985): Vol. 15, No. 3, 106-115.

- Bender, Paul S.; Northup, William D.; and Shapiro Jeremy F. "Practical Modeling for Resource Management." Harvard Business Review (March-April 1981): 163-173.
- Bertsimas, Dimitris J.; Jaillet, Patrick; and Odoni, Amedeo R. "A Priori Optimization." Operations Research (November-December 1990): Vol. 38, Iss. 6., 1019-1033.
- Biggs, Margaret. "An International Perspective." in Stern, Robert M.; Trezise, Philip H.; and Whalley, John, eds. Perspectives on a U.S.-Canadian Free Trade Agreement. Washington, D.C.: The Brookings Institute, 129-154, 1987.
- Bookbinder, James H. and Locke, Timothy D. "Simulation Analysis of Just-in-Time Distribution." International Journal of Physical Distribution and Materials Management (1986): Vol. 16, No. 7, 31-45.
- Bowersox, Donald J. "Evaluation of Alternative Solutions to the Food Distribution Center Location Problem." Ph.D. dissertation, Michigan State University, 1960.
- Bowersox, Donald J. "Planning Physical Distribution Operations with Dynamic Simulation." Journal of Marketing (January 1972): Vol. 36, 17-25.
- Bowersox, Donald J. and Closs, David J. "Simulation in Logistics: A Review of Present Practice and a Look to the Future." Journal of Business Logistics (1989): Vol. 10, No. 1, 133-148.
- Bowersox, Donald J. and Sterling, Jay U. "Multinational Logistics." Journal of Business Logistics (1982): Vol. 3, No. 2, 15-23.
- Bowersox, Donald J.; Closs, David J.; and Helferich, Omar K. Logistical Management. New York: Macmillan Publishing Co., 1986.
- Bowman, Robert J. "North American Free Rail Zone." World Trade (April 1992): Vol. 5, Iss. 3, 72-75.
- Boyd, Roy, and Krutilla, Kerry. "The Impact of the Free Trade Agreement on the U.S. Forestry Sector: General Equilibrium Analysis." Journal of Business Administration (1991/1992): Vol. 20, Iss. 1,2, 236-253.
- Bradhiser, Keith. "Economic Accord Reached By U.S., Mexico and Canada Lowering Trade Barriers." New York Times (August 13, 1992): Vol. CXLI, No. 49,057, p. 1 col.4.

- Brown, Drusilla K. and Stern, Robert M. "A Modeling Perspective." in Stern, Robert M.; Trezise, Philip H.; and Whalley, John, eds. Perspectives on a U.S.-Canadian Free Trade Agreement. Washington, D.C.: The Brookings Institute, 1987.
- Brown, Drusilla K.; Deardorff, Alan V.; and Stern, Robert M. "A North American Free Trade Agreement: Analytical Issues and a Computational Assessment." World Economy (January 1992): Vol. 15, Iss. 1, 11-29.
- Browning, John M.; Zabriskie, Noel B.; and Huellmantel, Alan B. "Strategic Purchase Planning." Journal of Purchasing and Materials Management (Spring 1983): 19-24.
- Buckley, Peter J. and Casson, Mark. The Economic Theory of the Multinational Enterprise. New York: St. Martin's Press 1985.
- Burgess, David F. "A Perspective on Foreign Direct Investment." in Stern, Robert M.; Trezise, Philip H.; and Whalley, John, eds. Perspectives on a U.S.-Canadian Free Trade Agreement. Washington, D.C.: The Brookings Institute, 1987.
- Byrne, Patrick M. "Global Logistics: Eight Forces for Global Change." Transportation & Distribution (April 1992): Vol. 33, Iss. 4, 53-54.
- Calvet, A. L. "A Synthesis of Foreign Direct Investment Theories and Theories of the Multinational Firm." Journal of International Business Studies (Spring/Summer 1981): 43-59.
- Canadian Appliance Manufacturers Association, The Major Appliance Section of Electrical and Electronic Manufacturers Association of Canada, Rexdale, Ontario Canada. Telephone interviews, May, June 1992.
- Canadian Appliance Manufacturers Association, The Major Appliance Section of Electrical and Electronic Manufacturers Association of Canada, Rexdale, Ontario Canada. Fax, June 2, 1992.
- Canel, Cem and Khumawala, Basheer M. "Application of International Facilities Location and Extensions." 1992 Proceedings Decision Sciences Institute (1992): Vol. 3, 1778-1780.
- Carlisle, David P., et al. "A Turnkey, Microcomputer-Based Logistics Planning System." Interfaces (July-August 1987): Vol. 17, Iss. 4, 16-26.

- Chamberlin, Edward H. The Theory of Monopolistic Competition. 7th ed. Cambridge, MA: Harvard University, 1956, cited by Bowersox, Donald J. "Evaluation of Alternative Solutions to the Food distribution Center Location Problem." Ph.D. dissertation, Michigan State University, 1960.
- Chisholm, Patricia. "Let's Get Going: Pattison Pushes Into The United States." Maclean's, March 18, 1991. p. 40.
- Chisholm, Patricia; Wickens, Barbara; and Laver, Ross. "Giving Up, Moving Out." Maclean's, March 18, 1991. pp. 36-39.
- Chopra, Karen J. "NAFTA Negotiations Will Be Comprehensive." Business America, April 8, 1991, p.8
- Chow, Garland; McRae, James J. "Non-Tariff Barriers and the Structure of the U.S.-Canadian (Transborder) Trucking Industry." Transportation Journal (Winter 1990): Vol. 30, Iss. 2, 4-21.
- Closs, David J. "Simulated Product Sales Forecasting: Mathematical Model, Computer Simulation and Validation," Ph.D. dissertation, Michigan State University, 1978.
- Cooper, Leon. "Location-allocation Problems." Operations Research (May-June 1963): XII:3, 331-343.
- Cox, David, and Harris, Richard G. "North American Free Trade and Its Implications for Canada: Results from a CGE Model of North American Trade." World Economy (January 1992): Vol. 15, Iss. 1, 31-44.
- CP Freight and Express, Ltd. Canada Rate Diskette. 1990.
- Customs and Excise Division of Revenue Canada, Ottawa, Canada. Fax, 1992.
- Customs and Excise Division of Revenue Canada, Ottawa, Canada. Telephone interview, 1992.
- "EC 1992 Presents Challenges For U.S. Businesses." Business America, (February 22, 1993): p.19.
- Davies, G. J. "The International Logistics Concept." International Journal of Physical Distribution and Materials Management (1987): Vol. 17, No. 2, 20-27.
- Department of External Affairs, Tariff Schedule of Canada, Annex 401.2, Ottawa, Canada, 1988.

- Dicer, Gary N. International Logistics: Elements of a Firm's Physical Distribution System. Knoxville, TN: The University of Tennessee, 1971.
- Dick, Toni E. "Canada: Free Trade Boosts Exports Despite Economic Slowdown." Business America, April 22, 1991, p. 8.
- Dobler, Donald W.; Burt, David N.; and Lee, Lamar Jr. Purchasing and Materials Management: Text and Cases. New York: McGraw-Hill, Fifth Edition, 1990.
- Donahue, Thomas R. "The Case Against a North American Free Trade Agreement." Columbia Journal of World Business (Summer 1991): Vol. 26, Iss. 2, 92-96.
- Dornbusch, Rudiger, "North American Free Trade." Columbia Journal of World Business (Summer 1991): Vol. 26, Iss. 2, 72-76.
- Dungan, D. Peter and Wilson, Thomas A. "Symposium - The Canada-U.S. FTA: Macroeconomic Effects and Sensitivity Analysis." Journal of Policy Modeling (Fall 1991): Vol. 13, Iss. 3, 435-457.
- Dunning, John H. "The Eclectic Paradigm of International Production: A Restatement and Some Possible Extensions." Journal of International Business Studies (Spring 1988): 1-19.
- Efroymsen, M. A. and Ray, T. L. "A Branch-Bound Algorithm For Plant Location." The Journal of Operations Research (May-June 1966): 361-368.
- Ellram, Lisa M. "Key Success Factors and Barriers in International Purchasing Partnership." Management Decision (1991): Vol. 29, Iss. 7, 38-44.
- Exel Logistics, Inc., Westerville, OH. Fax, November 6, 1992.
- Exel Logistics, Inc., Westerville, OH. Telephone interview, November 1992.
- Farmer, David H. "Developing Purchasing Strategies." Journal of Purchasing and Materials Management (Fall 1977): 3-8.
- Farnsworth, Clyde H. "Mulroney's Task: Selling Trade Pact To Canadians." New York Times (August 13, 1992): Vol. CXLII, No. 49,057, p. D5, col.1.

Farren, J. Michael. "Opportunities And Challenges In The New European Market." Business America, February 25, 1991, p. 6.

Fawcett, Stanley E. "Purchasing Characteristics and Supplier Performance in Maquiladora Operations." International Journal of Purchasing and Materials Management (Winter 1993): Vol. 29, No. 1, 25-34.

Fawcett, Stanley, E., "Logistics and Manufacturing Issues in Maquiladora Operations." International Journal of Physical Distribution and Materials Management (1990): Vol. 20, No. 4, 13-21.

Feldman, E.; Lehrer, F. A.; and Ray, T. L. "Warehouse Location Under Continuous Economies of Scale." Management Science (May 1966): Vol. 12, No. 9, 670-684.

Flaks, Marvin. "Total Cost Approach to Physical Distribution." Business Management (August 1963): Vol. 24, 55-61.

Forrester, Jay W. "Industrial Dynamics." Harvard Business Review (July-August 1958): Vol. 36, 37-66.

Frear, Carl R.; Metcalf, Lynn E.; and Alguire, Mary S. "Offshore Sourcing: Its Nature and Scope." International Journal of Purchasing and Materials Management (Summer 1992): Vol. 28, No. 3, 2-11.

Fulton, Maurice. "New Factors in Plant Location." Harvard Business Review in Bartlett, Hale C., ed. Readings in Physical Distribution. Chicago: The Interstate Publishers and Printers, Inc., 132-149, 1972.

Gaughan, Laura. "Fast Track And Why We Need It For The NAFTA." Business America, April 8, 1991, pp. 6-7.

Geoffrion, Arthur M. "A Guide to Computer-Assisted Methods for Distribution Systems Planning." Sloan Management Review (Winter 1975): Vol. 16, No. 2, 17-42.

Geoffrion, Arthur M. "Better Distribution Planning with Computer Models." Harvard Business Review (July-August 1976): Vol. 54, 92-99.

Geoffrion, Arthur M. and Graves, G.W. "Multicommodity Distribution System Design By Benders Decomposition." Management Science (January 1974): Vol. 20, No. 5, 822-844.

- Giunipero, Larry C. and Monczka, Robert M. "Organizational Approaches To Managing International Sourcing." International Journal of Physical Distribution and Logistics Management (1990): Vol. 20, No. 4, pp. 3-12.
- Glover, Fred; Jones, Gene; Karney, David; Klingman, Darwin; and Mote, John. "An Integrated Production, Distribution and Inventory Planning System." Interfaces (November 1979): Vol. 9, No. 5, 21-35.
- Greene, Walter E. "The Maquiladora-Japan's New Competitive Weapon." Business (October-December 1989): Vol. 39, No.4, 52-56.
- Greenhut, Melvin L. Plant Location in Theory and In Practise. Chapel Hill, NC: University of North Carolina Press, 1956.
- Hanjoul, Pierre; Hansen, Pierre; Peeters, Dominique; and Thisse, Jacques-Francois. "Uncapacitated Plant Location Under Alternative Spatial Price Policies." Management Science (January 1990): Vol. 36, 41-57.
- Harris, Richard G. "Symposium - The Canada-U.S. FTA: Economic Impact and Transition Effects." Journal of Policy Modeling (Fall 1991): Vol. 13, Iss. 3, 421-434.
- Hawkins, Chuck and Holstein, William J. "The North American Shakeout Arrives Ahead of Schedule." Business Week, April 17, 1989, pp. 34-35.
- Helferich, Omar K. "Logistics Decision Support Systems." Computers in Manufacturing (1983): Vol. V, New Jersey: Auerbach Publishing Co., 4.
- Helferich, Omar K. and Closs, David J. "Strategic and Operations Logistics Planning with Computer Simulation." Paper presented at the International Physical Distribution Conference, Tokyo, Japan, June 4-7, 1979.
- Helferich, Omar K. and Monczka, Robert M. "Development of A Dynamic Simulation Model for Planning Materials Input Systems: Formulation of the Conceptual Model." Journal of Purchasing (August 1972): 17-33.
- Heskett, James L. "A Missing Link In Physical Distribution System Design." Journal of Marketing (October 1966): Vol. 30, 37-41.

- Hinkel, Charles L. and Keuhn, Alfred A. "Heuristic Models: Mapping the Maze for Management." California Management Review (Fall 1967): Vol. 10, as cited in Ballou, Ronald H. "Heuristics: Rules of Thumb for Logistics Decision Making." Journal of Business Logistics (1989): Vol. 10, No. 1, 122-132.
- Hodder, James E. and Dincer, M. Cemal. "A Multifactor Model for International Plant Location and Financing Under Uncertainty." Computers and Operations Research (1986): Vol. 13, Iss. 5, 601-609.
- Hodder, James E. and Jucker, James V. "International Plant Location Under Price and Exchange Rate Uncertainty." Engineering Costs and Production Economics (April 1985): Vol. 9, 225-229.
- Holstein, William, J. and Borrus, Amy, with Baker, Stephen, and Drohan, Madelaine. "Inching Toward A North American Market." Business Week, June 25, 1990, pp. 40-41.
- Holstein, William, J.; Woodruff, David; and Borrus, Amy. "Is Free Trade With Mexico Good Or Bad For the U.S." Business Week, November 12, 1990, pp. 112-113.
- Holzinger, Albert G. "Broader Horizons For Free Trade." Nation's Business, United States Chamber of Commerce (December 1992): 18-28.
- Hoover, Edgar M. Location Theory and the Shoe and Leather Industry. Cambridge: Harvard University Press, 1937, cited in Richards, Hoy A. "Transportation Costs and Plant Location: A Review of Principal Theories." in Bartlett, Hale C., ed., Readings in Physical Distribution. Chicago: The Interstate Publishers and Printers, Inc., 124-131, 1972.
- Hoover, Edgar M. The Location of Economic Activity. New York, NY: McGraw-Hill Book Company, Inc. 1948.
- House, Robert G. and Jamie, Kenneth D. "Measuring the Impact of Alternative Market Classification Systems in Distribution Planning." Journal of Business Logistics (1981): Vol.2, No.2, 1-31.
- Hunter, Linda; Markusen, James R.; and Rutherford, Thomas F. "US-Mexico Free Trade and the North American Auto Industry: Effects the Spatial Organisation of Production of Finished Autos." World Economy (January 1992): Vol. 15, Iss. 1, 65-81.
- Hurlbert, Lynn, "Maquiladoras: Borderline Logistics in Mexico." Distribution, October 1987, pp. 53-58.

- Ingram, F. Jerry; Bayne, James; and Gassaway, Fred J. "M.A.P.S. -- Market Area Plant Strategy." Economic Development Review (Winter 1986): Vol. 4, Iss 1, 25-29.
- Instituto Nacional de Estadística, Geografía e Informática, Estados Unidos Mexicanos Resumen General XI Censo General de Población y Vivienda, 1990, Aguascalientes, Mexico, 1990.
- International Monetary Fund, Direction of Trade Statistics: Yearbook 1990. Washington, D.C.: International Monetary Fund, 1990, pp. 400-403.
- Isard, Walter. Location and Space-Economy: A General Theory Relating to Industrial Location, Market Areas, Land Use, Trade and Urban Structure. Cambridge, MA: The M.I.T. Press, 1956.
- Jacobs, Jon, "Mexico: Widening the Bottleneck." International Business (July 1992): Vol. 5, Iss. 7, 50-52.
- Jelacic, John. "U.S. Trade Outlook." Business America, April 22, 1991, pp. 2-7.
- Johnson, Jon R., and Schachter, Joel S. The Free Trade Agreement: A Comprehensive Guide. Aurora, Ontario, Canada: Canada Law Book Inc., 1988.
- Journal of Commerce Staff Report, "Some US, Canadian Unions Oppose Mexican Trade Pact." Journal of Commerce, June 22, 1990, p. 1A.
- Kallock, Roger W. "The Challenge of Managing Logistics in a Global Environment." Proceedings of the Council of Logistics Management. Vol. 1, Boston, MA., October 9-12, 1988.
- Keefer, K. B. "Easy Ways to Determine the Center of Distribution." Food Industry, 1934, cited by Bowersox, Donald J. "Evaluation of Alternative Solutions to the Food distribution Center Location Problem." Ph.D. dissertation, Michigan State University, 1960.
- Kent, Kara. The U.S. - Mexico Trade Pages, Your Single Source for Transborder Business, The Global Source, Washington, D.C., 1992.
- Kerlinger, Fred N. Foundations of Behavioral Research. 3rd ed. New York: Holt, Rinehart and Winston, Inc., 1986.

- Khumawala, Basheer M. "An Efficient Heuristic Procedure for the Uncapacitated Warehouse Location Problem." Naval Research Quarterly (March 1973) Vol. 20, No. 1, 109-121.
- Kirk, Roger E. Experimental Design: Procedures for the Behavioral Sciences. 2nd ed. Belmont, California: Brooks/Cole Publishing Company, 1982.
- Klincewicz, J. G. "Heuristics for the P-Hub Location Problem." European Journal of Operational Research (July 5, 1991): Vol. 53, Iss. 1, 25-37.
- Koo, Won W.; Uhm, Ihn Ho; and Golz, Joel T. "Bilateral Trade Relationship Between the United States and Canada: Implications of the Free Trade Agreement." Comporary Policy Issues (October 1991): Vol.9, Iss. 4, 56-69.
- Krajewski, Lee J. and Ritzman, Larry P. Operations Management: Strategy and Analysis. Reading, Massachusetts: Addison-Wesley Publishing Company, 1987.
- Kreinin, Mordechai, E. International Economics: A Policy Approach. New York: Harcourt Brace Jovanovich, 1987.
- Krueger, Anne O. "Government, Trade and Economic Integration." American Economic Review (May 1992): Vol. 82, Iss. 2, 109-114.
- Krugman, Paul, R. and Obstfeld, Maurice. International Economics: Theory and Policy. Glenview, IL: Scott, Foresman and Company, 1988.
- Kuehn, Alfred A. and Hamburger, Michael J., "A Heuristic Program for Locating Warehouses." Management Science (1963): Vol. 9, 543-666.
- Lancioni, Richard and Gattorna, John L. "Setting Standards for Quality Service in Logistics." International Journal of Physical Distribution & Logistics Management (1992): Vol. 22, Iss. 3, 24-29.
- Lary, Banning K. "North American Neighbors Are Tearing Down Their Fences." Management Review (September 1989) 47-51.
- Law, Averill M., and Kelton, W. David. Simulation Modeling And Analysis. New York: McGraw-Hill Book Company, 1982.
- Leenders, Michiel R. and Blenkhorn, David L. Reverse Marketing. New York: The Free Press, 1988.

Leenders, Michiel R.; Fearon, Harold E.; and England, Wilbur B. Purchasing and Materials Management. 9th ed. Homewood, IL: Irwin, 1989.

LeKashman, Raymond and Stolle, John F. "The Total Cost Approach to Distribution," Business Horizons (Winter 1965): 33-46, in Bowersox, Donald J.; LaLonde, Bernard J.; and Smykay, Edward A., eds., Readings in Physical Distribution Management The Logistics of Marketing. London: The Macmillan Company, 206-223, 1969.

Levitt, Theodore. "The Globalization of Markets." Harvard Business Review (May-June 1983): 92-102.

Lewis, Howard T.; Culliton, James W.; and Steele, Jack D. The Role of Air Freight in Physical Distribution. Boston: Division of Research, Graduate School of Business Administration, Harvard University, 1956, as cited in Bowersox, Donald J.; Smykay, Edward W.; and LaLonde, Bernard J. Physical Distribution Management. rev. ed., London: The Macmillan Company, 1968.

Lewis, Ronald J. "Strengthening Control of Physical Distribution Costs." Management Services (February 1968): 37-46, in Bowersox, Donald J.; LaLonde, Bernard J.; and Smykay, Edward A., eds., Readings in Physical Distribution Management The Logistics of Marketing. London: The Macmillan Company, 316-330, 1969.

Lippert, John. "UAW Fights Ford Plan To Shift Jobs To Mexico." Detroit Free Press. April 10, 1991, p. 1E.

Litvak, Isaiah A. "Free Trade Strategies with Canada." The Journal of Business Strategy (November/December 1988): 34-39.

Losch, August. The Economics of Location. Translated from the second revised edition by William H. Woglom with the assistance of Wolfgang F. Stolper. New Haven, CT: Yale University Press, 1954.

Lowery, Andrew. "Mexico: Market Is Large, Growing, Especially for U.S. Goods." Business America, April 22, 1991, p. 10.

Lyte Group, Inc. Canadian Market Areas Computer File. East Lansing, MI, 1991.

Magee, John. "The Logistics of Distribution." Harvard Business Review (July-August 1960): 89-101, in Bowersox, Donald J.; LaLonde, Bernard J.; and Smykay, Edward A., eds., Readings in Physical Distribution Management The Logistics of Marketing. London: The Macmillan Company, 235-242, 1969.

- Magnusson, Paul, and Baker, Stephen, with Beach, David; DeGeorge, Gail; and Symonds, William C.. "The Mexico Pact: Worth the Price?" Business Week, May 27, 1991, pp. 33-35.
- Markland, Robert E. "Analyzing Geographically Discrete Warehousing Networks by Computer Simulation." Decision Sciences (April 1973): Vol. 3, Iss. 2, 216-236.
- Markland, Robert E. and Sweigart, James R. Quantitative Methods: Applications to Managerial Decision Making, New York: John Wiley & Sons, Inc., 1987.
- Masur, Sandra, "The North American Free Trade Agreement: Why It's in the Interest of U.S. Business." Columbia Journal of World Business (Summer 1991): Vol. 26, Iss. 2, 98-103.
- McCabe, Joseph V. "Outside Managers Offer Packaged Export Expertise." Journal of Business Strategy (March/April 1990): Vol. 11, Iss. 2, 20-23.
- McCray, John P. and Gonzalez, Juan J. "Increasing Global Competitiveness with U.S.-Mexican Maquiladora Operations." SAM Advanced Management Journal (Summer 1989): Vol. 54, No. 3, 4-7, 23, 48.
- Miller, H. G. "Accounting for Physical Distribution," Transportation and Distribution Management (December 1961): 6-11, in Bowersox, Donald J.; LaLonde, Bernard J.; and Smykay, Edward A., eds., Readings in Physical Distribution Management. London: The Macmillan Company, 150-159, 1969.
- Miller, Tan, "The International Modal Decision (Part I)." Distribution (October 1991): Vol. 90, Iss. 11, 82-92.
- Min, Hokey and Galle, William P. "International Purchasing Strategies of Multinational U.S. Firms." International Journal of Purchasing & Materials Management (Summer 1991): Vol. 27, Iss. 3, 9-18.
- Ministry of Planning and Budget, Ministry of Foreign Affairs, Mexico: Economic and Social Information, National Institute For Statistics Geography and Information, Vol.III, Number 3, September-December 1991, Aguascalientes, Mexico.
- Moffet, Matt. "Salinas Goes on Tour to Push Free Trade." Wall Street Journal. April 15, 1991, p.A10.
- Monczka, Robert M. and Giunipero, Larry C. Purchasing Internationally. Tempe, AZ: National Association Of Purchasing Management, 1990.

- Monczka, Robert M. and Trent, Robert J. "Worldwide Sourcing: Assessment and Execution." International Journal of Purchasing and Materials Management (Fall 1992): Vol. 28, No. 4, 9-19.
- Moore, Jack. "A Computer Modeling Approach to Manufacturing and Distribution Strategy." Interfaces (August 1990): Vol. 10, Iss. 4, 16-21.
- Mossman, Frank H.; Bankit, Paul; and Helferich, Omar K. Logistics Systems Analysis. Washington D.C.: University Press of America, 1977.
- Muller, E. J. "Logistics Strategies for the North American Market." Distribution, April 1992, pp. 28-37.
- Murphy, Paul R. and Poist, Richard F. "Skill Requirements of Senior-Level Logistics Executives: An Empirical Assessment." Journal of Business Logistics (1991): Vol. 12, Iss. 2, 73-94.
- National Planning Data Corporation, 1991 Population Reported for All Zip Code Sectional Centers, Claritas/NPDC, Ithica, NY, 1992.
- Peters, Douglas D. "The Branch Plant in a Freer Trade Environment." Economic Development Review (Summer 1986): 4(2), 30-32.
- "Physical Distribution Costs - Performance In Selected Industries, 1990" Annual Conference Proceedings. Council of Logistics Management, Oakbrook, IL: 1990.
- Porter, Michael E. "The Competitive Advantage of Nations." Harvard Business Review (March-April 1990): 73-93.
- Powers, Richard F. "Optimization Models For Logistics Decisions." Journal of Business Logistics (1989): Vol. 10, No. 1, 106-121.
- Powers, Thomas L. "An Examination of the Effects of Trade Incentives on Logistical Performance in the Grocery Products Industry." Ph.D. dissertation, Michigan State University, 1985.
- Powers, Thomas L. and Closs, David J. "An Examination of the Effects of Trade Incentives on Logistical Performance in a Consumer Products Channel." Journal of Business Logistics, (1987): Vol. 8, No. 2, 1-28.
- Price Waterhouse, Doing Business In Mexico, September 1991.
- Raia, Patrice D. "Up River Rhapsody." World Trade (March 1992): Vol. 5, Iss. 2, 30-34.

- Reck, Robert F. and Long, Brian G. "Purchasing: A Competitive Weapon." Journal Of Purchasing And Materials Management (Fall 1988): 2-8.
- Richards, Hoy A. "Transportation Costs and Plant Location: A Review of Principal Theories." 1972, in Bartlett, Hale C. ed., Readings in Physical Distribution. Chicago: The Interstate Publishers and Printers, Inc., 124-131, 1972.
- Robert Morris Associates, RMA Annual Statement Studies 1991. Robert Morris Associates, Philadelphia, PA: 1991.
- Robinson, E. Powell, Jr. "Multi-Activity Uncapacitated Facility Location Problem: A New Tool For Logistics Planning." Journal of Business Logistics (1989): Vol. 10, No. 2., pp. 159-179.
- Robock, Stephan H. and Simmonds, Kenneth. International Business And Multinational Enterprise. 3rd ed. Homewood, IL: Richard D. Irwin, 1983.
- Ross, Julie Ritzer, "A NAFTA Sparks Partners, Connections." Global Trade (July 1992): Vol. 112, Iss. 7, 22-24.
- Sanyo Corporation, West Memphis, AR. Interview, 1992.
- Sears, Roebuck and Company, Sears 1992-93 Fall/Winter Annual Catalog, Chicago, IL: 1992.
- Shapiro, Jeremy F. "Quantitative Methods in Distribution." in Robeson, James F. and House, Robert G. The Distribution Handbook. New York: The Free Press, 1985.
- Sharma, R.R.K. "Modelling a Fertiliser Distribution System." European Journal of Operational Research (1991): Vol. 51, No. 1, 24-34.
- Shycon, Harvey N. and Maffei, Richard B. "Simulation-Tool for Better Distribution." Harvard Business Review (November-December 1960): 65-75.
- Sims, Jeffery R. "Simulated Product Sales Forecasting: An Analysis of Forecasting and Operating Discrepancies in the Physical Distribution System." Ph.D. dissertation, Michigan State University, 1974.
- Smith, G. Murray, and Stone, Frank, eds. Assessing the Canada-U.S. Free Trade Agreement. Ottawa, Ontario, Canada: The Institute for Research on Public Policy, 1987.

- Smith, George. "Knowing Your P.D. Costs." in Bartlett, Hale C. ed., Readings in Physical Distribution. Chicago: The Interstate Publishers and Printers, Inc., 68-78, 1972.
- Smith, Guy C. "The United States-Mexico Framework Agreement: Implications for Bilateral Trade." Law and Policy in International Business (1989): 20(4), 655-81.
- Smith, Murray G. "A Canadian Perspective." in Stern, Robert M.; Trezise, Philip H.; and Whalley, John, eds. Perspectives on a U.S.-Canadian Free Trade Agreement. Washington, D.C.: The Brookings Institute, 31-63, 1987.
- Sobarzo, Horacio E. "A General Equilibrium Analysis of the Gains from Trade for the Mexican Economy of a North American Free Trade Agreement." World Economy (January 1992): Vol. 15, Iss. 1, 83-100.
- Speckman, Robert E. "A Strategic Approach To Procurement Planning." Journal Of Purchasing And Materials Management (Winter 1981): 2-8.
- Speh, Thomas W. "The Performance of a Physical Distribution Channel System Under Various Conditions of Demand Uncertainty: A Simulation Experiment." Ph.D. dissertation, Michigan State University, 1974.
- Statistics Canada, 1986 Census of Canada, Urban Forward Sortation Area Profiles - Part I - Region 1, Ottawa, Canada.
- Statistics Canada, 1986 Census of Canada, Urban Forward Sortation Area Profiles - Part I - Region 2, Ottawa, Canada.
- Statistics Canada, 1986 Census of Canada, Urban Forward Sortation Area Profiles - Part I - Region 3, Ottawa, Canada.
- Statistics Canada, 1986 Census of Canada, Urban Forward Sortation Area Profiles - Part I - Region 4, Ottawa, Canada.
- Steltzer, Theresa M. "A Model Way to Make Decisions." Distribution, January, 1990, pp. 49-54.
- Stern, Robert M.; Trezise, Philip H.; and Whalley, John, eds. Perspectives on a U.S.-Canadian Free Trade Agreement. Washington D.C.: The Brookings Institute, 1987.
- Stock, James R. and Lambert, Douglas, M. Strategic Logistics Management. 2nd. ed. Homewood, IL: Irwin, 1987.

- Taylor, John C. "The U.S./Canada Free Trade Agreement: Facility Location Implications for Michigan." in The Canada-United States Free Trade Agreement: Perspectives and Implications. East Lansing, Michigan: Canadian Studies Center, Michigan State University, January 8, 1990.
- Taylor, John C. Michigan/Ontario Trade and Transborder Transportation: Current Levels, Forecasts, and Problems and Opportunities. Michigan Department of Transportation, Lansing, Michigan, October 24, 1988.
- Taylor, John C., Mason, MI. Interviews, 1992.
- Taylor, John, C. "The United States-Canada-Mexico Free Trade Area: A Logistics Perspective On Distribution Center Location Implications In An Integrated North American Market." Ph.D. dissertation, Michigan State University, 1991.
- The Lyte Group. East Lansing, MI. Interview, 1992.
- Transportadora Nacional, S.A. de C.V., Mexico. Fax, 1992.
- Transportadora Nacional, S.A. de C.V., Mexico. Telephone interview, 1992.
- Trela, Irene, and Whalley, John. "Trade Liberalisation in Quota Restricted Items: US and Mexico in Textiles and Steel." World Economy (January 1992): Vol. 15, Iss. 1, 45-63.
- Trezise, Philip. "U.S.-Canadian Free Trade: An Idea Whose Time Has Come?" in Stern, Robert M.; Trezise, Philip H.; and Whalley, John, eds. Perspectives on a U.S.-Canadian Free Trade Agreement. Washington, D.C.: The Brookings Institute, 1-10, 1987.
- U.S. Congress, Joint Economic Committee, Council of Economic Advisors, Economic Indicators, Washington D.C.: Government Printing Office, April 8, 1991.
- U.S. Department of Commerce, 1990 Annual Survey of Manufactures: 1990 and 1989 Statistics for Industry Groups and Industries, Washington, D.C.: Government Printing Office, March 1992.
- U.S. Department of Commerce, Bureau of the Census, Population Estimates and Projections, Washington D.C.: Government Printing Office, April 1991.
- U.S. Department of Commerce, Bureau of the Census, 1987 Census of Manufactures: General Summary. Washington D.C.: Government Printing Office. March 1987.

- U.S. Department of Commerce, International Trade Administration, Summary Of The U.S.-Canada Free Trade Agreement, Washington D.C.: Government Printing Office, February 1988.
- U.S. Department of Commerce, International Trade Administration, U.S.-Canada Free Trade Agreement: Review of Tariff Removal, Washington, D.C.: Government Printing Office, March, 1988.
- U.S. Department of Commerce, International Trade Administration, North American Free Trade Negotiations: Most Frequently Asked Questions and Their Answers, Washington, D.C.: Government Printing Office, February 14, 1991.
- U.S. Department of Commerce, Office of Mexico, Washington, D.C. Fax, 1992.
- U.S. Department of Commerce, Office of the U.S. Trade Representative, 1990 National Trade Estimate Report on Foreign Trade Barriers, Washington, D.C.: Government Printing Office, March 1990.
- U.S. Department of Commerce, Offices of Canada and Mexico, as presented in Gaughan, Laura, "Fast Track And Why We Need It For The NAFTA", Business America, April 8, 1991, p. 7.
- U.S. Department of Commerce, Report on Mexican Household Appliances and Parts Industry. by Robert W. Miller, Washington D.C.: Government Printing Office, 1988.
- U.S. Department of Labor, Bureau of Labor Statistics, International Comparisons of Hourly Compensation Costs for Production Workers in Manufacturing 1975-90, Report 817. Washington, D.C.: November 1991.
- U.S. International Trade Commission, Harmonized Tariff Schedule of the United States (1992), Washington, D.C.: Government Printing Office, 1992.
- U.S. International Trade Commission, Tariff Schedules of the United States Annotated (1987), Publication 1920, Washington, D.C: Government Printing Office, 1986.
- Van Roy, Tony J. "A Cross Decomposition Algorithm for Capacitated Facility Location." Operations Research (January-February 1986): Vol. 34, No. 1, 145-163.
- Van Roy, Tony J. "Multi-Level Production and Distribution Planning with Transportation Fleet Optimization." Management Science (December 1989): Vol. 35, No. 12, 1443-1453.

- Von Thunen, Johann Heinrich. Der Isolurte Staat in Benziehung auf Landwirtschaft und Nationalokonomie, Hamburg, 1826, as cited in Richards, Hoy A. "Transportation Costs and Plant Location: A Review of Principal Theories.", in Bartlett, Hale C. ed., Readings in Physical Distribution. Chicago: The Interstate Publishers and Printers, Inc., 124-131, 1972.
- Wallace, Roger W. "North American Free Trade Agreement: Generating Jobs For Americans." Business America, April 8, 1991, pp. 3-5.
- Wassmansdorf, Paul A. "Identifying and Controlling the Costs of Physical Distribution." Management of the Physical Distribution Function. Management Report No. 49, New York: American Management Association, 1960, in Bartlett, Hale C. ed., Readings in Physical Distribution. Chicago: The Interstate Publishers and Printers, Inc., 61-67, 1972.
- Weber, Alfred. Theory of the Location of Industries. Chicago: University of Chicago Press 1929.
- Weiss, Neil A. and Hassett, Matthew J. Introductory Statistics. 2nd ed. Reading, MA: Addison-Wesley Publishing Company 1987.
- Whirlpool Corporation, Benton Harbor, MI. Telephone interviews, 1992.
- White, Michael, "The Intermodal Revolution." International Business (March 1992): Vol. 5, Iss. 3, 58-65.
- Wickens, Barbara. "A Giant Marketplace." McCleans, June 25, pp. 20-21.
- Wood, Donald F. "International Logistics Channels." International Journal of Physical Distribution & Logistics Management (UK) (1990): Vol. 20, Iss. 9, 3-9.
- Wood, Nancy with Fulton, E. Kaye. "Reopening the Trade Wounds." Maclean's, March 18, 1991, pp. 42-43.
- Wright, Don, and Haehling von Lanzanauer, Christoph. "COAL: A New Heuristic approach for Solving the Fixed Charge Problem - Computational Results." European Journal of Operational Research (Netherlands) (May 27, 1991): Vol. 52, Iss. 2, 235-246.
- Wu, Pei-Tse, "New Trading Bloc Is Envisioned." Journal of Commerce, October 30, 1990, pp. 5A, 9A.
- Xerox Corporation, Rochester, NY. Interview, 1992.

Yassen, Leonard D. Plant Location. New York: American Research Council, 1956, as cited in Bowersox, Donald J. "Evaluation of Alternative Solutions to the Food Distribution Center Location Problem." Ph.D. dissertation, Michigan State University, 1960.

Yellow Freight System, Inc. Memphis, TN. Fax, 1992.

Yellow Freight System, Inc. Memphis, TN. Telephone interview, 1992.

Yellow Freight System, Inc. U.S./Canadian and U.S. Zip Disk. 1990.

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