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Accounting Information in Global Manufacturing Networks:
The Information Effect on Competitive Position

presented by

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of the requirements for

Ph.D. degree in Accounting

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ACCOUNTING INFORMATION IN GLOBAL MANUFACTURING NETWORKS:
THE INFORMATION EFFECT ON COMPETITIVE POSITION

By
Sheldon Ray Smith

A DISSERTATION

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

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Department of Accounting

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ABSTRACT

ACCOUNTING INFORMATION IN GLOBAL MANUFACTURING NETWORKS: THE INFORMATION EFFECT ON COMPETITIVE POSITION

By

Sheldon Ray Smith

This dissertation examines managerial accounting's role in both strategic and operational decisions in a global manufacturing environment. The objective is to provide evidence that managerial accounting information improves conversion system performance and competitive position. Research data were gathered from 122 firms involved in production sharing operations in Mexico. A survey was used to collect data about five constructs: Economic Globalization (EG), Strategic Locationing Sophistication (SLS), Managerial Accounting Competence (MAC), Conversion Competence (CC), and Competitive Position (CP).

The measures of these constructs were used to test a structural equations model. The originally hypothesized model was modified slightly before an acceptable fit was obtained.

Results of the tests of the direct hypotheses imply that 1) the perceived impact of Economic Globalization is related to greater Managerial Accounting Competence, 2) greater Strategic Locationing Sophistication is related to greater Managerial Accounting Competence, 3) greater Managerial Accounting Competence is related to a firm's Conversion Competence, and 4) greater Conversion Competence

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improves a firm's Competitive Position. The direct links between 1) Economic Globalization and Managerial Accounting Competence, and 2) Strategic Locationing Sophistication and Competitive Position were not supported. The two indirect links hypothesized in the model were both supported and imply that greater sophistication of the strategic locationing information system and greater Managerial Accounting Competence can help improve a firm's competitive position.

Results from this study help managers coordinate their firm's value chain activities more effectively. The results also provide insight about the role of managerial accounting information, both strategic and operational, in a global economic environment.

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I am indebted to the Michigan State University Center for International Business Education and Research and the Michigan State University Department of Accounting for financial assistance in completing this project.

My everlasting thanks go to my wife, Sarah, and my children, Haley and Jordan, for supporting me during this project. Their sacrifices to this dissertation have been as great as mine. The rewards of a completed dissertation belong equally to them.

Above all, I acknowledge a loving Heavenly Father who hears and answers prayers and on whom I rely for strength, knowledge, and truth.

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CHAPTER I

INTRODUCTION

The world economy is globally competitive (Starr 1988). Because little is known about how accounting systems support global competition (Bruns and Kaplan 1987), research identifying management accounting's impact is important to firms affected by this competition. This study examines whether the production and use of managerial accounting information, in a global environment, is related to a firm's manufacturing and logistics performance and its competitive position.

A research model with five constructs--Economic Globalization (EG), Strategic Locationing Sophistication (SLS), Managerial Accounting Competence (MAC), Conversion Competence (CC), and Competitive Position (CP)--was developed and tested. The research model is illustrated in Figure 1. The model posits that 1) Economic Globalization is related to Strategic Locationing Sophistication and Managerial Accounting Competence, 2) Strategic Locationing Sophistication is related to Managerial Accounting Competence, 3) Managerial Accounting Competence is related to Conversion Competence, and 4) Strategic Locationing

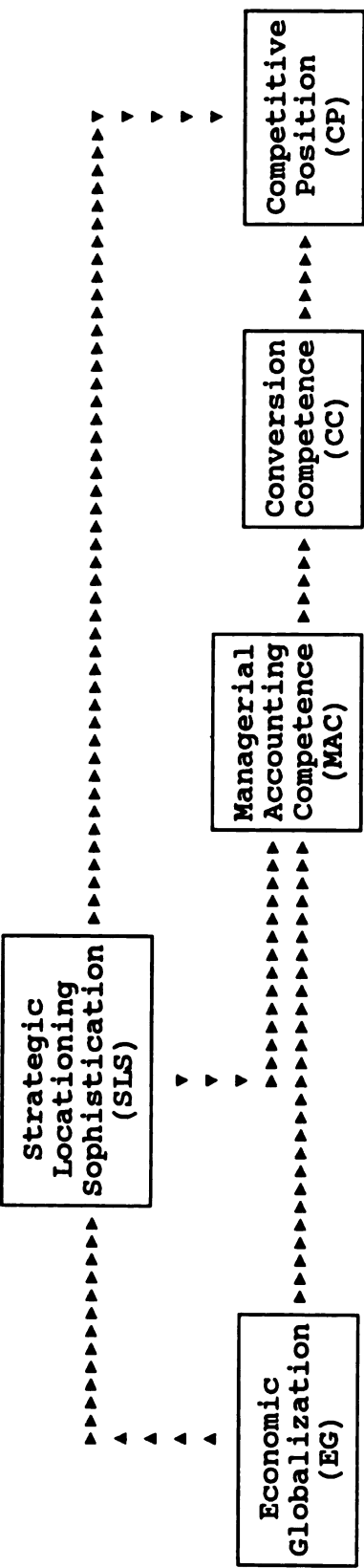


Figure 1
Research Model

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Sophistication and Conversion Competence are related to Competitive Position.

The general research model was tested using survey data. The data were collected from U.S. firms in a specific global setting--firms with manufacturing operations in Mexico.

Management accounting has evolved and continues to evolve toward producing information concerning the measurement and control of production costs and performance (Shank and Govindarajan 1989). Although these production issues are extremely important to the competitiveness of a firm, the manufacturing environment involves more than just production; it is a series of interrelated value-adding functions. These interrelated functions are the value chain. The value chain encompasses any activity "that is performed to design, produce, market, deliver, and support" a firm's product (Porter 1985, 36). A firm's strategy is a plan for configuring and coordinating these activities to gain and maintain a competitive advantage. Managerial accounting provides information to managers so that they can develop and operationalize effective global strategies which sustain competitive advantage.

As global competition increases, value chain functions become more global in nature; and non-production activities take on greater significance. For instance, logistics activities are more significant in a global manufacturing environment than they might have been in the past when

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suppliers, manufacturers, and consumers were in close proximity or at least in the same country. Advances in transportation and communication technologies have made world markets more accessible, thus facilitating global production and marketing (Bruns and Kaplan 1987; Cohen et al. 1987; Drucker 1988; Porter 1980). Global competition also causes the linkages among value chain activities to become more complex and more important (McGrath and Bequillard 1987). Managing linkages throughout the value chain is vital to maintaining a competitive advantage.

OVERVIEW OF RESEARCH MODEL

As the economy becomes more global, maintaining a competitive advantage is an increasingly complex challenge. A competitive advantage is dependent, to a great extent, on manufacturing and logistics competence. Designing, building, executing, and monitoring a competitive strategy based on this competence require obtaining and using relevant and reliable information. Production cost and performance information is not sufficient; information about other value chain activities and value chain linkages is also important. Figure 1 illustrates the research constructs and the hypothesized linkages among them.

Constructs

Economic Globalization refers to intensified competitive pressures and increasing access to global

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markets (both input and output markets). Strategic Locationing Sophistication is the extent to which useful information is available to top management in the strategic process of deciding where to locate activities in a global manufacturing network.

The managerial accounting system is the system (or set of systems) that identifies, measures, analyzes, and communicates information useful to managers (at any level) in making operating decisions which are consistent with the firm's global strategies. Managerial Accounting Competence is the ability of the managerial accounting system to provide information so that firm manufacturing and logistics decisions are consistent with competitive priorities.

Conversion Competence is the ability of the manufacturing and logistics systems to meet goals consistent with the competitive strategy. Competitive Position is the level of comparative advantage provided by a firm's Mexican operations with respect to costs, financial performance, quality, and customer service.

Hypotheses

The specific hypotheses to be tested in this study, all related to the research model in Figure 1, are stated here in the alternative form as follows:

- H₁: The overall research model is descriptive of the relationships among the research constructs.

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- H₂: Greater perceived impact of Economic Globalization on the firm is related to greater Strategic Locationing Sophistication.
- H₃: Greater perceived impact of Economic Globalization on the firm is related to greater Managerial Accounting Competence.
- H₄: Greater Strategic Locationing Sophistication is related to greater Managerial Accounting Competence.
- H₅: Greater Managerial Accounting Competence is related to greater Conversion Competence.
- H₆: Greater Strategic Locationing Sophistication is related to a perception of improved Competitive Position.
- H₇: Greater Conversion Competence is related to a perception of improved Competitive Position.
- H₈: Greater Strategic Locationing Sophistication is indirectly related to a perception of improved Competitive Position through Managerial Accounting Competence and Conversion Competence.
- H₉: Greater Managerial Accounting Competence is indirectly related to a perception of improved Competitive Position through Conversion Competence.

Further discussion of and support for these hypotheses is provided in Chapters II and III.

CONTRIBUTION OF RESEARCH

This research examines managerial accounting functions in a globally competitive environment. Two dimensions of accounting information are examined.

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The first dimension is the information related to strategic locationing--where specific value chain activities should be located geographically. The focus of this information is on external variables or potential variables in the global competitive environment surrounding the firm. This research examines the linkage between Strategic Locationing Sophistication and Managerial Accounting Competence; it also examines how Strategic Locationing Sophistication is related to Competitive Position.

The second dimension is the information provided for making operating decisions which are consistent with the firm's global strategies. The scope of this information includes cost, productivity, and performance information relative to the manufacturing and logistics value chain activities and linkages among these activities. The focus is on internal variables, those managed within the firm's existing environment. This research determines the relationship of Managerial Accounting Competence to Conversion Competence and Competitive Position.

RESEARCH SETTING

The specific global manufacturing setting for this research is U.S. production sharing in Mexico. Production plants in Mexico, usually close to the U.S. border, fabricate or assemble many items using mostly imported material inputs and relatively inexpensive Mexican labor. The finished products or components are then shipped back to

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the U.S. for sale or use in production. The major reasons U.S. companies choose to establish this type of production sharing operation include 1) low labor costs; 2) advantageous tariff provisions on equipment, materials, and products which cross the borders; and 3) the linked logistics infrastructure and common border between the U.S. and Mexico (McCray and Gonzalez 1989).

The research constructs developed and the hypotheses tested in this study were designed to be generic to any global manufacturing setting. Although many areas of the world have become popular locations for global production sharing operations, U.S.-Mexican production sharing was chosen as the specific setting to test the hypothesized relationships. The research in the area of accounting information in global manufacturing networks is very limited. Thus, even though this study was confined to a specific geographic area, its contribution is significant. Also, since the research is exploratory in nature, a relatively simple environment was chosen, one where the logistics issues are not as complex as in other global settings because of the proximity of Mexico and the U.S. and the common border between them.

CONCLUSIONS AND IMPLICATIONS

The original research model was modified slightly by adding a direct path from Economic Globalization to Competitive Position in order to achieve statistically

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acceptable results. Four of the direct hypotheses, Hypotheses 2, 4, 5, and 7, were supported by the data. These hypotheses imply that 1) companies that perceive a greater impact from Economic Globalization also have more sophisticated strategic locationing information systems, 2) managers who want to have good operational accounting information should make sure they have good strategic information, 3) useful accounting information with respect to manufacturing and logistics does improve the actual conversion activities, and 4) manufacturing and logistics activities are important determinants of competitive performance.

Hypotheses 3 and 6 were not supported by the data. The lack of support for these hypotheses indicates that managers' perception of Economic Globalization is not directly related to the competence of the managerial accounting system and that greater sophistication of the strategic locationing information system does not coincide with improved business performance. Possible reasons for the lack of support are mentioned in Chapter V.

The two indirect hypotheses were supported. These two hypotheses imply that more sophisticated strategic locationing systems and greater Managerial Accounting Competence are indirectly linked to improved competitive performance. These relationships are important for people who are designing information systems or who are concerned about competitive performance

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OVERVIEW OF REMAINING CHAPTERS

Chapter II contains a literature review which provides the background and support for the model to be tested. Chapter III presents the formal research model and the specific hypotheses to be tested. Chapter IV outlines the methodology employed to gather the data and test the hypotheses proposed in Chapter III. Results of the structural model analysis and hypothesis tests are presented in Chapter V. Finally, Chapter VI presents a discussion, contributions, limitations, and directions for future research.

CHAPTER II

RESEARCH BACKGROUND

To achieve competitive success, firms. . . must possess a competitive advantage in the form of either lower costs or differentiated products that command premium prices. To sustain advantage, firms must achieve more sophisticated competitive advantages over time, through providing higher-quality products and services or producing more efficiently (Porter 1990, 10).

In an increasingly global economy, maintaining a competitive advantage is a complex challenge. Providing information to support globalization is a management accounting function. The literature reviewed below was used to develop a conceptual model for investigating accounting information's role in global competitive success (see Figure 1).

ECONOMIC GLOBALIZATION

"The economies of the world are no longer isolated islands but have merged into a global landscape" (Chan and Justis 1991, 39). Economic Globalization is evidenced by two major factors: intensified global competition and increased access to global markets.

The intensification of global competition is well documented, not only in the literature (Cohen et al. 1987;

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Griffin 1990; Haas 1987; Kim and Mauborgne 1988; Levitt 1983; Oliff et al. 1987; Porter 1986a, 1986b, 1990) but also in the experience of most, if not all, industries (Dimnik and Kudar 1989). One example of an industry in the U.S. which has experienced intensified global competition is the automobile industry. Asian and European car manufacturers have increased the competitive pressure felt by U.S. automakers over the past 20 years, as they have been able to become major players in the U.S. market through low-cost or differentiation strategies. Companies in most industries and most countries are increasingly searching globally to find and exploit competitive advantages.

The other indicator of Economic Globalization--increasing global market access--makes it possible for companies to seek out these competitive advantages. Not only do companies have more opportunities to market their products globally, they also have the opportunity to purchase factor inputs globally. "Firms compete with truly global strategies involving selling worldwide, sourcing components and materials worldwide, and locating activities in many nations to take advantage of low cost factors" (Porter 1990, 14). This type of global market access means that companies are no longer limited to resources available in their own countries. The factor inputs of production have been decoupled from the nations where these inputs are found and where sales markets exist.

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A research measure of Economic Globalization has emerged and evolved over the last several years (Fawcett 1990a, 1990b, 1992; Fawcett and Closs 1993). It has been operationalized through survey items concerning the perceived impact of global competition and global market access on the firm. Multiple Likert-type survey items have been used for data collection, and the item responses have been aggregated to provide a measure of Economic Globalization. Following the line of previous research, this study also operationalized Economic Globalization through perceptual measures of global competition and access to global markets.

COORDINATED GLOBAL MANUFACTURING/LOGISTICS

"Simply stated, a coordinated global manufacturing strategy shifts the productive activities of an organization to the various regions of the world where they will add the most value to the product and then integrates these activities within a cohesive manufacturing strategy" (Fawcett 1990a, 2). By employing a cohesive manufacturing strategy, a firm can gain a competitive advantage by lowering its relative cost of providing the product.

Conversion systems include manufacturing and logistics activities which are the primary upstream activities in the value chain. These activities are responsible for converting the factor inputs into the desired output. Upstream conversion activities are often easier to decouple

from specific countries than are downstream value chain activities which are more closely tied to the buyer, and in many cases, to the buyer's country. Therefore, conversion activities can often be located in countries where the greatest value is added, leading to the possibility of worldwide manufacturing networks.

Global Manufacturing

Global manufacturing can mean one of at least five different things:

- 1) a product can be manufactured domestically from parts sourced internationally,
- 2) a product can be manufactured by a foreign subsidiary and then imported for domestic use,
- 3) a product can be manufactured in a foreign country to enhance access to the output markets in that country or surrounding countries,
- 4) domestically produced goods can be exported, or
- 5) component parts can be manufactured in different countries and then brought together for final assembly through coordinated global manufacturing.

The last of these concepts is the focus of this study.

Global manufacturing networks are created to find the "best" combination of factor inputs to be used in the production process (Fawcett 1990a). This factor-input strategy involves international sourcing. Thus, the different examples of global manufacturing do not have to be mutually exclusive. However, since a factor-input model does not concentrate on access to foreign markets, the focus

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of coordinated global manufacturing in this research is serving a home market.

For coordinated global manufacturing to be successful, competitive priorities consistent with an established strategy must be achieved. Hayes et al. (1988) suggest five competitive priorities that can affect the performance of a manufacturing operation: cost, quality, dependability, flexibility, and innovation (see also Hayes and Wheelwright 1984; Roth et al. 1987). A low-cost advantage was described as the ability to manufacture and market a comparable product at a lower cost. Firms competing on a low-cost basis concentrate on the cost priority. However a product cannot provide a low-cost competitive advantage just by having the lowest cost. The other competitive priorities must also be given adequate attention. For example, a product manufactured at a lower cost may not provide a low-cost competitive advantage if the product quality level is not comparable. Since a comparative advantage, in isolation, is not necessarily a competitive advantage, all five of the competitive priorities mentioned for manufacturing are examined in this research.

Global Logistics

Logistics activities are a major component of and are integrated with the primary upstream value chain activities. Bowersox (1978, 4) defines integrated logistics in a broad sense as "the process of managing all activities required to

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strategically move and store materials, parts, and finished inventory from suppliers, between enterprise facilities, and to customers." The logistics system is essentially a system of storage, handling, and transportation of physical goods; but related information and communication flows are also necessary. The logistics system also encompasses order processing design, inventory policy, customer service policy, transport policy, and supply and distribution networks because of their effect on the movement of goods (Shapiro and Heskett 1985).

Globalization of the manufacturing process increases the importance and cost of logistics activities. Globalization also lengthens supply lines and product distribution channels. As the manufacturing network becomes geographically larger, the logistics issues become more complex. Improved information, communication, and transportation technologies and a changing regulatory environment make it possible to provide global logistics support in a coordinated global manufacturing network.

As with the manufacturing function, the logistics function also has some competitive priorities. Shapiro and Heskett (1985) list the priorities as cost leadership, customer service, and innovation. Once again, cost leadership does not mean only the lowest cost; it must include an acceptable service level. Customer service involves rapid and consistent delivery, availability, and flexibility with respect to customer changes. Innovation

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includes flexibility with respect to volume shifts or product changes and the ability to handle small orders or erratic order frequencies. Companies that can generate a comparative advantage in one or more of these areas can improve their competitive position (Busher and Tyndall 1987).

Conversion Competence

Conversion system activities are important elements of the value chain for manufacturing firms. Competence of conversion activities is not simply a measure of performance of conversion activities; it is "measured by how well manufacturing's [and logistics'] strengths and weaknesses complement the priorities of the business strategy" (Cleveland et al. 1989, 655).

Cleveland et al. (1989) presented a measure of production competence. A list of nine key performance areas was established: adaptive manufacturing, cost-effectiveness of labor, delivery performance, logistics, production economies of scale, process technology, quality performance, throughput and lead time, and vertical integration. For each company in the study, these performance areas were ranked according to the priorities of the firm's strategy. Actual performance for each of these areas was assessed as strong (+1), neutral (0), or weak (-1). Each strength/weakness score was multiplied by the corresponding ranking to provide a score for each performance area.

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Overall production competence was obtained by summing the scores over all of the performance areas.

Another measure of production competence was developed by Vickery et al. (1993). This measure used an expanded list (31 items) of competitive priorities (performance areas) which were rated (importance to the firm's strategic profile on a scale of 1 to 7) rather than ranked. The performance level of each priority was measured on a -3 to +3 scale. In addition, a measure of percent responsibility that manufacturing has for each priority was obtained. A score for each competitive priority was calculated by multiplying the importance rating by the performance rating by the manufacturing responsibility percentage. The overall competence measure was again a sum of the scores over all the competitive priorities.

This study measures Conversion Competence along two different dimensions--manufacturing competence and logistics competence. Manufacturing competence was operationalized by measuring the relative importance of five manufacturing competitive priorities--cost, quality, dependability, flexibility, and innovation (Hayes et al. 1988)--and multiplying the importance factor for each priority by an average score for three manufacturing performance items matched to that specific competitive priority. Like the production competence measures already discussed, the overall manufacturing competence dimension was measured by

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summing the weighted performance scores across the competitive priorities.

Five logistics priorities, disaggregated from the priorities outlined by Shapiro and Heskett (1985), were used in operationalizing logistics competence. These priorities are flexibility, quality customer service, cost leadership, rapid and reliable delivery, and service innovation. Logistics performance items matched to each priority were also used. The overall logistics competence dimension was measured by combining weighted scores the same way they were combined for manufacturing.

MANAGERIAL ACCOUNTING

"Companies that are unable to gain firm strategic control of their worldwide operations and manage them in a globally coordinated manner will not succeed in the emerging international economy" (Bartlett and Ghoshal 1988, 54). Information is an important factor in developing a cohesive global manufacturing strategy.

Managerial accounting includes relevant cost, productivity, and performance measures. It helps managers achieve organizational objectives and gain competitive advantages (Bruns and Kaplan 1987; Horngren and Sundem 1990; Kaplan and Atkinson 1989; Worthy 1987). It encompasses information for strategy formulation and for strategy implementation. Managerial accounting includes both internal business information and information about external

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participants, either cooperative or competitive (Bromwich 1990). It also includes information about activities or linkages in the value chain (Johnson 1988). Managerial accounting systems "cannot be developed and maintained in isolation from the organization and technology or a company's manufacturing processes" (Kaplan 1986, 175).

One way of analyzing managerial accounting systems has been to measure the characteristics of either the system or the information provided by the system. Gallagher (1974) used 15 semantic differential pairs of words to have questionnaire participants measure the value of the reports provided by an information system. These pairs included such items as informative-uninformative, helpful-harmful, useful-useless, relevant-irrelevant, and necessary-unnecessary. Data on the quantity, format, reliability, timeliness, and cost of the information were also gathered using additional semantic differential pairs. Swanson (1974) used a similar approach with a Likert-type scale to measure several attributes of management information system appreciation. The appreciation concept was then linked to involvement in management information system development.

Larcker and Lessig (1980) presented an instrument designed to measure perceived usefulness of management information. This instrument divided usefulness into two dimensions--perceived importance and perceived usability. These constructs were tested for reliability and validity in a capital-budgeting setting.

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Chenhall and Morris (1986) also measured perceived usefulness of a management accounting system using 24 Likert-type survey items designed to measure four broad information characteristics--scope, timeliness, level of aggregation, and integration. These broad characteristics were used as dependent variables in a model designed to test the impact of structure (decentralization), environment (uncertainty), and interdependence on the perceived usefulness of management accounting systems.

Another line of research (Khandwalla 1972, 1973) studied different types of competition (price competition, marketing competition, and product competition) and the effect of these types of competition on management controls. Results reported support "the generalization that competition in practically any form induced management to institute formal, fairly sophisticated controls" (1972, 281).

Other researchers have examined linkages between control systems and business strategy. Govindarajan and Gupta (1985) used contingency theory to examine links between "build" or "harvest" strategies, an incentive bonus system, and strategic business unit effectiveness.

Simons (1987) used interview and questionnaire data to provide evidence on how firms using different strategies (Defender or Prospector) differ in their use of control systems. The study reported that firms with a Prospector strategy used their control systems intensively and modified

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them as necessary. Conversely, firms with a Defender strategy used control systems less intensively and made fewer changes in their control systems. Further research by Simons (1990, 1991) studied the interaction between strategy formation, strategy implementation, and control systems. Diagnostic control systems, those used to manage by exception for strategy implementation, are distinguished from interactive control systems, those used by top management in a feedback process for continuing strategy formulation. The studies provide empirical evidence showing that the strategic orientation of top managers influences their use of diagnostic versus interactive control systems.

As discussed above, characteristics of information and information systems have been measured and used in constructs which have been examined for relationships to strategy, environment, competition, and business unit effectiveness. This type of research is continued here by using two accounting information constructs--Strategic Locationing Sophistication and Managerial Accounting Competence--to test hypothesized relationships to Economic Globalization, Conversion Competence, and Competitive Position. A hypothesized relationship between the two information constructs is also tested.

Strategic Locationing Sophistication

Achieving a low-cost competitive advantage through coordinated manufacturing is not simple. Even in domestic

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settings, locating manufacturing activities is a complicated decision process. Companies use information about interstate resource costs and availability, governmental influences, and geographic/demographic factors to make site selections (Schmenner et al. 1987). Economic models and optimization models have also been developed as decision tools for these selections (see Gilley et al. 1988; Park and Mathur 1988; Schilling 1980). Although domestic locationing decisions are important, the complexities of any manufacturing network are multiplied and magnified when decisions are made to globalize the network. The diverse legal, political, cultural, and economic climates of different countries increase the risks and unknowns in global networks (Hunt and Koulamas 1989; Porter 1986b). Therefore, decisions made by managers in a global manufacturing environment require the collection and communication of substantially larger amounts and different types of information, financial and nonfinancial, to facilitate effective configuration and coordination of manufacturing networks.

Khandwalla (1977) used an extensive questionnaire to study 103 Canadian firms. One of the constructs from this questionnaire was called "sophistication of control and information system." It was measured by 15 Likert-type survey items measuring the extent to which general accounting controls were used in the organization.

Strategic Locationing Sophistication is a more specific measure of the extent to which information is available to help managers decide where to locate conversion activities in global manufacturing networks. Although the specific construct is new, the survey items used to measure it were based on several lists of criteria for selecting countries for global operations (Arpan and Radebaugh 1985; Gritzmacher and Callarman 1987; AlHashim and Arpan 1988; Anthony et al. 1989; Quelch et al. 1991). These lists include items about economic conditions, legal and political conditions, competitive conditions, and labor and material availability and costs.

Managerial Accounting Competence

Managerial Accounting Competence in this study is confined to operational measures of information related to manufacturing and logistics activities. As with the Conversion Competence construct, Managerial Accounting Competence is measured along these two dimensions. It was designed to measure how well a firm's information system provides useful information which allows managers to make decisions relative to each of the manufacturing and logistics competitive priorities discussed earlier.

The two dimensions of Managerial Accounting Competence were obtained in a manner similar to the two dimensions of Conversion Competence. The relative importance of each of the five manufacturing priorities was multiplied by an

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average score for three manufacturing information items matched to that competitive priority. The sum of these weighted scores provided a measure of the manufacturing dimension of Managerial Accounting Competence. The logistics dimension of Managerial Accounting Competence was calculated the same way using the logistics competitive priorities and information items matched to those priorities. Instead of measuring only how much information is provided or how well it is provided, this construct implicitly measures how well information is provided weighted by its importance to the manufacturing and logistics strategies of the firm, because the competitive priorities are given relative importance weightings in accordance with the firm's business strategy.

COMPETITIVE POSITION

Competitive position can be measured in many different ways. In general, competitive position is the relative measure of a firm's performance. Sometimes objective measures are available. However, several studies have operationalized competitive position/business performance by measuring relative subjective ratings for specific performance criteria.

Swamidass and Newell (1987, 516) examined a path analytic model including manufacturing strategy, environmental uncertainty, and performance. Because "most of the participants . . . politely declined to furnish

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objective performance data requested in the questionnaire," participating managers were asked to provide perceptual information rating their business unit's growth in return on total assets, growth in sales, and growth in return on sales compared to industry averages.

Another study which operationalized the concept of business performance (Cleveland et al. 1989) used relative subjective ratings for cost, quality, dependability, flexibility, market share, growth rate, and pretax return on assets.

Vickery et al. (1993) also examined the link between production competence and business performance. Business performance was measured using return on assets after tax, return on investment after tax, growth in return on investment, and return on sales. Each of these items were measured by three methods: 1) a subjective assessment of the firm's performance relative to its major competitors, 2) a subjective assessment of the firm's performance relative to its historic performance and/or company goals, and 3) an objective measure of the actual values. The analysis does note that sample sizes for actual values are much smaller than the sample sizes for the subjective assessments "due to the unwillingness of many firms to release such sensitive and confidential information" (Vickery et al. 1993, 446).

In another study examining the effects of strategy, control systems, and resource sharing on business-unit performance (Govindarajan and Fisher 1990), business

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effectiveness is measured subjectively along ten performance dimensions: return on investment, profit, cash flow from operations, cost control, development of new products, sales volume, market share, market development, personnel development, and political-public affairs.

Fawcett (1990a) measured Competitive Position using relative subjective measures of cost reduction, customer service, overall competitive position, growth in return on total assets, and growth in sales. The performance construct in this study was called Competitive Position and used these same five items and two additional items measuring growth in market share and product quality.

PRODUCTION SHARING IN MEXICO

Production sharing occurs when a firm shifts part of the production process to another country to gain a competitive advantage or provide market access (Salinas 1987; Schwartz 1987; USITC 1988). Production sharing is consistent with attempts to lower costs in a coordinated global manufacturing network (Fatemi 1990). Some background about the development of U.S.-Mexican production sharing will help explain the importance of Mexico as one of many potential settings to test the hypothesized relationships among the research constructs.

Development of U.S.-Mexican Production Sharing

The Mexican government invited U.S. companies to establish production sharing in Mexico when it instituted the Border Industrialization Program (BIP) in 1965. The BIP was established to provide jobs for Mexicans who lived along the U.S. border, attract foreign capital and technology, and provide foreign exchange to improve Mexico's balance of payments (Fatemi 1990; Sable 1989; Schwartz 1987; USITC 1988). The program encourages production sharing by allowing foreign ownership of maquiladoras (production plants licensed under the program) and the duty-free importation of equipment and materials for the production process. Companies are allowed to take materials into Mexico and use inexpensive Mexican labor in the production process, as long as the output is exported.

U.S. companies were further encouraged by existing U.S. tariff provisions requiring duties on the reimported products to be paid only on the value added in Mexico. Besides lower labor costs and advantageous tariff provisions, Mexico and the U.S. have a common border and a linked logistics infrastructure. Thus, transportation costs can be kept relatively low; plant managers can live in the U.S. and commute to work; and communications among plant managers, suppliers, company officials, and customers are facilitated (USITC 1988).

Since the initial program started, new incentives have been added to allow maquiladoras in regions other than the

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border and to allow qualifying plants to sell up to 50% of their output in Mexico. However, these added incentives to choose Mexico as a location for production sharing are overshadowed by an economic incentive. In 1982 and since then, the Mexican peso has lost much of its value vis-à-vis the U.S. dollar. For example, the average pesos per dollar jumped from 24.6 in 1981 to 57.4 in 1982. The devaluation continued. By the beginning of 1992, the exchange rate was in excess of 3,000 pesos per dollar (three zeros were dropped from the currency at the beginning of 1993, so 1 new peso is equivalent to 1,000 old pesos) (Dow Jones 1992). This economic phenomenon has been a great incentive to U.S. companies because the real cost of Mexican labor has decreased dramatically (Fatemi 1990; USITC 1988). Mexican labor costs, which had been higher than costs in other low labor cost areas such as the Far East, became lower. Appenfelder et al. (1990) report that the fully burdened wage rate for assembly workers averages about \$0.83 per hour.

Up until 1979 fewer than 500 maquiladoras employed less than 100,000 people. These numbers didn't change much until 1982. Since 1982 the number of maquiladoras in operation and the number of employees at these plants have increased considerably every year. By the beginning of 1990, 1,834 maquiladoras were in operation and employed nearly 450,000 people (Morales 1991; Sklair 1989). Most of the Fortune 500 companies participate in production sharing in Mexico

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(Barrio 1990; USITC 1988). These companies perceive an advantage to their competitive position by including this type of production sharing in their global manufacturing networks.

The U.S. is currently involved in free trade talks with Mexico. Any free trade agreement between these two countries is likely to increase the opportunities and incentives for production sharing between the two countries. Many of the current maquiladora licensing restrictions would be lifted, allowing an even more open flow of goods between countries.

This research focuses on maquiladoras, because they are the dominant organizational form for U.S.-Mexican production sharing. However, the research constructs were designed to examine production sharing in general and do not depend on the existence of maquiladoras. If a free trade agreement is reached, licensed maquiladoras may disappear, but production sharing in Mexico could still exist.

Maquiladora Research

An article by Groff and McCray (1991) is typical of much of the research published on maquiladoras. It is a descriptive article about the advantages of maquiladoras and steps in establishing a maquiladora, but it does not provide empirical data. Other research has focused on the development of the maquiladora program or government statistics about growth in number of maquiladoras, number of

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employees, value added in maquiladoras, etc. (Sklair 1989). Still other research reports information about associated social and political issues: Mexican worker exploitation, work safety and standards, environmental regulations and concerns, and the maquiladora effect on U.S. jobs (Fatemi 1990, Schwartz 1987).

One empirical study is reported by Fawcett (1990b). This study collects data on specific production and logistics costs and involves hypothesis testing. However, other than this paper, little empirical research involving data collection and hypothesis testing has been published in relation to how maquiladoras enhance competitiveness.

The existence of maquiladoras is an indication that companies are finding advantages through this type of production sharing. Empirical research is important to understand how management accounting can enhance competitive advantages in a coordinated global manufacturing environment.

CONCEPTUAL LINKAGES

Several conceptual linkages hypothesized in the literature are important to this study. These linkages are discussed in this section.

Economic Globalization/Strategic Locationing Sophistication

As firms face increasing global competition and gain access to global markets, a common, if not necessary,

response is the development of global manufacturing networks. In order to develop global manufacturing networks, information must be available to top management to help choose optimal, or at least acceptable, locations for manufacturing activities.

The changes in the competitive environment due to Economic Globalization bring about more complex organizations. Bruns and Kaplan (1987) state that demand for effective management accounting information increases when firms become more complex. Information systems need to be sufficiently sophisticated to match the complexity of the organization.

Although a general link between environmental characteristics and strategic planning has been studied previously (Lindsay and Rue 1980; Boulton et al. 1982), this study examines the link between Economic Globalization, a specific environmental characteristic, and Strategic Locationing Sophistication, a specific strategic planning information construct.

Economic Globalization/Managerial Accounting Competence

Johnson and Kaplan (1987, 4) state that vigorous competition necessitates a managerial accounting system which can "provide timely and accurate information to facilitate efforts to control costs, to measure and improve productivity, and to devise improved production processes." Khandwalla (1972, 1973) presents empirical evidence that

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increased competition leads to a greater use of management controls. Other authors offer reminders of the need to understand global competition and the importance of coordination among manufacturing network activities (Leontiades 1986; Porter 1986b). Economic Globalization intensifies the need for Managerial Accounting Competence to support this coordination.

Strategic Locationing Sophistication/Managerial Accounting Competence

Anthony et al. (1989) state that strategic planning precedes the management control process (see also Belkaoui 1985). The strategic planning process produces strategies and goals. The control process should then provide for the operationalization of these strategies. Managerial accounting information is a link between strategic planning and business operations, facilitating management control (see Coulthurst 1989; Mueller et al. 1991).

Simons (1990) mentions that little is known about the effects of strategy on management control systems. However, several authors referring to Japanese manufacturing success have observed that Japanese management accounting is subservient to corporate strategy and is designed to reinforce manufacturing strategies (Hariman 1990; Hiromoto 1988, 1991; Morgan and Weerakoon 1989; Pogue 1990). If managerial accounting fulfills its role in providing information to implement and control company strategies,

companies with better strategic planning systems should be able to provide better managerial accounting information to link the strategies with actual business operations.

Managerial Accounting Competence/Conversion Competence

Since the purpose of managerial accounting is to help managers implement and monitor business strategies to meet organizational objectives, managerial accounting systems should improve the coordination among value-chain activities (Drucker 1990; Grady 1991; Kaplan and Atkinson 1989; Shank 1989). Johnson and Kaplan (1987) imply that effective management accounting systems are necessary to coordinate logistical, conversion, and distribution activities efficiently. Kaplan (1983, 688) says that "the challenge of improving a firm's manufacturing performance is particularly relevant for managerial accountants." Managerial accounting information should assist managers in improving the performance of value chain activities.

Strategic Locationing Sophistication/Competitive Position

Every activity in a firm's value chain should affect the firm's competitive position. Information technology, important to managerial accounting for both strategic planning and management control purposes, has seen great advances in the last few years. These advances in information technology are a strategic weapon used by global organizations to perform better than their competitors

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(Bender 1985). According to Porter and Millar (1985, 160), "the question is not whether information technology will have a significant impact on a company's competitive position, rather the question is when and how this impact will strike."

Strategic planning, by itself, does not ensure company success. However, firms which use a strategic planning process and then follow up with management control can gain a competitive advantage. Kim and Mauborgne (1988) point out that effective global companies need broad monitoring of competitors to be successful. This monitoring of competitors is part of strategic planning. Belkaoui (1985) cites research which shows that firms with formal planning are more successful than firms that use informal planning. Two other studies involving small firms also provide evidence that greater planning process sophistication contributes to a firm's financial success (Bracker and Pearson 1986; Bracker et al. 1988).

Conversion Competence/Competitive Position

International production sharing is another way firms try to enhance their competitiveness (McCray and Gonzalez 1989). Manufacturing and logistics are both important parts of international production sharing. Cleveland et al. (1989) provided limited evidence that a relationship exists between production competence and business performance (see also Vickery 1991). Bender (1985) points out that recent

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advances in logistics practices such as innovative inventory management techniques are used as strategic weapons by today's global competitors (also see Shapiro and Heskett 1985). Busher and Tyndall (1987) also point out that logistics can be vital in producing a competitive advantage.

SUMMARY

The literature reviewed in this chapter has provided a background for the development of the five research constructs--Economic Globalization, Strategic Locationing Sophistication, Managerial Accounting Competence, Conversion Competence, and Competitive Position. The development of U.S.-Mexican production sharing was also reviewed because this was the global setting chosen to test the research hypotheses. The review of conceptual linkages provides the basis for the research model and hypotheses that are presented in the next chapter.

CHAPTER III

CONCEPTUAL MODEL AND HYPOTHESES

Based on the literature reviewed and the conceptual linkages presented in Chapter II, a conceptual research model was developed. The development process included consideration of other models, some of them with additional constructs. The conceptualization of the constructs evolved to provide a final model consistent with the literature. This model is shown in Figure 2. It is essentially a path diagram which illustrates hypothesized links among several constructs. Economic Globalization (EG) is an exogenous construct (variable) because it is not explained by any other constructs in the system. The other four constructs-- Strategic Locationing Sophistication (SLS), Managerial Accounting Competence (MAC), Conversion Competence (CC), and Competitive Position (CP)--are endogenous constructs (explained within the system).

To aid the discussion of the hypotheses, Figure 2 also shows an additional classification of the constructs. Economic Globalization is a measure associated with the environment. Strategic Locationing Sophistication and Managerial Accounting Competence are information constructs.

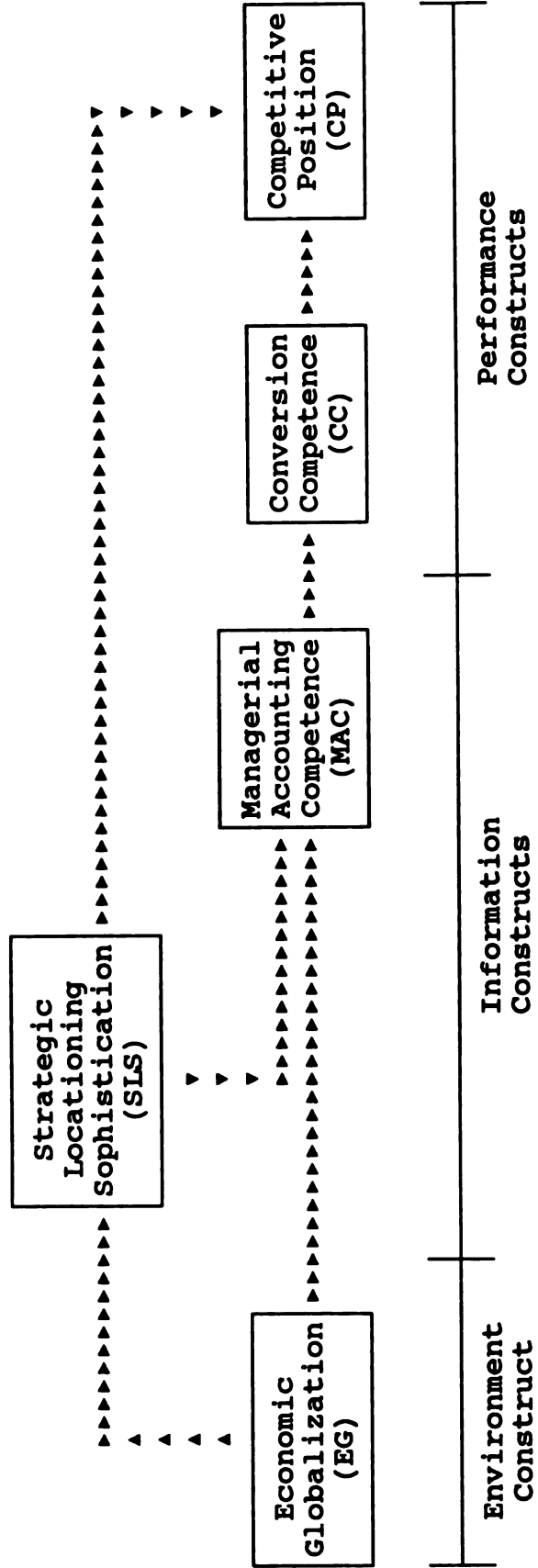


Figure 2
Research Model/Path Diagram

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Conversion Competence and Competitive Position are performance constructs.

The first hypothesis is proposed to test the theorized research model. All hypotheses are stated in the alternative.

H₁: The overall research model is descriptive of the relationships among the research constructs.

Because all of the remaining hypotheses are tests of specific links in the model, the model is first tested to determine if the data support the specified model relationships.

DIRECT EFFECT HYPOTHESES

The next six hypotheses are represented by the six arrows on the path diagram. These hypotheses are all concerned with direct links or direct effects of one construct on another. Support for these direct links was provided through the literature cited in the "Conceptual Linkages" section of Chapter II. Indirect links and hypotheses are discussed later.

Economic Globalization Hypotheses

Because Economic Globalization adds complexity to value chain functions, firms facing this globalization will need relevant and reliable accounting information. Firms that perceive a greater impact of Economic Globalization will be searching for ways to make the intensified competition and

increased market access a competitive advantage. This competitive advantage can come through effective configuration and coordination of global manufacturing activities (Oliff et al. 1987; Porter 1986b). Effective configuration requires Strategic Locationing Sophistication, and effective coordination requires Managerial Accounting Competence (Arpan and Radebaugh 1985; Johnson and Kaplan 1987). The following two hypotheses are proposed to test the linkage between perceived Economic Globalization and companies' managerial accounting information.

- H₂: Greater perceived impact of Economic Globalization on the firm is related to greater Strategic Locationing Sophistication.
- H₃: Greater perceived impact of Economic Globalization on the firm is related to greater Managerial Accounting Competence.

Competence Hypotheses

Managerial accounting systems provide information to managers so that they can make decisions consistent with the strategy of the firm. Therefore, companies with more effective strategic planning should be in a better position to provide better operational information to implement the strategies (see Coulthurst 1989; Mueller et al. 1991). Hypothesis 4 tests the relationship of Strategic Locationing Sophistication, a specific part of strategic planning, to Managerial Accounting Competence.

H₄: Greater Strategic Locationing
Sophistication is related to greater
Managerial Accounting Competence.

Simons (1990, 1991) presents evidence to show that some management control systems are used interactively by top management to provide feedback for strategy formulation. However, because of the specific definitions of the Strategic Locationing Sophistication and Managerial Accounting Competence constructs used here and the diagnostic nature of the Managerial Accounting Competence construct items, no reciprocal relationship is hypothesized.

Managerial accounting information is important to the operation of the conversion activities of any company (Grady 1991; Johnson and Kaplan 1987). Because Managerial Accounting Competence is operationalized specifically to measure manufacturing and logistics information, it should have a positive relation to the competence of the actual manufacturing and logistics activities. The following hypothesis provides evidence of the linkage between Managerial Accounting Competence and Conversion Competence.

H₅: Greater Managerial Accounting Competence
is related to greater Conversion
Competence.

Competitive Impact Hypotheses

Firms with better strategic planning are better able to find comparative advantages (Belkaoui 1985; Kim and Mauborgne 1988). Firms that have greater Strategic Locationing Sophistication are better able to monitor

competition and other external forces and to position themselves to exploit the comparative advantages to provide a competitive advantage. To test the relationship of Strategic Locationing Sophistication to Competitive Position, the following hypothesis is proposed.

H₆: Greater Strategic Locationing Sophistication is related to a perception of improved Competitive Position.

Manufacturing and logistics activities are important to the success of any manufacturing firm (Bender 1985; Busher and Tyndall 1987; Cleveland et al. 1989; Shapiro and Heskett 1985). The following hypothesis is proposed to test the relationship of Conversion Competence and Competitive Position.

H₇: Greater Conversion Competence is related to a perception of improved Competitive Position.

INDIRECT EFFECT HYPOTHESES

Indirect links in the path diagram are those links where two constructs are connected through one or more intermediate constructs. Two indirect links are of particular interest: the indirect link between Strategic Locationing Sophistication and Competitive Position and the indirect link between Managerial Accounting Competence and Competitive Position. The reason these indirect links are of interest is that they provide evidence about managerial accounting's impact on Competitive Position.

Based on the previous discussion of accounting information being a necessary component of competitive success, the need for conversion system activities to operate a business, and the need for information to carry out the conversion activities, the following two hypotheses are proposed.

- H₁: Greater Strategic Locationing Sophistication is indirectly related to a perception of improved Competitive Position through Managerial Accounting Competence and Conversion Competence.
- H₂: Greater Managerial Accounting Competence is indirectly related to a perception of improved Competitive Position through Conversion Competence.

SUMMARY

This chapter presents a conceptual research model based on the constructs and conceptual linkages from Chapter II. Specific hypotheses are also formalized. The tests of the hypotheses outlined in this chapter provide evidence about whether the production and use of managerial accounting information, in a global environment, is related to a firm's conversion system performance and its Competitive Position. Chapter IV presents the methodology employed to test the hypothesized relationships.

CHAPTER IV

METHODOLOGY

To test the study's hypotheses, the research methodology used is explained in the following sections: research design, research setting, study population and sampling procedure, survey development, survey items, descriptive analysis, measurement model analysis, and structural model analysis and hypothesis testing.

RESEARCH DESIGN

Since management accounting phenomena exist only in complex organizations, with their rich interaction of people, products, processes, markets, technologies, and cultures, it becomes extremely difficult to study the subject except in actual organizational settings. (Bruns and Kaplan 1987, 1-2).

The hypotheses tested in this study include management accounting constructs, as well as environmental and performance constructs. Therefore, these constructs were studied in actual organizational settings through a field research design.

Several types of field research could be used to study the constructs and relationships theorized. A mail survey approach was chosen because of its relatively low cost to administer and its ability to gather empirical data from a

large number of managers who are geographically scattered. Also, because of the large number of data items to be gathered to measure the research constructs and stratifying variables, other survey methods such as a telephone survey would have been difficult to administer.

Because many of the survey items were perceptual in nature, a written survey, if pre-tested thoroughly, is desirable to assure that all respondents receive the same instructions and that survey items are worded consistently between participants. Finally, because of the structural equation modeling chosen for the analysis and the complexity of the model hypothesized, a large number of responses was required to test the hypotheses.

RESEARCH SETTING

Production sharing operations in Mexico provide a specific research setting for examining issues in global manufacturing networks. The setting in Mexico provides a relatively simple environment for the initial examination of the hypotheses proposed because of Mexico's proximity to U.S. manufacturers.

The recent development of this production sharing opportunity and the high growth in the number of plants are two reasons for interest in this particular setting. Entry into and exit from Mexican production sharing is made easier by the possibility of subcontracting the manufacturing operations to existing plants rather than owning a plant in

Mexico. Subcontracting is sometimes used by firms who want to minimize risk while evaluating the potential of Mexican production sharing. However, many companies are sufficiently committed to the program that they have built their own plants. The vast majority of maquiladoras are operated by or for U.S. companies (although companies from Japan and other countries are also increasingly involved in Mexican production sharing). Therefore, access to managers who might be recruited to participate in the research is greater than if the controlling companies were evenly spread among many nations.

Because of Mexico's proximity to the U.S., U.S. company managers are often able to have direct or almost direct control over decisions regarding maquiladora operations. Because of this control, the study focuses on information provided to and decisions made by U.S. decision makers. The research setting is well defined because the production sharing operations involved are confined to Mexico.

STUDY POPULATION AND SAMPLING PROCEDURE

The study population consists of firms which are involved in Mexican production sharing. The mailing list was compiled from *The Complete Twin Plant Guide*, a listing of approximately 2,200 maquiladoras operating throughout Mexico (Solunet 1991), the *Directory of American Firms Operating in Foreign Countries* (Uniworld Business Publications 1991), *America's Corporate Families and*

International Affiliates (Dun's Marketing Service 1991), and the *International Directory of Corporate Affiliations* (National Register Publishing 1991).

These directories listed 2,191, 573, 353, and 248 maquiladoras or firms, respectively. After eliminating duplicate listings between directories and certain companies such as non-manufacturing companies, companies not listed with their maquiladoras, companies with no contact person listed, and companies without a complete mailing address listed, the mailing list contained 633 remaining companies.

The survey was targeted at managers who have knowledge relating to the survey items. Because the survey includes items on corporate strategy, global perceptions, and firm competitive position, as well as items related to Mexican operations, these managers must have a knowledge of company activities in both the U.S. and Mexico. Therefore, instead of targeting managers at the Mexican plants (those who mainly oversee plant operations), managers at the U.S. division or corporate level are targeted.

Some strategic business units operate more than one maquiladora. Since the survey is designed to gather firm information as well as Mexican operation information, strategic business units are targeted rather than specific maquiladoras. Thus, only one response per strategic business unit is sought, instead of one response per maquiladora. This minimizes the possibility of introducing bias into the data analysis which could exist if duplicate

firm information were allowed through responses from multiple maquiladoras operated by the same firm.

Although little empirical research on maquiladoras has been published, managers in firms with maquiladoras indicate that they receive many surveys. To increase the response rate, two follow-up mailings were sent after the original mailing. The original mailing was sent to 633 managers. At approximately 2 1/2-week intervals, a postcard reminder and then the two follow-up survey mailings were sent. Copies of the postcard reminder and the cover letters for the three mailings are included in the appendix.

Over the course of the survey administration, 109 surveys were returned undeliverable or inappropriately addressed. These surveys were subtracted from the total, bringing the adjusted sample size to 524. Of these, 131 responses were received; 65 from the first mailing, 45 from the second mailing, and 21 from the final mailing. The number of surveys returned represents a 25% response rate. Analysis of differences in responses between the three mailings are reported later with the analysis of stratifying variables.

SURVEY DEVELOPMENT

The survey instrument (see Appendix) was developed after extensive review of existing literature and several related surveys. The Economic Globalization and Competitive Position constructs have been used in prior research

(Fawcett 1990a). These constructs were shown to be reliable. They were modified for use in the present survey by the addition of several survey items. After modification, these constructs were retested for reliability. Conversion Competence is a new construct using ideas from the literature and related constructs from prior surveys. The accounting constructs--Strategic Locationing Sophistication and Managerial Accounting Competence--are new constructs based conceptually in the literature. In addition to items measuring the actual constructs, the survey also includes several stratifying variables such as level of the responding manager (plant, division, or corporate), functional area of expertise of respondent, industry, ownership relationship, and technology level.

Pre-testing of the survey was accomplished in several phases. First, several professors critiqued specific items or constructs. In response to these critiques, items were modified or deleted, instructions on some specific questions were changed, and constructs and construct measures were changed to increase content validity. Second, an on-campus evening MBA international business class, including a number of students who have connections with Mexican operations, pre-tested the survey to identify inconsistencies or items that were difficult to understand. Most of the survey changes at this phase were cosmetic. Some minor changes were also made to improve understandability. Third, the survey was sent to several managers with experience in

Mexican operations. These managers were asked to fill out the survey and provide additional comments about the terminology, instructions, and ability of the survey to gather appropriate information about the constructs. Again, the survey was modified after the responses were evaluated. The major modification at this phase was to shorten the survey to encourage manager response. The order of survey items was also modified to vary the types of items from one page to another. For example, since most of the survey items were measured using seven-point Likert-type scales, the stratifying variables which were measured using other scales were interspersed throughout the survey. This was done to keep the respondents' interest level high.

SURVEY ITEMS

Other than the stratifying variables and questions 4 and 5, all of the survey items are measured using seven-point Likert-type scales. These scales are used to provide interval-level data for analysis. Each construct is measured by multiple survey items. Churchill (1979) explains how multiple-item measures can diminish some specific measurement difficulties. He also explains that "no single item is likely to provide a perfect representation of the concept, just as no single word can be used to test for differences in subjects' spelling abilities and no single question can measure a person's intelligence" (68).

Since the research constructs are unobservable, observable variables are measured to provide manifestations (indicators) of the constructs. Because the constructs used in this research are so broad, multiple manifestations of the underlying constructs are expected. This means that items for a construct may be represented by two or more factors which are treated as manifestations of the construct. Analysis with multiple-indicator constructs is explained later.

Economic Globalization Items

The Economic Globalization construct was measured with nine items asking perceptions of global competition and access to global markets. Survey questions 26, 46 and 49 were taken from Fawcett's (1990a) survey. Six additional items--question 29, 32, 34, 36, 40, and 45--were added to provide a more complete perceptual measure of the construct. Table 1 lists these items and shows the variable names used to report analysis and results.

Table 1
Survey Items for Economic Globalization

<u>Variable Name</u>	<u>Survey Item</u>
Q26	Your firm does not view foreign production as necessary to remaining competitive.*
Q29	Economic globalization has had no important impact on your firm's competitive strategy.*
Q32	Economic globalization has had no impact on the competitive pressure faced by your firm.*
Q34	Your firm is seldom challenged in the marketplace by low-cost competitors from other countries.*
Q36	Your firm is often challenged in the marketplace by foreign competitors with a differential advantage based on quality, flexibility, or technological innovation.
Q40	Economic globalization has greatly increased your firm's ability to gain access to materials and labor in foreign countries.
Q45	Economic globalization has greatly increased your firm's ability to enter and develop markets in different areas of the world.
Q46	Your firm feels foreign production is essential to compete with low-cost foreign manufacturers.
Q49	Your firm does not view foreign production as essential to improving its access to global markets.*

* Item was reverse worded in survey/reverse coded in analysis.

Strategic Locationing Sophistication Items

The Strategic Locationing Sophistication construct was measured by 18 items which assess the amount of information available to make strategic location decisions. These items are found in question 20 in the survey. Table 2 lists these items and their associated variable names. The items were chosen based on lists from several sources which enumerate types of information that would be important to the strategic locationing process (AlHashim and Arpan 1988; Anthony et al. 1989; Arpan and Radebaugh 1985; Gritzmacher and Callarman 1987; Quelch et al. 1991). The items were selected to provide an inclusive list without including excessive detail.

Table 2
Survey Items for Strategic Locationing Sophistication

<u>Variable Name</u>	<u>Survey Item</u>
SLS1	Cross-national economic conditions
SLS2	Political stability
SLS3	Competitors' strategies
SLS4	Global technology developments
SLS5	Global transportation rates (logistics costs)
SLS6	Exchange rates
SLS7	Cross-national productivity
SLS8	Production quality across countries
SLS9	Labor unionization
SLS10	Potential sales in foreign market
	Governmental policies:
SLS11	currency convertibility
SLS12	domestic content laws
SLS13	foreign ownership laws
SLS14	tariffs/quotas
SLS15	tax issues
	Opportunities for comparative advantage:
SLS16	cross-national labor rates
SLS17	cross-national materials input costs
SLS18	cross-national resource availability

Managerial Accounting Competence Items

Managerial Accounting Competence refers specifically to the information provided about conversion (manufacturing and logistics) activities. Survey questions 4 and 5 measure manufacturing and logistics priorities for the company (Hayes et al. 1988; Shapiro and Heskett 1985) and questions 21 and 22 measure how well information items are provided for each of these priorities. Table 3 lists the priorities from questions 4 and 5 and shows the variable names for these items. Table 4 lists the specific items relating to manufacturing and logistics information from questions 21 and 22 and shows the variable names used.

Table 3
Survey Items for Competitive Priorities

Manufacturing Priorities

<u>Variable</u> <u>Name</u>	<u>Survey Item</u>
MFLEX	Flexible/Responsive Production
MQUAL	High-Quality Production
MCOST	Low-Cost Production
MDEPN	Dependability (due-date performance)
MINNO	Innovation (rapid new product introduction and process uniqueness)

Logistics Priorities

<u>Variable</u> <u>Name</u>	<u>Survey Item</u>
LFLEX	Flexible/Responsive Logistics (quick response)
LQUAL	High-Quality Customer Service (customer success)
LCOST	Logistics Cost Leadership
LDELV	Rapid and Reliable Delivery (on-time performance)
LINNO	Service Innovation

Table 4
Survey Items for Accounting Information

Manufacturing Items

<u>Variable Name</u>	<u>Survey Item</u>
MINF1	Actual changeover times to different products
MINF2	Backorder performance (e.g. number of days to fill backorders)
MINF3	Changes in important production costs including labor and materials
MINF4	Cost of manufacturing system flexibility
MINF5	Cost of quality (includes cost of poor quality and cost of improving quality)
MINF6	Costs of missing promised production due dates
MINF7	Costs of product and process innovation
MINF8	Due-date performance (e.g. percent of due dates met)
MINF9	Manufacturing cycle times
MINF10	Process control (information used to identify problems in the production process)
MINF11	Product costing (labor, materials, and overhead) for items produced in Mexico
MINF12	Production defect rates
MINF13	R&D effectiveness
MINF14	Time-to-market performance (product development lead times)
MINF15	Total labor costs (fully loaded wages plus training costs)

Table 4 (cont'd)

Logistics Items

Variable

NameSurvey Item

LINF1	Quick response (e.g. length of time to respond to customer inquiries; percent of order changes that can be handled immediately)
LINF2	Cost of flexible and responsive logistics system
LINF3	Cost of logistics service innovation
LINF4	Cost of quality logistics customer service
LINF5	Cost of rapid and reliable delivery
LINF6	Delivery performance (e.g. percent of orders delivered on time)
LINF7	Expediting performance (e.g. length of time to deliver expedited shipments)
LINF8	Logistics cycle time analysis (information used to reduce order cycle times)
LINF9	Logistics impact on customer (information collected directly from customers)
LINF10	Logistics service customization (e.g. number and type of special requests handled)
LINF11	Logistics-related customer complaints (e.g. number and type of complaints)
LINF12	Order system costs (e.g. cost per order; order costs as a percent of sales)
LINF13	Total logistics cost information for items to and from Mexico
LINF14	Transportation costs (e.g. as a percent of sales; modal/carrier comparison)
LINF15	Value analysis (information used to increase the value added by logistics services)

Conversion Competence Items

Conversion Competence refers to how well specific manufacturing and logistics activities are performed combined with how important these activities are to firm success. The same priorities used for Managerial Accounting Competence are used for Conversion Competence (survey items 4 and 5, shown in Table 3). The conversion activity performance measures are in survey question 10. Table 5 lists these performance measures along with their variable names.

Table 5
Survey Items for Conversion Activity Performance

Manufacturing Items

<u>Variable</u> <u>Name</u>	<u>Survey Item</u>
MPER1	Ability to consistently meet production schedule
MPER2	Ability to meet promised due dates
MPER3	Ability to take advantage of production economies of scale
MPER4	Aggressiveness of R&D and concurrent engineering programs
MPER5	Appropriateness of process technology (advanced, unique process)
MPER6	Backordered products (smaller backlog is better)
MPER7	Changeover time from one product type or output volume to another
MPER8	Defect rate (fewer defective parts per million is better)
MPER9	Labor productivity
MPER10	Manufacturing system adaptability
MPER11	New product development lead times (shorter lead times are better)
MPER12	Products consistently meet customer expectations
MPER13	Products consistently meet design specifications
MPER14	Throughput lead times (shorter cycle times are better)
MPER15	Unit cost (lower cost is better)

Table 5 (cont'd)

Logistics Items

<u>Variable Name</u>	<u>Survey Item</u>
LPER1	Ability to deliver expedited shipments
LPER2	Aggressiveness in increasing the value-added content of logistics services
LPER3	Aggressiveness in the reduction of order cycle time (logistics cycle time)
LPER4	Customer satisfaction provided by logistics services
LPER5	Delivery lead times for goods shipped to and from your Mexican operations
LPER6	Inventory costs (raw materials, finished goods and pipeline)
LPER7	Logistics labor productivity
LPER8	Logistics system's ability to provide new and better logistics services
LPER9	Logistics system's ability to accommodate special or non-routine requests
LPER10	Logistics system's ability to handle unexpected events
LPER11	Logistics system's ability to provide rapid response to customer requests
LPER12	Logistics system's ability to enhance customer success
LPER13	Number of logistics related complaints (fewer is better)
LPER14	On-time delivery performance (percent of on-time deliveries)
LPER15	Transportation costs (lower costs are better)

Competitive Position Items

Competitive Position consists of seven perceptual items designed to measure a firm's comparative performance with respect to its Mexican operations. Survey items 28, 31, 33, 37, and 42 were taken from Fawcett's (1990a) survey and include growth in sales, customer service, overall competitive position, return on assets, and cost reduction. Two additional items--items 23 and 44, growth in market share and product quality were added to those from prior research. The items for Competitive Position are shown in Table 6 with their associated variable names.

Table 6
Survey Items for Competitive Position

<u>Variable Name</u>	<u>Survey Item</u>
Q23	Your Mexican operations have helped the firm achieve above average growth in market share.
Q28	Production sharing in Mexico has led to an above average rate of growth in sales for your firm.
Q31	Your Mexican operations have achieved above average levels of customer service when compared to competitors' (similar) foreign production operations.
Q33	Your Mexican operations have helped the firm achieve above average improvement in overall competitive position.
Q37	Production sharing in Mexico has led to an above average rate of growth in return on total assets for your firm.
Q42	Your Mexican operations have achieved above average cost reductions when compared to competitors' (similar) foreign production operations.
Q44	Your firm's Mexican operations have helped it achieve above average levels of product quality compared to competitors' (similar) foreign production operations.

DESCRIPTIVE ANALYSIS

The data were input and proofread for accuracy. Nine surveys were eliminated from the analysis because the respondents were not paying enough attention to notice the reverse worded items. The analysis was performed using the remaining 122 surveys. (Missing data items were excluded listwise in most of the analysis that is reported. However, where means were calculated as part of a construct measurement, these means were calculated using available data points, ignoring those that were missing.) Descriptive statistics were calculated for each of the survey items. Descriptive statistics are reported to provide a demographic overview of the respondents and their firms and to make initial assessments of the survey results. Statistics such as mean, median, mode, standard deviation, minimum, maximum, and number missing were analyzed for individual items. Analyses of these statistics, even before the hypotheses are tested, provided insights into the responses.

Demographic Data

Over 70% of the respondents reported being division or corporate managers. Table 7 shows the level of managerial responsibility reported by the participants. The respondents' area of expertise was also reported. Area of expertise is reported in Table 8. The survey responses came from managers from a wide variety of industries. Table 9 reports industries. The "other" category includes many

industries represented by only one or two responses. The data in Table 9 was compared to 1990 statistics of maquiladoras by industry (Morales 1991). Because the categorization of industries is different, direct comparison

Table 7
Level of Managerial Responsibility

Plant Manager	29
Division Manager	31
Corporate Manager	58
Other	2
Missing	<u>2</u>
Total	122

Table 8
Area of Expertise

Accounting/Finance	16
Engineering	7
Materials Management/Physical Distribution (logistics)	12
Manufacturing/Production	41
Marketing	22
Other	9
Chose multiple areas	14
Missing	<u>1</u>
Total	122

Table 9
Industry

Apparel	8
Electronic/Electric	32
Metals	6
Transportation Equipment	14
Machinery, except electric	3
Food Products	3
Chemicals	9
Medical/Health Care	8
Auto supplies	5
Other	<u>34</u>
Total	122

is difficult. However, the sample data in this research seem to over represent the transportation equipment and chemical industries and to under represent the apparel and furniture industries.

The mean number of years the firms have been operating in Mexico is 17.7, ranging from 1 year to 65 years. However, the median number of years is 13 and the mode is 10. The size of the firms in number of employees ranges from 4 to 21,000. Again, a few large firms skewed the average number of employees to 1,145. The median number of employees is 300. Table 10 reports the number of employees for the sample firms. Respondents from 83% of the firms reported fewer than 1,000 employees. An additional 14% of the respondents reported between 1,000 and 5,000 employees, and only five responses indicated more than 5,000 employees.

Table 10
Number of Employees

fewer than 100	20
100-199	24
200-299	15
300-399	10
400-499	8
500-999	23
1,000-4,999	16
more than 5,000	5
missing	<u>1</u>
Total	122

If owning the physical buildings housing their Mexican facilities is a sign of commitment to production sharing in Mexico, then most of the firms are demonstrating this commitment. Forty-eight percent of the firms own their buildings, another 23% own some and rent others, and the remaining firms rent their buildings.

Table 11 shows the ownership relationship of the Mexican operations. Most of the responding firms have 100% U.S. ownership of their Mexican operations. Of the 21 responses in the "other" category, three had majority U.S. ownership, five had majority Mexican ownership, five were unspecified joint ventures, and the remaining eight reported miscellaneous ownership relationships.

Table 11
Ownership Relationship of Mexican Operations

100% U.S. ownership	93
Shelter/subcontract operation(s)	8
Other	<u>21</u>
Total	122

Most of the survey respondents (77%) classified their operations as medium technology or high technology. While labor intensity and technology level are not exactly correlated, the response about the technology level of the Mexican operations (Table 12) suggests that there may be reasons besides low labor costs for companies to operate manufacturing facilities in Mexico. The technology level reported by respondents is consistent with the evolution of maquiladora plants discussed by Fatemi (1990). Originally, these plants were highly labor-intensive operations requiring unskilled workers. Recently, industries that are production sharing in Mexico have "begun to build more complex, capital-intensive, highly integrated industrial plants" (11).

Table 12
Technology Level of Mexican Operations

High technology	17
Medium technology	77
Low technology	<u>28</u>
Total	122

Another survey item that can help describe the firms is the role their Mexican facilities play in the production process, from fabrication to assembly to integrated manufacturing. Table 13 shows the number of firms involved in these separate roles. The total number reported is greater than 122 because respondents were asked to check all of the choices that apply to their firms.

Table 13
Mexican Facility Role in Production Process

Fabrication of component parts	41
Assembly of subassemblies	46
Assembly of finished goods	70
Integrated manufacturing operations	<u>63</u>
Total	220

To provide a signal of the global nature of these companies, participants were asked to indicate whether or not their companies operate production facilities in several specific geographic areas of the world. Table 14 presents the results of these responses. Again, the total is greater than 122 because some companies operate production facilities in several of these areas. The total of 308 implies that, on average, these firms operate production facilities in 2.5 of the 6 geographic areas listed. However, 33 of the respondents did not check any of these geographic areas. The geographic dispersion reported, in addition to Mexican and U.S. plants, indicates that many of these firms are operating on a global basis.

Table 14
Location of Other Production Facilities

Mainland Asia (China, India, etc.)	35
Canada	62
Caribbean Basin	23
Europe	78
South America	47
Pacific Basin (Australia, Hong Kong, Japan, etc.)	<u>63</u>
Total	308

Univariate Descriptive Statistics

This section presents and discusses univariate descriptive statistics for the specific survey items designed to measure the constructs of research interest. Tables 15, 16, 17, 18, 19, and 20 present summary statistics for these items. These tables show statistics for Economic Globalization items, Strategic Locationing Sophistication items, manufacturing and logistics competitive priority items, accounting information items, conversion activity performance items, and Competitive Position items, respectively.

Table 15
Summary of Economic Globalization Survey Items

<u>Item</u>	<u>Mean</u>	<u>Median</u>	<u>Mode</u>	<u>St. Dev.</u>	<u>Min.</u>	<u>Max.</u>	<u># Missing</u>
Q26*	5.336	6	7	1.935	1	7	0
Q29*	5.262	6	7	1.709	1	7	0
Q32*	5.508	6	6	1.560	1	7	0
Q34*	5.377	6	7	1.653	1	7	0
Q36	4.541	5	6	1.692	1	7	0
Q40	4.525	5	5	1.602	1	7	0
Q45	4.533	5	6	1.782	1	7	0
Q46	5.238	6	6	1.596	1	7	0
Q49*	5.471	6	7	1.528	1	7	1

* Item was reverse worded in survey/reverse coded in analysis.

Table 16
Summary of Strategic Locationing Sophistication Survey Items

<u>Item</u>	<u>Mean</u>	<u>Median</u>	<u>Mode</u>	<u>St. Dev.</u>	<u>Min.</u>	<u>Max.</u>	<u># Missing</u>
SLS1	4.593	5	5	1.711	1	7	4
SLS2	4.619	5	5	1.653	1	7	4
SLS3	4.771	5	5	1.304	1	7	4
SLS4	4.590	5	5	1.504	1	7	5
SLS5	4.305	4	4	1.522	1	7	4
SLS6	5.500	6	6	1.484	1	7	2
SLS7	4.580	5	5	1.634	1	7	3
SLS8	4.839	5	5	1.558	1	7	4
SLS9	4.700	5	4	1.638	1	7	2
SLS10	4.771	5	5	1.682	1	7	4
SLS11	5.210	5	7	1.631	1	7	3
SLS12	5.050	5	5	1.578	1	7	3
SLS13	5.143	5	5	1.591	1	7	3
SLS14	5.118	5	5	1.606	1	7	3
SLS15	5.294	6	6	1.531	1	7	3
SLS16	4.932	5	6	1.605	1	7	4
SLS17	4.855	5	5	1.626	1	7	5
SLS18	4.822	5	6	1.567	1	7	4

Since most of the items are seven-point Likert-type measures, it is difficult to ascertain much information from the summary statistics themselves. With one exception (Table 18), all of the means of seven-point items fell between 4 and 6. Responses ranged from 1 to 7 for all items except seven (see Tables 18 and 19). These items ranged from 2 to 7. The number of missing data points for the items ranged from 0 to 6.

The means of the Economic Globalization items in Table 15 ranged from 4.525 to 5.508. The means of all reverse-worded items were higher than the means of all non-reverse-worded items. The means have a bimodal distribution, with means for Q36, Q40, and Q45 all close to 4.500 and means for Q26, Q29, Q32, Q34, Q46, and Q49 all greater than 5.200.

The means for Strategic Locationing Sophistication items in Table 16 ranged from 4.305 to 5.500. All of the means were below 5.000 except item SLS6 (exchange rates) and items SLS11 to SLS15 (governmental policy items). The means for these items were all above 5.000.

Table 17, which presents the summary statistics for the competitive priority survey items (not on a seven-point scale), does provide some valuable insights. Quality seems to be the most important priority for both manufacturing and logistics. Likewise, innovation seems to be the least important priority for both manufacturing and logistics. However, cost, which was the second highest priority for manufacturing, is the fourth highest priority for logistics.

Table 18 presents statistics for the accounting information items related to both manufacturing and logistics. The means of the manufacturing items ranged from 3.974 to 5.521 and the means of the logistics items ranged from 4.093 to 5.361. The range of means for the manufacturing items was greater than for the logistics items.

Table 19 presents statistics for the manufacturing and logistics performance items. The means of the manufacturing items ranged from 4.095 to 5.438 and the means of the logistics items ranged from 4.570 to 5.397. Again, the range of means for the manufacturing items was greater than for the logistics items.

Descriptive statistics for the Competitive Position items are listed in Table 20. The means range from 4.708 to 5.590.

Table 17
Summary of Competitive Priority Survey Items

Manufacturing Priorities

<u>Item</u>	<u>Mean</u>	<u>Median</u>	<u>Mode</u>	<u>St. Dev.</u>	<u>Min.</u>	<u>Max.</u>	<u># Missing</u>
MFLEX	17.303	20	20	7.844	0	40	0
MQUAL	29.344	30	30	10.462	10	70	0
MCOST	21.590	20	20	11.572	0	70	0
MDEPN	18.730	20	20	7.822	0	40	0
MINNO	13.033	10	10	8.807	0	40	0

Logistics Priorities

<u>Item</u>	<u>Mean</u>	<u>Median</u>	<u>Mode</u>	<u>St. Dev.</u>	<u>Min.</u>	<u>Max.</u>	<u># Missing</u>
LFLEX	19.455	20	20	9.349	0	80	1
LQUAL	29.099	30	30	11.692	0	80	1
LCOST	15.777	15	20	9.230	0	50	1
LDELV	22.512	20	20	7.838	0	50	1
LINNO	13.157	10	10	8.543	0	55	1

Table 18
Summary of Accounting Information Survey Items

Manufacturing Items

<u>Item</u>	<u>Mean</u>	<u>Median</u>	<u>Mode</u>	<u>St. Dev.</u>	<u>Min.</u>	<u>Max.</u>	<u># Missing</u>
MINF1	4.783	5	6	1.342	1	7	2
MINF2	5.168	5	5	1.392	1	7	3
MINF3	5.151	5	6	1.169	2	7	3
MINF4	4.661	5	5	1.302	1	7	4
MINF5	4.856	5	5	1.463	1	7	4
MINF6	4.331	4	5	1.596	1	7	4
MINF7	4.466	5	5	1.477	1	7	4
MINF8	5.229	5	5	1.380	1	7	4
MINF9	5.169	5	6	1.208	2	7	4
MINF10	4.890	5	5	1.425	1	7	4
MINF11	5.521	6	6	1.149	2	7	3
MINF12	5.239	5	5	1.337	1	7	5
MINF13	3.974	4	4	1.563	1	7	6
MINF14	4.271	4	4	1.678	1	7	4
MINF15	5.475	5	5	1.145	2	7	4

Logistics Items

<u>Item</u>	<u>Mean</u>	<u>Median</u>	<u>Mode</u>	<u>St. Dev.</u>	<u>Min.</u>	<u>Max.</u>	<u># Missing</u>
LINF1	4.908	5	5	1.455	1	7	2
LINF2	4.322	4	5	1.426	1	7	4
LINF3	4.093	4	4	1.327	1	7	4
LINF4	4.291	4	4	1.421	1	7	5
LINF5	4.610	5	4	1.390	1	7	4
LINF6	5.361	6	6	1.332	1	7	3
LINF7	4.906	5	5	1.456	1	7	3
LINF8	4.336	4	4	1.480	1	7	3
LINF9	4.412	4	4	1.498	1	7	3
LINF10	4.403	4	5	1.475	1	7	3
LINF11	4.655	5	4	1.481	1	7	3
LINF12	4.364	4	4	1.506	1	7	4
LINF13	4.525	5	5	1.523	1	7	4
LINF14	4.824	5	4	1.394	1	7	3
LINF15	4.291	4	4	1.497	1	7	5

Table 19
Summary of Conversion Activity Performance Survey Items

Manufacturing Items

<u>Item</u>	<u>Mean</u>	<u>Median</u>	<u>Mode</u>	<u>St. Dev.</u>	<u>Min.</u>	<u>Max.</u>	<u># Missing</u>
MPER1	5.264	5	6	1.167	1	7	1
MPER2	5.215	5	6	1.142	1	7	1
MPER3	5.092	5	6	1.444	1	7	2
MPER4	4.095	4	3	1.538	1	7	6
MPER5	4.559	4.5	4	1.441	1	7	4
MPER6	5.067	5	5	1.200	2	7	2
MPER7	5.124	5	4	1.187	2	7	1
MPER8	5.200	5	6	1.363	1	7	2
MPER9	4.967	5	6	1.278	1	7	1
MPER10	5.083	5	5	1.187	2	7	1
MPER11	4.454	5	5	1.436	1	7	3
MPER12	5.438	6	6	1.110	1	7	1
MPER13	5.433	6	6	1.150	1	7	2
MPER14	4.892	5	4	1.314	1	7	2
MPER15	5.132	5	5	1.408	1	7	1

Logistics Items

<u>Item</u>	<u>Mean</u>	<u>Median</u>	<u>Mode</u>	<u>St. Dev.</u>	<u>Min.</u>	<u>Max.</u>	<u># Missing</u>
LPER1	5.397	5	5	1.084	1	7	1
LPER2	4.983	5	5	1.174	1	7	2
LPER3	4.925	5	5	1.161	1	7	2
LPER4	5.118	5	5	1.158	1	7	3
LPER5	5.017	5	6	1.335	1	7	2
LPER6	4.570	5	4	1.347	1	7	1
LPER7	4.893	5	4	1.196	1	7	1
LPER8	4.575	4	4	1.150	1	7	2
LPER9	4.842	5	4	1.160	1	7	2
LPER10	4.818	5	4	1.225	1	7	1
LPER11	5.132	5	5	1.197	1	7	1
LPER12	4.926	5	5	1.184	1	7	1
LPER13	4.942	5	4	1.227	1	7	1
LPER14	5.150	5	5	1.179	1	7	2
LPER15	4.686	5	5	1.403	1	7	1

Table 20
Summary of Competitive Position Survey Items

<u>Item</u>	<u>Mean</u>	<u>Median</u>	<u>Mode</u>	<u>St. Dev.</u>	<u>Min.</u>	<u>Max.</u>	<u># Missing</u>
Q23	5.590	6	6	1.278	1	7	0
Q28	4.767	5	4	1.459	1	7	2
Q31	5.116	5	4	1.392	1	7	1
Q33	5.230	5	5	1.271	1	7	0
Q37	4.833	5	4	1.374	1	7	2
Q42	4.708	5	4	1.417	1	7	2
Q44	4.983	5	5	1.329	1	7	1

MEASUREMENT MODEL ANALYSIS

Before the structural modeling analysis was performed, measurement model analysis was performed to determine which survey items should be used in each of the final constructs. Reliability and validity are the concepts guiding development of these final research measures.

For each construct, Cronbach's alpha was calculated to determine the reliability of the initial items for that construct. When multiple items are used to create a construct, internal consistency among the items is important. Cronbach's coefficient alpha checks for this consistency and was used in creating each of the constructs in this study. Nunnally (1978) states that in the early stages of basic research, alphas of .70 or higher suffice.

Two types of validity were considered: content validity and construct validity (Saraph et al. 1989). Content validity refers to a consensus among researchers and experts that the items for a given construct cover the content domain of the proposed construct. This type of validity is subjectively judged by researchers and is built into the constructs through the literature review and a thorough process of survey creation.

Construct validity exists if the operational items measure the theoretical construct. This type of validity was evaluated through confirmatory factor analysis. Factor analysis helps determine if items actually measure constructs or construct dimensions as expected.

Exploratory factor analysis (using eigenvalues greater than 1 as the cutoff for factor extraction) was used for the Strategic Locationing Sophistication construct to indicate possible factors and the survey item loadings on each of these factors. Exploratory factor analysis was used because Strategic Locationing Sophistication is a new construct. The rule used to determine which items load on which factors is that an item must load at least .60 on one factor and less than .40 on other factors (Haka 1982). Using this rule, some items were dropped because of ambiguous loadings.

Using a priori theory and/or exploratory factor analysis, confirmatory factor analysis was performed to determine a final set of survey items to measure some of the constructs. As discussed later, confirmatory factor

analysis was not used for Managerial Accounting Competence and Conversion Competence. At this stage, additional items were dropped to improve the measurement model for each construct. Reliability coefficients were then recalculated for the final items in the measurement model. Once the factors were determined, the items in each factor were combined to provide measures for the indicators of each construct.

The confirmatory factor analysis and the test of the research model reported later were both accomplished through structural equation modeling. A good introduction to the concept of structural equation modeling is provided by Bollen (1989, 1):

Most researchers applying statistics think in terms of modeling the *individual observations*. In multiple regression or ANOVA (analysis of variance), for instance, we learn that the regression coefficients or the error variance estimates derive from the minimization of the sum of squared differences of the predicted and observed dependent variable for each case. Residual analyses display discrepancies between fitted and observed values for every member of the sample.

The methods of this book demand a reorientation. The procedures emphasize *covariances* rather than cases. Instead of minimizing functions of observed and predicted individual values, we minimize the difference between the sample covariances and the covariances predicted by the model. The observed covariances minus the predicted covariances form the residuals.

The sample covariances are the covariances between each pair of observed indicators. The proposed structural and/or measurement equations in the model imply certain

relationships among the constructs and indicator variables or items.

The fundamental hypothesis for these structural equation procedures is that the covariance matrix of the observed variables is a function of a set of parameters. If the model were correct and if we knew the parameters, the population covariance matrix would be exactly reproduced (Bollen 1989, 1).

If the hypothesized model is descriptive of the relationships theorized among the items or constructs, the observed covariance matrix should match the covariance matrix predicted by the equations in the model. To test a particular model, the residual covariances are evaluated for significance using a chi-square test. Usually, hypothesis testing is performed by testing a null hypothesis with the hope that it can be rejected in support of the alternative hypothesis. However, in this case, the hypothesis tested is that the covariances predicted by the model will be equal to the sample covariances. Therefore, the lower the chi-square statistic and the higher the probability level, the better the fit of the model. Although models with a probability level greater than .05 cannot be rejected at common significance levels, higher probability levels are desirable before accepting the model as an adequate fit.

Bollen (1989) points out that caution must be exercised when using chi-square estimates. He suggests using some fit indices in addition to the chi-square estimates and reviews several of these fit indices. The indices used here are incremental fit indices, indicating that a baseline model

must be used for comparison. "The baseline model is the simplest, most restrictive model that is a reasonable standard to which to compare the less restrictive maintained model" (Bollen 1989, 269-70). Bentler and Bonett (1980) propose a normed fit index, known as Δ_1 :

$$\Delta_1 = \frac{\chi^2_b - \chi^2_m}{\chi^2_b},$$

where the subscript b stands for the baseline model and the subscript m stands for the maintained (hypothesized) model. Other incremental fit indices have been proposed by Bollen (1988), Δ_2 ; Bollen (1986), ρ_1 ; and Tucker and Lewis (1973), ρ_2 . These indices are used in this analysis and are shown below with similar notation (df representing degrees of freedom).

$$\Delta_2 = \frac{\chi^2_b - \chi^2_m}{\chi^2_b - df_m}$$

$$\rho_1 = \frac{(\chi^2_b/df_b) - (\chi^2_m/df_m)}{\chi^2_b/df_b}$$

$$\rho_2 = \frac{(\chi^2_b/df_b) - (\chi^2_m/df_m)}{(\chi^2_b/df_b) - 1}$$

Although no statistical test for significance of these incremental fit indices exists, Bentler (1989, 93) suggests that values "greater than .9 are desirable," at least for Δ_1 .

The next five sections discuss the development of the final indicators for the five constructs. Each construct is treated separately.

Economic Globalization

Survey items measuring Economic Globalization were designed to measure the two theoretical indicators of Economic Globalization--intensifying competitive pressure and increasing market access.

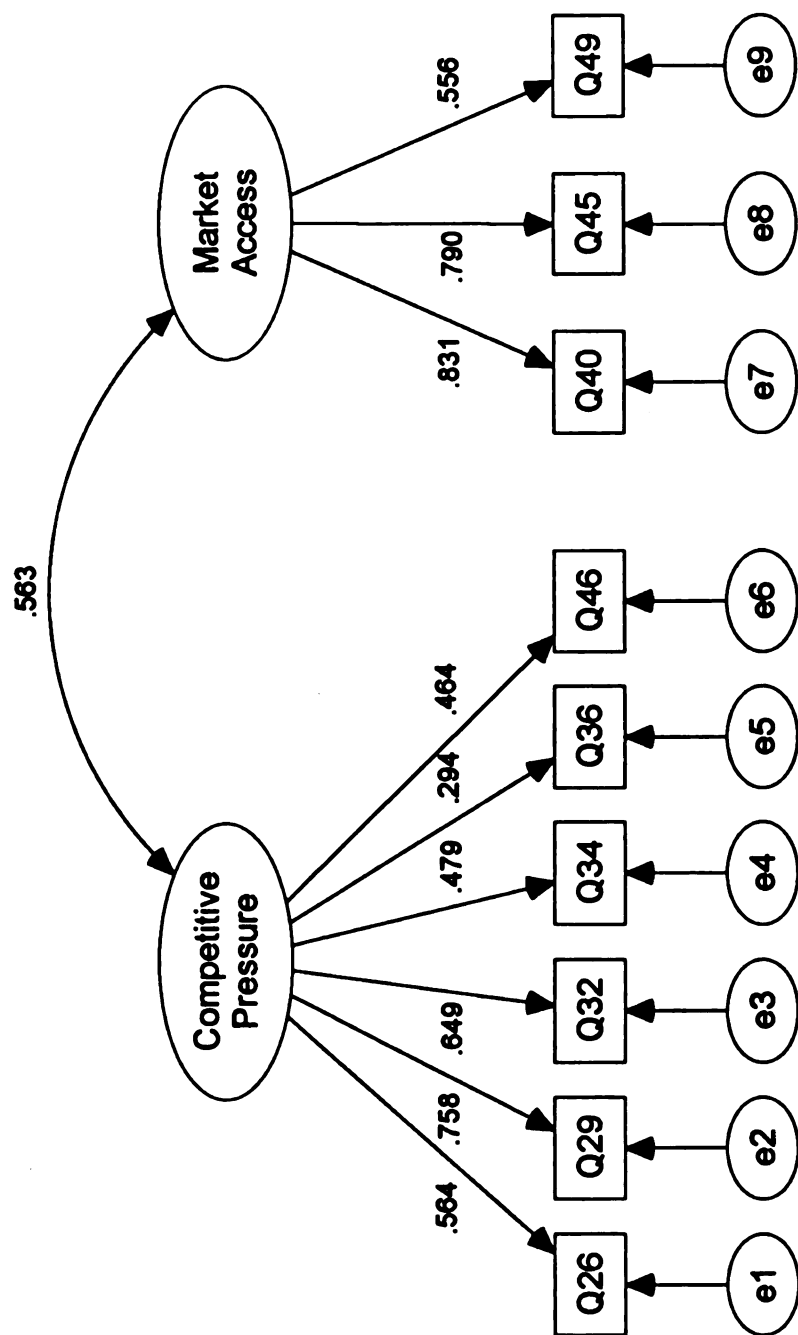
Reliability. Cronbach's coefficient alpha was calculated to measure the reliability of the nine survey items designed to measure Economic Globalization. The calculated alpha value was .79.

During initial data analysis of the Economic Globalization items, it became apparent that reverse-worded items had higher inter-item correlations with reverse worded items and lower inter-item correlations with non-reverse worded items. Also, non-reverse-worded items had higher inter-item correlations with non-reverse-worded items than with reverse-worded items. Although two indicators of Economic Globalization were theorized, the two groups formed by combining the reverse-worded items into one group and the non-reverse-worded items into another group did not match the two indicators as designed.

Original surveys were examined in an attempt to determine if the reverse-worded items were correctly interpreted by survey participants. Although no statistical tests were performed, the observation of survey items indicated a potential problem with the reverse-worded items. Nine survey participants did not seem to recognize the reverse-worded items as different from non-reverse-worded

items and gave a uniform response to all items. These surveys were excluded from all analysis. Recognition of reverse-worded items was difficult to determine on some of the other surveys. Perhaps, because these items measuring Economic Globalization were located at the end of a rather lengthy survey, participants were not reading as carefully as needed to notice the reverse wording. Although no statistical conclusions can be drawn regarding whether or not reverse wording was a problem, the possibility of a problem was considered in further analysis.

Confirmatory Factor Analysis. Based on the a priori theory, an initial measurement model was examined using confirmatory factor analysis. The initial model tested is illustrated in Figure 3 (this figure and the ones that follow use the standard convention of representing observed variables with ovals and unobserved variables with rectangles). It includes an indicator for competitive pressure and another indicator for market access. The numbers listed by single-headed arrows are standardized regression weights and the number listed by a double-headed arrow is a correlation coefficient. The statistical results of this model are also shown as part of Figure 3. The model in Figure 3 was rejected because the probability level was less than .05. Since the model did not provide an acceptable fit, modifications to the model were considered.



Chi-square = 81.539

Degrees of freedom = 26

Probability level = .000

Labels on arrows are standardized regression weights
Labels on two-headed arrows are correlations

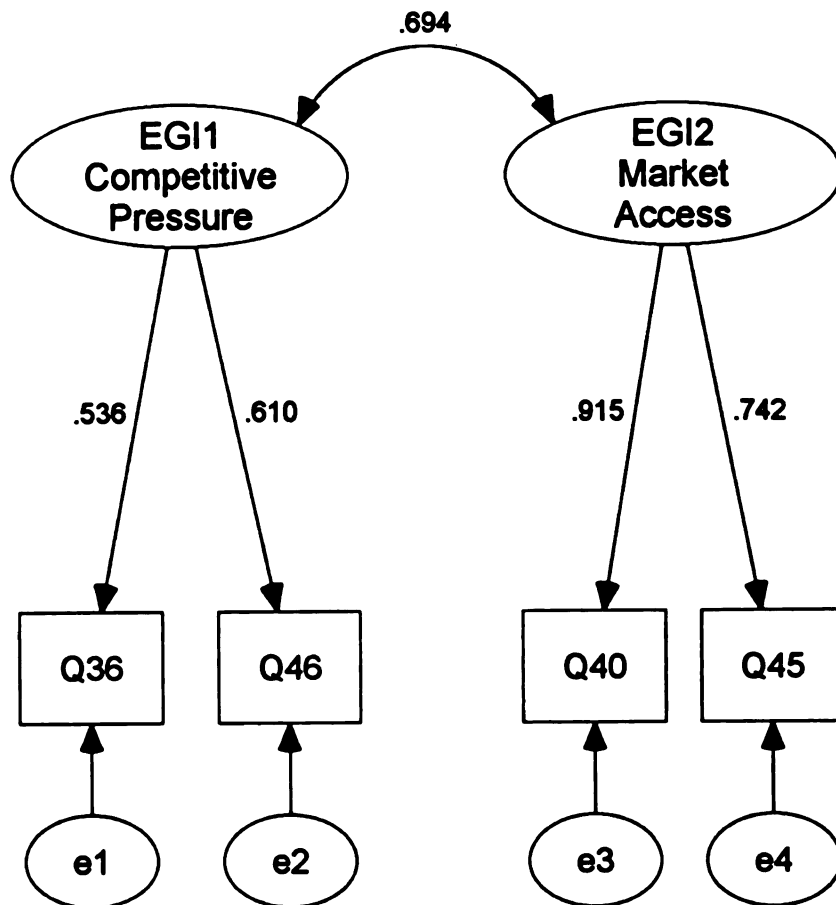
Figure 3
Theoretical Measurement Model--Economic Globalization

Procedures for structural equation modeling often include modification indices, giving some indication of how the chi-square might improve (decrease) if specific additions are made to the model. If used with care and according to supportable theory, these indices can be helpful in structural modeling; but they are not extremely helpful for measurement models, as the desire is to find items to delete from the measurement model (those that are not helpful in measuring the construct), not to find additions to the model.

One method for potentially improving a measurement model is to look at the standardized regression weight estimates and re-run the model without one or more of the items with the lowest weights. Although this method has no guarantee of improving the model fit, it can show whether or not the basic measurement model hypothesized can be adjusted to provide an adequate fit.

Items with low standardized regression weights were dropped to try to improve the model. None of these models resulted in a probability level above .05.

Additional models considering the possibility that the reverse-worded items may not be good measures for the underlying indicators of Economic Globalization were tested. The resulting model without reverse-worded items provided the best fit and is illustrated in Figure 4. With one degree of freedom and a chi-square of 3.410, this model has



Chi-square = 3.410
 Degrees of freedom = 1
 Probability level = .065

Labels on arrows are standardized regression weights
 Labels on two-headed arrows are correlations

Figure 4
 Final Measurement Model--Economic Globalization

a probability level of .065. Table 21 shows the values for the incremental fit indices for this model and also shows the recalculated reliability coefficient for the four items in the final measurement model.

Table 21
Incremental Fit Indices--Economic Globalization

Δ_1	.97
Δ_2	.98
ρ_1	.83
ρ_2	.87
Reliability coefficient	
$\alpha = .71$	

Table 22 shows the squared multiple correlations for each endogenous variable in the model. The squared multiple correlation is a measure of the percent of the variance of the endogenous variable accounted for by the model. Even though the model had a probability level above .05, the percent of the variance in Q36 and Q46 accounted for by the model is not very high.

This model has two indicators which do coincide with the two hypothesized indicators, intensifying competitive pressure and increasing market access. The items in each indicator--Q36 and Q46 for the competitive pressure

Table 22
Squared Multiple Correlations--Economic Globalization

Q36	.29
Q40	.84
Q45	.55
Q46	.37

indicator and Q40 and Q45 for the market access indicator-- were averaged to provide the measure of each indicator used in the structural model. For future discussion, these indicators will be labeled EGI₁ and EGI₂, respectively.

Strategic Locationing Sophistication

The survey items measuring Strategic Locationing Sophistication were not taken from a prior survey, so the a priori theory was not as well established. Therefore, exploratory factor analysis was used to determine an initial model.

Reliability. Cronbach's alpha for the 18 Strategic Locationing Sophistication items was .97. No further attempts were made to drop items to increase this value.

Exploratory Factor Analysis. Exploratory factor analysis of these 18 items, using SPSS and a varimax rotation, resulted in two factors with eigenvalues greater

than 1.00. The rotated factor matrix is illustrated in Table 23. Of the 18 items, nine had ambiguous loadings between the two factors, five loaded on one factor, and the remaining four loaded on the other factor. The items with ambiguous loading were omitted.

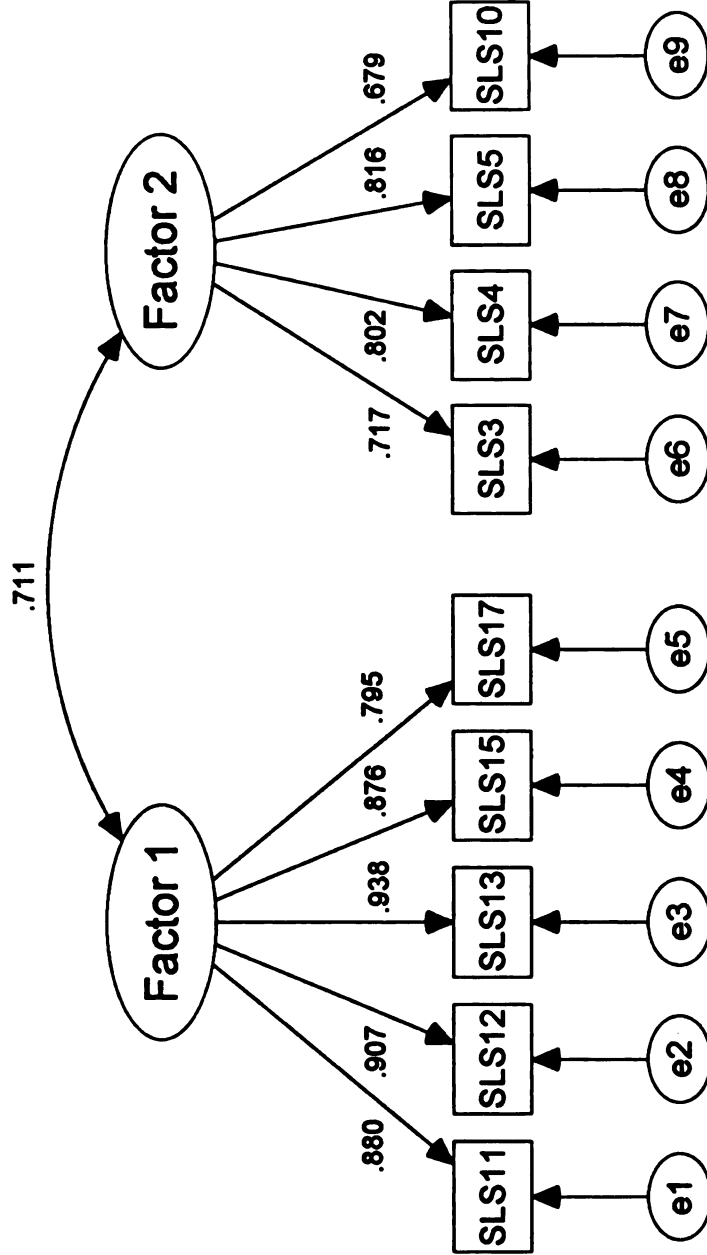
Table 23
Rotated Factor Matrix--SLS Items

	<u>Factor 1</u>	<u>Factor 2</u>
SLS1	.47592	.70688
SLS2	.48490	.67383
SLS3	.21930	.70529*
SLS4	.22638	.79575*
SLS5	.28773	.80909*
SLS6	.62309	.53377
SLS7	.45147	.74146
SLS8	.50786	.63306
SLS9	.47501	.68284
SLS10	.31449	.65544*
SLS11	.85202*	.30996
SLS12	.85328*	.33980
SLS13	.86348*	.33684
SLS14	.81569	.41462
SLS15	.84492*	.27245
SLS16	.59915	.49262
SLS17	.73605*	.37476
SLS18	.75429	.49507

*Indicates that the item loads on that factor greater than .60 and less than .40 on the other factor

Confirmatory Factor Analysis. Confirmatory factor analysis was performed on the model from the exploratory factor analysis with the nine remaining items. This model is illustrated in Figure 5.

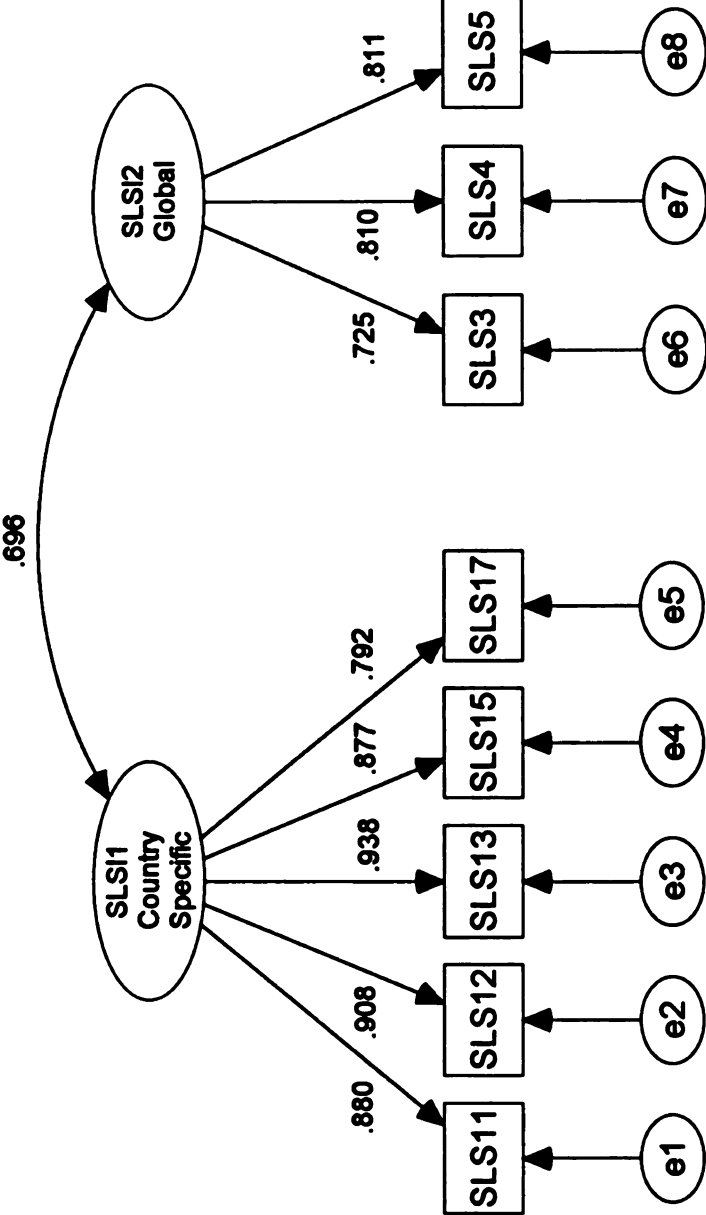
Again, the initial model did not have a satisfactory fit (probability level less than .05). It was modified by eliminating items with low standardized regression weights. The final measurement model for Strategic Locationing Sophistication is illustrated in Figure 6. It is a two-indicator model with five items for one indicator and three items for the other. This model has a chi-square of 24.160. With 19 degrees of freedom, the associated probability level is .190. Table 24 shows the incremental fit indices for this model and the reliability coefficient for the eight items remaining in the model. Table 25 shows the squared multiple correlations for the endogenous variables in this model.



Chi-square = 69.900
 Degrees of freedom = 26
 Probability level = .000

Labels on arrows are standardized regression weights
 Labels on two-headed arrows are correlations

Figure 5
 EFA Measurement Model--Strategic Locationing Sophistication



Chi-square = 24.160
Degrees of freedom = 19
Probability level = .190

Labels on arrows are standardized regression weights
Labels on two-headed arrows are correlations

Figure 6
Final Measurement Model--Strategic Locating Sophistication

Table 24
Incremental Fit Indices--
Strategic Locationing Sophistication

Δ_1	.97
Δ_2	.99
ρ_1	.95
ρ_2	.99
Reliability coefficient $\alpha = .92$	

Table 25
Squared Multiple Correlations--
Strategic Locationing Sophistication

SLS3	.53
SLS4	.66
SLS5	.66
SLS11	.77
SLS12	.83
SLS13	.88
SLS15	.77
SLS17	.63

The five-item indicator seems to be a measure of country-specific strategy items, and the three-item indicator seems to include items of a more global nature. As with the Economic Globalization indicators, the items for each Strategic Locationing Sophistication indicator are averaged to provide the measures for the indicators used in the structural model. The five-item indicator is labeled $SLSI_1$ and the three-item indicator is labeled $SLSI_2$.

Managerial Accounting Competence

The Managerial Accounting Competence construct is theorized as two indicators, one for manufacturing information and one for logistics information. However, the measurement model analysis used on the prior two constructs cannot be used for this construct because the survey items measuring how well specific accounting information items are provided are grouped together and weighted by the competitive priorities for manufacturing and logistics.

Reliability. Initially, separate Cronbach's alphas were calculated for the two sets of 15 information items, one set measuring manufacturing information and one set measuring logistics information. The alpha for the 15 manufacturing-related items, MINF1 to MINF15, is .94, and the alpha for the 15 logistics-related items, LINF1 to LINF15, is .97.

Since the survey was designed to have three items to measure manufacturing or logistics information relevant to

each of the five competitive priorities, reliabilities were also calculated for these groups of three items. The items are grouped by competitive priority in Table 26. The alpha values are also reported for each group in this table. All of the reliability coefficients are above .70 and most of them are above .80.

Table 26
Information Items Grouped by Competitive Priority

Manufacturing Items

	<u>MFLEX</u>	<u>MOUAL</u>	<u>MCOST</u>	<u>MDEPN</u>	<u>MINNO</u>
Survey	MINF1	MINF5	MINF3	MINF2	MINF7
Items	MINF4	MINF10	MINF11	MINF6	MINF13
	MINF9	MINF12	MINF15	MINF8	MINF14
Reliability	.80	.79	.83	.74	.83

Logistics Items

	<u>LFLEX</u>	<u>LOUAL</u>	<u>LCOST</u>	<u>LDELV</u>	<u>LINNO</u>
Survey	LINF1	LINF4	LINF12	LINF5	LINF3
Items	LINF2	LINF9	LINF13	LINF6	LINF8
	LINF10	LINF11	LINF14	LINF7	LINF15
Reliability	.90	.86	.87	.88	.91

Indicator Measurement. Confirmatory factor analysis is not appropriate for this construct because of the weighting of the information items by the competitive priorities to determine a measure of competence for manufacturing information and a measure of competence for logistics information. The two indicators for Managerial Accounting Competence were calculated by a three-step process. First, the three items in each group from Table 26 were averaged. Second, the mean from each group was then multiplied by the appropriate weighting from the associated competitive priority. Third, the weighted averages were summed across all manufacturing or logistics priorities. The sum of the weighted averages for all manufacturing priorities is the measure for the manufacturing indicator of Managerial Accounting Competence. This indicator is named MACI₁ for future discussion. The sum of the weighted averages for all logistics priorities is the measure for the logistics indicator of Managerial Accounting Competence. This indicator is named MACI₂.

Conversion Competence

Like Managerial Accounting Competence, Conversion Competence is theorized as two indicators, one for manufacturing and one for logistics. However, instead of measuring how well information is provided, Conversion Competence uses the measures of manufacturing and logistics performance on specific activities. The determination of

measures for the two indicators of Conversion Competence follows closely the method used for Managerial Accounting Competence.

Reliability. Separate Cronbach's alphas were calculated for the two sets of 15 performance items, one set measuring manufacturing performance and one set measuring logistics performance. The alpha for the 15 manufacturing-related items, MPER1 to MPER15, is .92, and the alpha for the 15 logistics-related items, LPER1 to LPER15, is .95.

Reliabilities were also calculated for each group of three performance items relating to one of the manufacturing or logistics priorities. The items in each group are shown in Table 27, and the related reliability coefficient for each group is also reported. Again, all of the reliabilities are above .70 and most of them are above .80.

Table 27
Performance Items Grouped by Competitive Priority

Manufacturing Items

	<u>MFLEX</u>	<u>MOUAL</u>	<u>MCOST</u>	<u>MDEPN</u>	<u>MINNO</u>
Survey	MPER7	MPER8	MPER3	MPER1	MPER4
Items	MPER10	MPER12	MPER9	MPER2	MPER5
	MPER14	MPER13	MPER15	MPER6	MPER11
Reliability	.79	.87	.74	.87	.77

Logistics Items

	<u>LFLEX</u>	<u>LOUAL</u>	<u>LCOST</u>	<u>LDELV</u>	<u>LINNO</u>
Survey	LPER9	LPER4	LPER6	LPER1	LPER2
Items	LPER10	LPER12	LPER7	LPER5	LPER3
	LPER11	LPER13	LPER15	LPER14	LPER8
Reliability	.92	.86	.71	.83	.85

Indicator Measurement. The two indicators for Conversion Competence--manufacturing competence and logistics competence--were calculated by using the same three-step process used for Managerial Accounting Competence. However, the three-item groups for Conversion Competence come from Table 27. The sum of the weighted averages for all manufacturing priorities is the measure for the manufacturing indicator of Conversion Competence, and the sum of the weighted averages for all logistics priorities is the measure for the logistics indicator of

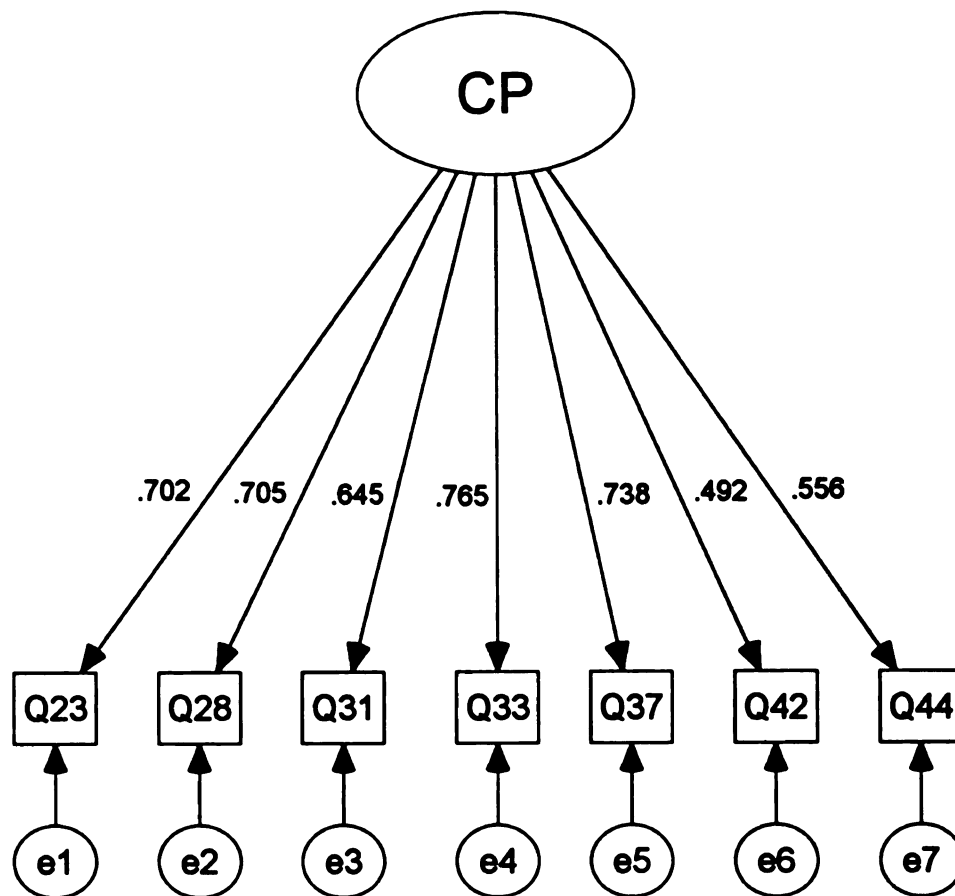
Conversion Competence. These indicators are named CCI₁ and CCI₂, respectively.

Competitive Position

Seven items were included on the survey to measure perceptions of Competitive Position. Since the items were adapted from a prior survey, and these items loaded on one factor in prior research, one indicator of Competitive Position was expected.

Reliability. The alpha coefficient calculated for these seven items is .84. No attempts were made to drop items to increase this value.

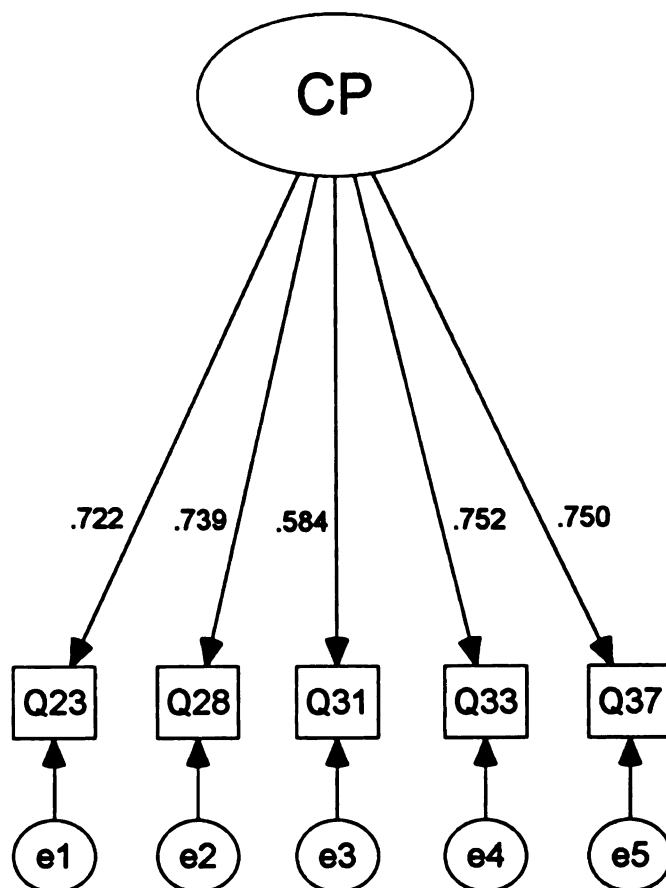
Confirmatory Factor Analysis. Figure 7 illustrates the simple, one-factor model that was tested using confirmatory factor analysis. Because this initial model had a probability level less than .05, the standardized regression weights were examined to determine if some items should be dropped to improve the measurement model fit. The final model, without Q42 and Q44, resulted in a chi-square of 2.969 with five degrees of freedom and a probability level of .705. It is illustrated in Figure 8. Table 28 shows the incremental fit indices for this model and the reliability coefficient for the five items remaining as part of the Competitive Position construct. Table 29 shows the squared multiple correlations for the endogenous variables in the Competitive Position measurement model.



Chi-square = 36.771
Degrees of freedom = 14
Probability level = .001

Labels on arrows are standardized regression weights

Figure 7
Theoretical Measurement Model
Competitive Position



Chi-square = 2.969
Degrees of freedom = 5
Probability level = .705

Labels on arrows are standardized regression weights

Figure 8
Final Measurement Model--Competitive Position

Table 28
Incremental Fit Indices--Competitive Position

Δ_1	.99
Δ_2	1.00
ρ_1	.97
ρ_2	1.00
Reliability coefficient	
$\alpha = .84$	

Table 29
Squared Multiple Correlations--Competitive Position

Q23	.52
Q28	.55
Q31	.34
Q33	.57
Q37	.56

Because only one factor underlies the Competitive Position items, the five items in the "best" measurement model are averaged and become a measure for Competitive Position. Without multiple indicators of this construct, no observed indicator of an unobserved construct exists; rather, now an observed construct, Competitive Position (CP), measured by the average of the five items exists.

Indicator Descriptive Statistics

Descriptive statistics of these final indicators were calculated and analyzed, mostly to determine if the skewness and kurtosis measures indicate a problem with outliers that might adversely affect the covariances to be used in the structural equation analysis. Table 30 reports the mean, standard deviation, skewness, and kurtosis for each of the nine indicator measures from the preceding sections.

Table 30
Final Indicator Descriptive Statistics

	<u>Mean</u>	<u>St. Dev.</u>	<u>Kurtosis</u>	<u>Skewness</u>
EGI ₁	4.889	1.337	.181	-.627
EGI ₂	4.529	1.550	-.397	-.440
SLSI ₁	5.116	1.433	.375	-.858
SLSI ₂	4.556	1.242	.155	-.187
MACI ₁	4.985	1.019	-.111	-.248
MACI ₂	4.595	1.175	.379	-.288
CCI ₁	5.149	.917	.838	-.321
CCI ₂	4.979	.951	1.650	-.241
CP	5.116	1.056	.763	-.341

None of the skewness or kurtosis measures have an absolute value above 2.00 and most of them have an absolute value less than 1.00, so the existence of outliers does not seem to be a problem.

No significant differences for survey number occurred. This implies that survey participants did not respond significantly different according to which survey they returned. The stratifying variable with the most significant items was technology level. The reason these were significant is that firms with higher technology levels reported higher responses on the measures for Strategic Locationing Sophistication, Managerial Accounting Competence, Conversion Competence, and Competitive Position. Firms that reported greater levels of success for their Mexican operations also reported higher responses on the measures for Conversion Competence and Competitive Position.

STRUCTURAL MODEL ANALYSIS AND HYPOTHESIS TESTING

The structural equations associated with the path diagram in Figure 2 are listed below.

$$SLS = p_{SLS,EG}EG + e_{SLS} \quad (1)$$

$$MAC = p_{MAC,EG}EG + p_{MAC,SLS}SLS + e_{MAC} \quad (2)$$

$$CC = p_{CC,MAC}MAC + e_{CC} \quad (3)$$

$$CP = p_{CP,CC}CC + p_{CP,SLS}SLS + e_{CP} \quad (4)$$

where

EG is the Economic Globalization construct

SLS is the Strategic Locationing Sophistication construct

MAC is the Managerial Accounting Competence construct

CC is the Conversion Competence construct

CP is the Competitive Position construct

$p_{j,i}$ is the path coefficient between constructs i and j

e_j is the error term for construct j

Because most of the constructs are unobservable and are measured by multiple indicators, additional measurement equations are necessary in addition to the structural equations. The eight measurement equations needed are listed below.

$$EGI_1 = \delta_1 EG + e_1 \quad (5)$$

$$EGI_2 = \delta_2 EG + e_2 \quad (6)$$

$$SLSI_1 = \delta_3 SLS + e_3 \quad (7)$$

$$SLSI_2 = \delta_4 SLS + e_4 \quad (8)$$

$$MACI_1 = \delta_5 MAC + e_5 \quad (9)$$

$$MACI_2 = \delta_6 MAC + e_6 \quad (10)$$

$$CCI_1 = \delta_7 CC + e_7 \quad (11)$$

$$CCI_2 = \delta_8 CC + e_8 \quad (12)$$

where

EGI_x is the observed score for indicator x of the Economic Globalization construct

$SLSI_x$ is the observed score for indicator x of the Strategic Locationing Sophistication construct

$MACI_x$ is the observed score for indicator x of the Managerial Accounting Competence construct

CCI_x is the observed score for indicator x of the Conversion Competence construct

δ_y is the expected change in the dependent (observed) variable for a one unit change in the independent (unobserved) variable

e_y is a disturbance term in the measurement equation

$x = 1, 2$

$y = 1, 2, 3, 4, 5, 6, 7, 8$

Figure 9 shows the complete path diagram illustrating both the structural equations and the expansion of the model for the measurement equations listed above. As outlined in

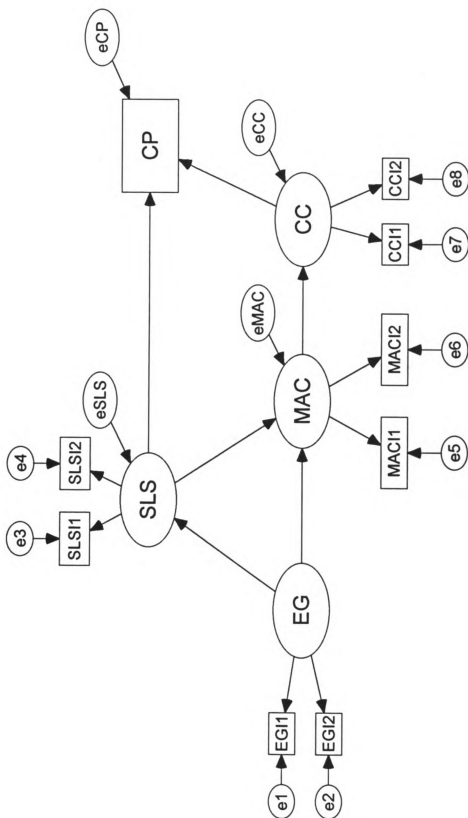


Figure 9
Hypothesized (original) Path Model

the hypotheses, all path coefficients were expected to be positive. Hypothesis 1 is a test of the complete model. The covariance matrix used for the model analysis is included in Table 32.

Table 32
Covariance Matrix for Research Model

	<u>EG11</u>	<u>EG12</u>	<u>SLS11</u>	<u>SLS12</u>	<u>MAC11</u>	<u>MAC12</u>	<u>CC11</u>	<u>CC12</u>	<u>CP</u>
EG11	1.7195								
EG12	.8479	2.4215							
SLS11	.3294	.6150	2.0591						
SLS12	.1886	.4706	1.1027	1.5504					
MAC11	.2259	.2286	.8027	.8210	1.0360				
MAC12	.2779	.3737	.9990	.9685	.9616	1.3810			
CC11	-.0010	.1245	.3908	.4939	.5757	.5042	.7478		
CC12	.1199	.1812	.5053	.5081	.5615	.6270	.5613	.7856	
CP	.2764	.4487	.4601	.4158	.4115	.4913	.4280	.4964	.9262

Since the chi-square of the model in Figure 9 was significant (probability level of .015), the model is not descriptive. Two changes were made to the model. Both of them improved the fit of the model so that the resulting model had a chi-square of 13.737 with 20 degrees of freedom. The associated probability level is .844. A baseline model was tested, and the results were used to calculate the incremental fit indices discussed.

Until a model proves acceptable (cannot be rejected), the strength or statistical significance of the specific links cannot be assessed with any interpretable meaning. Once the modified model proved successful, the direct

hypotheses were then tested. The direct effects are determined by the path coefficients between constructs. These path coefficients are standardized beta weights from the regressions implied by the structural equations. The significance of the direct effects is tested by an approximate t-test of the unstandardized regression weights (see Chenhall and Morris 1986; Arbuckle 1988). The statistical software package used to calculate path coefficients and associated statistical tests provides a critical ratio (CR) instead of a t-score (Arbuckle 1988). The critical ratio is calculated the same way as a t-score (parameter estimate divided by standard error). The assumptions that exogenous variables must have a multivariate normal distribution and that cases must be independent are the same for both the t-test and the CR-test. However, the standard errors used in calculating the critical ratio are only approximations because "the theory on which these results are based is 'asymptotic', which means that it can be made to apply with any desired degree of accuracy, but only using a sufficiently large sample" (Arbuckle 1988, 9).

Indirect effects between any two constructs were calculated by multiplying path coefficients along any indirect paths between the two constructs and summing the results. Summing results was not necessary in this research, because both direct effects hypotheses involve only one indirect path between the two constructs (there is

only one indirect path from SLS to CP and only one indirect path from MAC to CP).

As no specific statistical test exists to determine the significance of the magnitude of the indirect effects, Hypotheses 8 and 9 must be tested in another way. Results of additional models with or without direct paths between constructs with hypothesized indirect effects were calculated and compared to the original model. For example, to test the hypothesis that an indirect relationship exists between Strategic Locationing Sophistication and Competitive Position, the direct path is removed, leaving only the indirect path. Results of the new model are compared to those of the original model with the direct path to provide evidence about the significance of the indirect path. The difference between the chi-square of the two models is tested for significance using a chi-square test. These additional models provide evidence as to whether or not the indirect effects are important.

Additional discussion of the results of the structural modeling is in the next chapter. Results of the hypothesis tests follow that discussion.

CHAPTER V

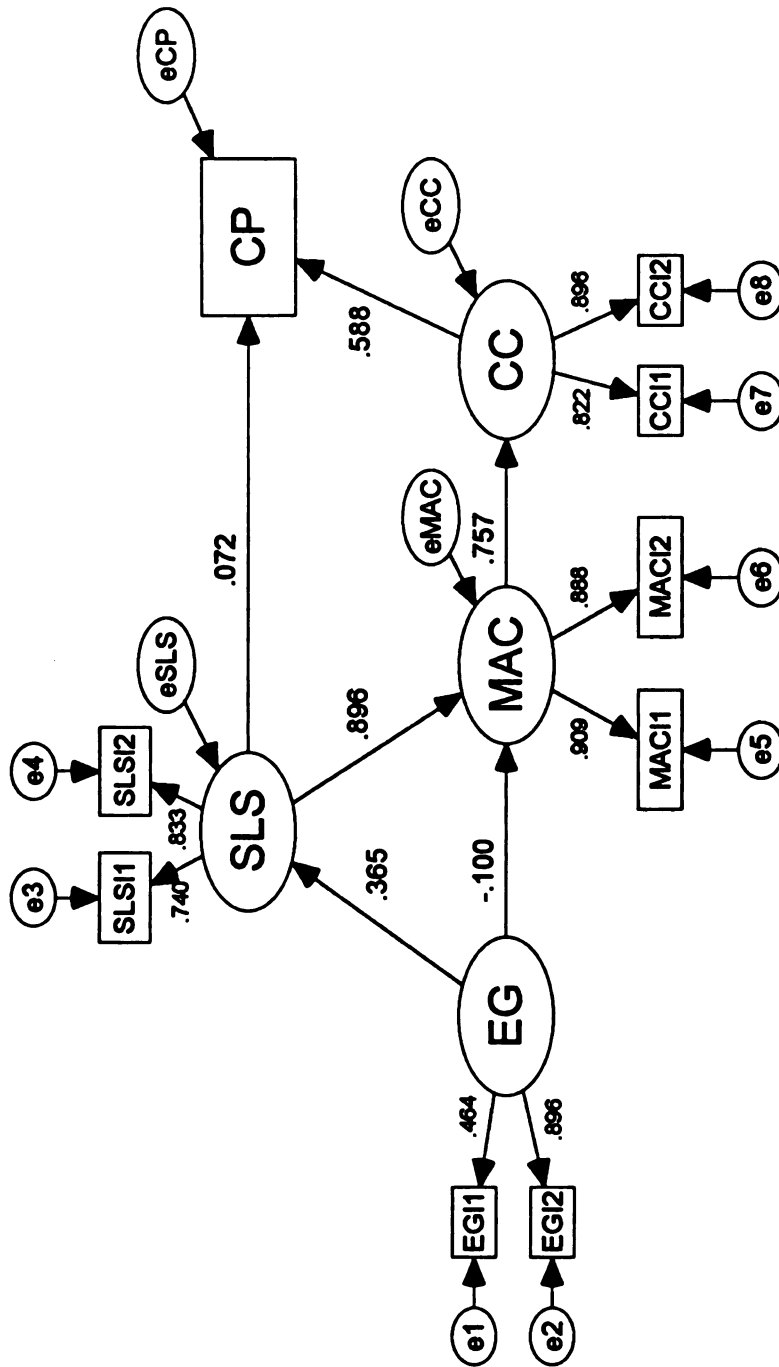
STRUCTURAL MODEL AND HYPOTHESIS TEST RESULTS

Chapter IV discussed the methodology for gathering the data and creating the final measures to be used in the structural equation analysis. This chapter presents the results of that analysis and then discusses the results of the hypotheses proposed in Chapter III.

STRUCTURAL MODEL RESULTS

The hypothesized model was presented in Figure 9. The structural and measurement equations associated with this model were presented in Equations (1) through (12). Figure 10 shows the model again, this time with associated path coefficients and statistical results. This model produced a chi-square of 38.824 with 22 degrees of freedom. The associated probability level is .015. Because the model was rejected, changes to the model were considered to improve the model fit. Two different changes were made in succession.

The first change was to allow the errors on two of the measurement equations (Equations 9 and 11) to be correlated. The usual assumption of structural equation modeling is that all errors are uncorrelated. However, correlated errors are



Chi-square = 38.824
 Degrees of freedom = 22
 Probability level = .015

Labels on arrows are standardized regression weights

Figure 10
 Original Model Results

allowed when a common factor outside the model potentially affects the variability of two indicators separate from the variability of the underlying latent variables. In this case, the error in Equation 9, e_3 , represents the variability in $MACI_i$ not due to variability in Managerial Accounting Competence. The error in Equation 11, e_7 , represents the variability in CCI_i not due to variability in Conversion Competence. Because the two indicators, $MACI_i$ and CCI_i , both measure manufacturing-related data and the measures are weighted by the same manufacturing priorities, the variability in the indicators may be partially due to the common factor of how they were measured (in addition to the variability due to Managerial Accounting Competence and Conversion Competence, respectively).

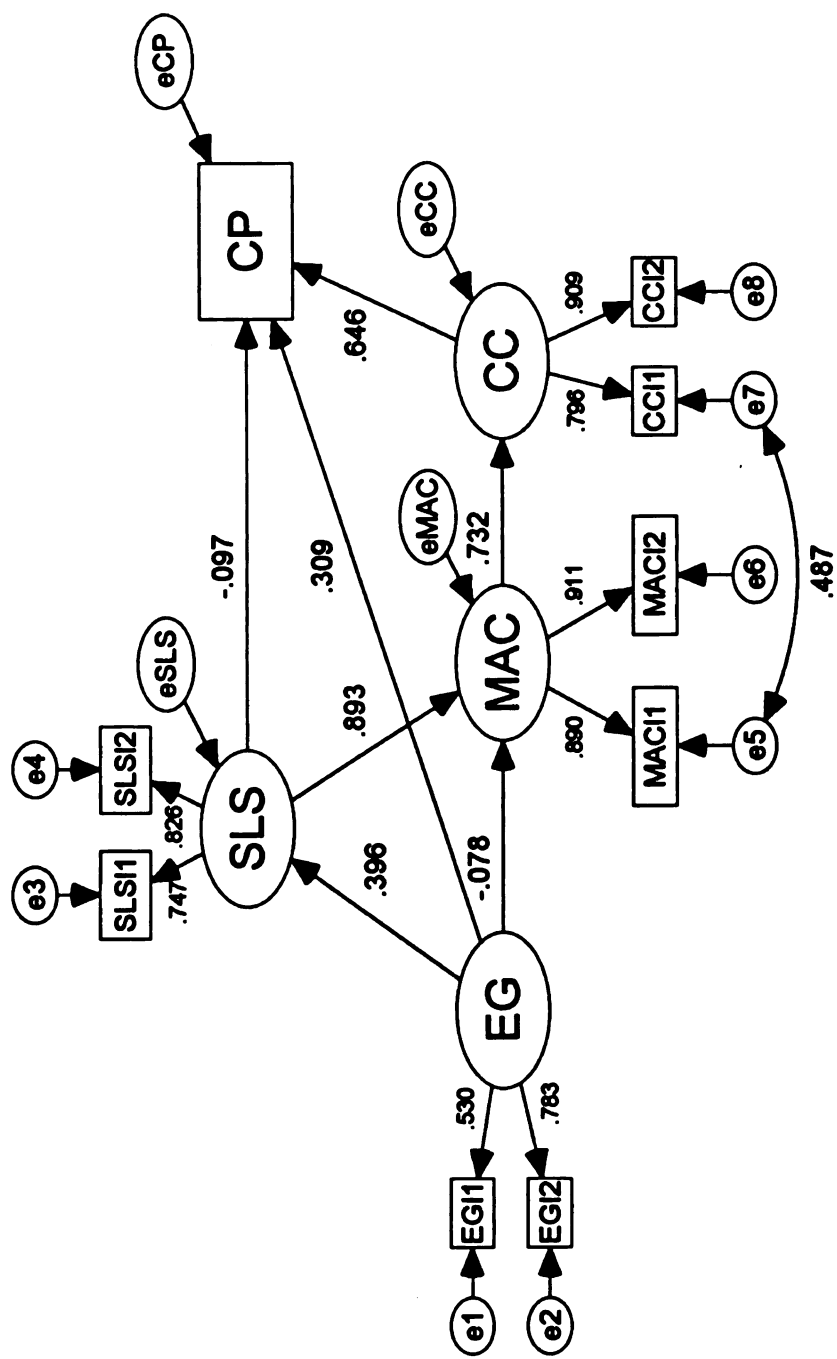
The same reasoning for allowing the errors in Equations 9 and 11 to be correlated could apply to the errors in Equations 10 and 12. However, allowing the errors in Equations 10 and 12 to be correlated did not improve the model fit, so that correlation was not included in the model.

The second modification was to add a direct path from Economic Globalization to Competitive Position. Although not part of the originally hypothesized model, this additional path implies that there is a relationship between Economic Globalization and Competitive Position that is not captured in the existing direct and indirect links in the path diagram.

It is possible that managers who are more aware of a globalizing economy also have managerial skills, separate from information systems or conversions systems, to improve their firm's Competitive Position. Such managerial skills could account for a direct relationship between Economic Globalization and Competitive Position that is not measured by the three existing model constructs between them.

The new path model including the two modifications, is illustrated in Figure 11. This figure also shows the path coefficients and statistical results. The chi-square for this model is 13.737 with 20 degrees of freedom. The associated probability level of .844 means that the model cannot be rejected.

Incremental fit indices were then calculated to provide additional evidence of the model fit. These incremental fit indices are listed in Table 33. Squared multiple correlations for the endogenous research constructs are shown in Table 34.



Chi-square = 13.737
Degrees of freedom = 20
Probability level = .844

Labels on arrows are standardized regression weights
Labels on two-headed arrows are correlations
Figure 11
Modified Model Results

Table 33
Incremental Fit Indices--Overall Model

Δ_1	.97
Δ_2	1.00
ρ_1	.95
ρ_2	1.00

Table 34
Squared Multiple Correlations--Overall Model

SLS	.157
MAC	.749
CC	.536
CP	.499

The modified path model has a high probability level (.844), and all of the incremental fit indices are above .90, so this model has an acceptable fit. The squared multiple correlation for Strategic Locationing Sophistication is noticeably low. Even though the regression weight from Economic Globalization to Strategic Locationing Sophistication is statistically significant, this relationship doesn't account for a very large portion

of the variance in Strategic Locationing Sophistication. The squared multiple correlations for Managerial Accounting Competence, Conversion Competence, and Competitive Position were higher. Because the model was designed to test a few specific relationships and not to be an all-inclusive model, other variables not operationalized in this model could help explain the variance of these constructs.

HYPOTHESES TEST RESULTS

Hypothesis 1 was a test of the overall research model. As reported in the prior section, the originally hypothesized model was not acceptable. However, the modified model is acceptable. Since the modified model includes all of the direct paths from the original model, the direct effect hypotheses are still testable. Since the modified model also includes both indirect paths outlined in the indirect hypotheses, the results are examined for support of these hypotheses. The following sections discuss the statistical tests of the direct hypotheses and the support for the indirect hypotheses.

Results of Direct Effect Hypotheses

Table 35 presents the statistical test results of each of the direct effect hypotheses. The table lists each hypothesis, the direct path represented, the standardized regression weight (path coefficient), the unstandardized

regression weight, the standard error of the regression weight, the critical ratio, and the significance level.

Table 35
Statistical Tests of Direct Effects Hypotheses

<u>Hypothesis</u>	<u>Path</u>		<u>Stand.</u>	<u>Regr.</u>	<u>Stand.</u>	<u>Critical</u>	
	<u>From</u>	<u>To</u>	<u>Regr.</u>	<u>Weight</u>	<u>Error</u>	<u>Ratio</u>	<u>Sig.</u>
H ₂	EG	SLS	.396	.610	.228	2.677	<.01
H ₃	EG	MAC	-.078	-.102	.133	-.764	n.s.
H ₄	SLS	MAC	.893	.757	.110	6.916	<.01
H ₅	MAC	CC	.732	.550	.069	8.028	<.01
H ₆	SLS	CP	-.097	-.087	.119	-.736	n.s.
H ₇	CC	CP	.646	.912	.170	5.382	<.01

n.s.--not significant

Hypotheses 2 (EG to SLS), 4 (SLS to MAC), 5 (MAC to CC), and 7 (CC to CP) all have significance levels less than .01. This implies that the null hypotheses would be rejected in favor of the alternative hypotheses (the regression weights are significantly different than zero).

The rejection of these null hypotheses provides support for some of the theories on which the alternative hypotheses were based. For example, although no causality is proven, greater perceived impact of Economic Globalization is related to greater Strategic Locationing Sophistication. The managers in this study who perceived a greater impact of global competition and market access on their firms reported

more sophistication in the information used to make manufacturing network location decisions.

The statistical support for the relationship in Hypothesis 4 implies that, at least with the definitions used here, better strategic information is related to better operational information. This relationship is consistent with the concept that managers should thoroughly consider the strategic planning process as one method of improving the firm's ability to provide relevant operational information about manufacturing and logistics activities.

Results of the test of Hypothesis 5 support the idea that greater Managerial Accounting Competence with respect to manufacturing and logistics is related to greater Conversion Competence. This implies that managers who want to improve manufacturing and logistics performance should consider the potential impact of expanding the resources used to provide relevant information.

The results of the test of Hypothesis 7 support a relationship between Conversion Competence and Competitive Position. Although intuitive, it is important to provide evidence of a link between a firm's conversion activities and its Competitive Position. This link implies that managers might improve competitive position by appropriately managing the manufacturing and logistics activities in their global manufacturing networks.

For hypotheses 3 (EG to MAC) and 6 (SLS to CP), the statistical tests are not significant, so the null

hypotheses that these regression weights equal zero cannot be rejected. The results of this model do not support a relationship between Economic Globalization and Managerial Accounting Competence or a relationship between Strategic Locationing Sophistication and Competitive Position.

Several potential reasons for the lack of support of the theorized relationships exist. Some of the reasons come from anecdotal evidence provided by on-site interviews at Mexican manufacturing facilities. One potential reason is the difficulty in measuring Economic Globalization and Strategic Locationing Sophistication. Perhaps more refined measures would provide results more in conformity with the expectations from the literature. Other possible reasons for the lack of a relationship between Economic Globalization and Managerial Accounting Competence include the following: 1) companies may transfer existing accounting and/or other information systems to Mexican operations without making appropriate modifications for the new manufacturing environment, and 2) Mexican operations are treated as cost centers, so some appropriate manufacturing and logistics information is not collected and reported.

A possible reason for not finding a relationship between Strategic Locationing Sophistication and Competitive Position is the follow-the-leader mentality. Some firms seem to start up Mexican operations, not because of Strategic Locationing Sophistication, but because other firms are finding it successful. In these cases, a manager

might provide survey responses that lead to a high measure of Competitive Position even though the measure of Strategic Locationing Sophistication is not high.

The data gathered for this research does not support Hypotheses 3 and 6. Without further research and refinement of the constructs, managers cannot assume that Economic Globalization is related to Managerial Accounting Competence or that Strategic Locationing Sophistication is related to Competitive Position in the current research setting.

Since the original model was modified slightly to provide a model with an acceptable fit, an additional direct path in the path diagram that was not originally hypothesized exists. This path goes from Economic Globalization to Competitive Position. Although this path was not hypothesized, the regression weight is statistically significant. The standardized regression weight for this path is .309 and the unstandardized regression weight is .428 with an associated standard error of .161. This results in a critical ratio of 2.662 which is significant at a probability level of less than .01.

Results of Indirect Effect Hypotheses

The indirect effects were calculated by multiplying the path coefficients for each direct link along the indirect paths. The indirect effect from Strategic Locationing Sophistication to Competitive Position is .422 ($.893 \times .732 \times .646$), and the indirect effect from Managerial Accounting

Competence to Competitive Position is .473 ($.732 \times .646$). Without standard errors, no significance test is available to test whether these effects are different than zero. However, the indirect effects can be tested by a comparison of competing models, one with both the direct and indirect links and the other with only the indirect links. A direct comparison of models is possible when one of the models can be obtained by imposing additional constraints on the parameters of the other. A test that the stronger model (the one with additional parameter constraints) is correct versus the weaker model is obtained by 1) finding the difference between the chi-square values of the two models, and 2) using a chi-square test to determine the significance of the difference in these chi-square values. The degrees of freedom used for this test is the difference between the degrees of freedom of the two models. If that statistical test is not significant, the stronger model has a better fit than the weaker model (Arbuckle 1988).

To provide evidence about Hypothesis 8, an additional parameter constraint was added to the model. This constraint fixed the regression weight between Strategic Locationing Sophistication and Competitive Position at zero. This strengthened model has a chi-square of 14.276 with 21 degrees of freedom. The increase in chi-square is .539 ($14.276 - 13.737$) with an increase of one degree of freedom. This chi-square statistic is not significant, implying that the strengthened model is a better fit than the original

model. Since the original model includes both direct and indirect paths between Strategic Locationing Sophistication and Competitive Position and the strengthened model, which has a better fit, includes only the indirect path, this result provides evidence that the indirect relationship between Strategic Locationing Sophistication and Competitive Position is significant.

Evidence for Hypothesis 9 is provided similarly. A weaker model was constructed by including a direct path from Managerial Accounting Competence to Competitive Position. The original model is now the stronger model because it includes the implicit constraint that this path has a regression weight of zero. The chi-square of the weaker model is 13.706 with 19 degrees of freedom. The stronger, original model has a chi-square of 13.737, a difference of .031 ($13.737 - 13.706$) with a change of one degree of freedom. Again, the difference between the chi-square values of the two models is not significant, implying that the original, stronger model is a better fit than the weaker model with the direct path between Managerial Accounting Competence and Competitive Position. Since the original model (with only the indirect path between Managerial Accounting Competence and Competitive Position) has an acceptable fit and the weaker model (with both indirect and direct paths from Managerial Accounting Competence to Competitive Position) does not provide as good a fit, the

indirect relationship between Managerial Accounting Competence and Competitive Position is supported.

SUMMARY

The original model in Hypothesis 1 was not an acceptable fit. However, theory-based modifications provided an acceptable fit and allowed for the direct effect hypotheses to be tested. Hypotheses 2, 4, 5, and 7 were all supported by rejection of the null hypotheses that the related path coefficients were equal to zero. The null form of Hypotheses 3 and 6 could not be rejected, so path coefficients associated with those hypotheses are not statistically significant from zero.

Hypotheses 8 and 9 were supported by comparison of models with and without the direct paths associated with the indirect paths to be tested. The results of the structural modeling and the hypothesis tests are discussed further in the next chapter.

CHAPTER VI

CONCLUSION

Prior chapters described the methodology, analysis, and results of the study. This chapter includes a discussion of the analysis and results, a presentation of the study's contributions, a description of limitations of the research, and some directions for future research.

DISCUSSION

This section discusses some of the conclusions and implications of the analysis and results. Specific items from the prior sections on demographic data, univariate descriptive statistics, stratifying variables, and hypothesis tests are included in this discussion.

Demographic Data

Survey respondents represented a wide range of industries, perhaps a wider range than that reported in earlier maquiladora research. Companies in an increasing number of industries are finding advantages of production sharing in Mexico. Although low-cost labor is still a big incentive for Mexican manufacturing, some of these companies

are finding other or additional incentives to move manufacturing operations across the border.

The number of participants stating that their firms own the physical buildings housing their Mexican operations was substantial. This could be a result of not only U.S. company commitment to Mexican production sharing, but also of a relaxation of Mexican government regulation on foreign company ownership. Prior laws prohibited U.S. companies from owning a controlling interest in Mexican subsidiaries, but these laws are changing, at least in some industries. The ability to have a controlling ownership interest may be an incentive to build facilities rather than rent them.

Maquiladoras have often been characterized as a part of the low-technology, labor-intensive manufacturing sector. However, 77% of the survey respondents classified their operations as medium or high technology, supporting Fatemi's (1990) claim that maquiladoras are becoming more capital-intensive. Although no specific data on labor intensity was collected, higher technology manufacturing operations are often more capital intensive and less labor intensive than are lower technology operations. This again supports the idea that competitive forces in addition to low labor costs are influencing companies to manufacture in Mexico.

Univariate Descriptive Statistics

Survey participants responded to the competitive priority items by allocating 100 points among the five priorities for manufacturing and 100 points among the five logistics priorities. The summary statistics in Table 17 indicate that quality is the most important priority and that innovation is the least important priority for both manufacturing and logistics. However, the average weights given to other priorities differ between manufacturing and logistics. For example, cost, which was the second highest priority for manufacturing, is the fourth highest priority for logistics.

One possible reason for this difference in the importance of cost between manufacturing and logistics is that global manufacturing is relatively uniform in quality, flexibility, and innovation, making cost a distinguishing factor for successful companies. Global logistics systems are perhaps not as uniform or not managed as strategically as global manufacturing systems. Firms which have high quality, flexibility, and good delivery can distinguish themselves more on those qualities and can still pass the logistics costs on to the customer without paying a penalty of lost customers.

Another possible reason became apparent through interviews with managers of Mexican operations. Several of these managers implied that their logistics functions are managed according to a satisficing strategy. If they get

the logistics service they need at an acceptable cost, little effort is expended worrying about cost reductions.

A third possible reason for the difference is that cost information for manufacturing has historically been available for a much longer time than for logistics. Since accountants and managers have had a longer time to determine what information is important to manufacturing (and how to gather it), perhaps the manufacturing information provided for manufacturing systems is better than that provided for logistics systems. Evidence from the survey supports this idea. The mean responses for the survey items designed to measure manufacturing cost information availability were as follows: MINF3, 5.151; MINF11, 5.521; and MINF15, 5.496. The mean responses for the items designed to measure logistics cost information availability were consistently lower: LINF12, 4.364; LINF13, 4.525; and LINF14, 4.824. Since manufacturing cost information is more available than logistics cost information, this could lead to cost being a higher priority for manufacturing than for logistics. However, as firms globalize their manufacturing networks, logistics costs become a relatively larger part of the value chain cost, so managers should consider the costs and benefits of additional logistics cost information.

Stratifying Variables

The final indicator measures were analyzed as dependent variables in one-way ANOVAs with some of the stratifying

variables from the survey. As reported previously, firms with higher technology also indicated greater Strategic Locationing Sophistication, Managerial Accounting Competence, Conversion Competence, and Competitive Position. Other differences reported on Table 31 that were statistically significant at the .05 level existed for area of expertise, industry, and level of success of Mexican operations.

Significant differences existed in responses for SLSI₁ and MACI₁ across managers with different areas of expertise. The differences exist because logistics managers had substantially higher-than-average responses for these two indicators and engineering managers had substantially lower-than-average responses. Other groups had responses close to the average. Interestingly, both of these indicators relate to logistics, and it was the logistics managers that had higher responses.

The EGI2 indicator, relating to market access, was statistically different across industries. The main reason for this difference is the high responses from the transportation industry and the low responses from the apparel industry. This information is consistent with the idea that transportation industry companies are interested in Mexican production sharing because of the ability it gives them to gain market access, while companies in the apparel industry are more concerned about production sharing as a strategy to be low-cost competitors.

The EGI2 indicator was also statistically different across levels of success. Respondents who evaluated the overall success of their Mexican operations higher had higher responses on the items in EGI2. Other indicators that were different across levels of success include both indicators of Conversion Competence and Competitive Position. It is fairly intuitive that higher Conversion Competence and Competitive Position would coincide with higher perceptions of success.

Hypothesis Tests

Although the model tested in Hypothesis 1 was based in theory, it is not extremely surprising that it was not acceptable without some modifications. With exploratory research in structural modeling and using several new constructs, it would be difficult to hypothesize a relatively simple model that would be acceptable without modification. The two modifications made to the model in this study are relatively minor. Correlation between the errors of two manufacturing-related indicators might be expected. Also, since not all of the relationship between Economic Globalization and Competitive Position is mediated by information and Conversion Competence constructs, the direct link between these two constructs can explain more of this relationship.

Hypotheses 2 to 7 tested the significance of the direct links in the path model. Four of the six direct links (five

of seven direct links in the modified model) hypothesized were significantly different than zero. Interestingly, the two links with the strongest path coefficients involved accounting/information constructs. The link from Strategic Locationing Sophistication to Managerial Accounting Competence had a path coefficient of .893 and the link from Managerial Accounting Competence to Conversion Competence had a path coefficient of .732. These coefficients support strong relationships between these pairs of constructs.

Two constructs are significantly related to Competitive Position, Economic Globalization and Conversion Competence. The link between Conversion Competence and Competitive Position has a much stronger path coefficient than does the link between Economic Globalization and Conversion Competence. The difference in magnitude between these two path coefficients supports the concept that actual conversion activities are more important to competitive success than is a perception of Economic Globalization.

Based on the results of this study, two of the hypothesized relationships were not significant. A greater perceived impact of Economic Globalization on the firm was not related to greater Managerial Accounting Competence. Also, greater Strategic Locationing Sophistication was not related to a perception of improved Competitive Position. Perhaps the theorized relationships between these constructs are mediated by other constructs which are not part of the research model in this study. This study does provide

evidence of an indirect relationship between Strategic Locationing Sophistication and Competitive Position; the model also has an indirect path from Economic Globalization to Managerial Accounting Competence (not tested in the study). So it is possible that other indirect paths between these constructs with additional mediating variables could explain the theorized relationship.

It is also possible that because the information constructs are new, they need to be refined. Another possibility is that the theorized relationships do not hold, at least in this research setting.

CONTRIBUTIONS

This research provides three important contributions to the accounting literature. The first contribution is the evidence of a relationship between Economic Globalization and Strategic Locationing Sophistication. Firms that are impacted by intense competitive pressure and global market access seem to have more sophisticated strategic information related to locating conversion activities

The second contribution is evidence of a relationship between strategic planning and Managerial Accounting Competence. The managerial accounting information system provides information for the management control process--the process of implementing a firm's strategies. Therefore, evidence about the relationship between information for strategic planning and information for management control

can help a firm that wants to configure and coordinate its value chain activities globally.

The third contribution is support for a relationship between Managerial Accounting Competence and performance of global conversion systems. The function of any firm-related information should be to help the implementation and control of a successful value chain. This research helps show that accounting information in global manufacturing networks is related to this success.

In an increasingly global economy, accounting curricula focus more on global issues in managerial accounting. Accounting educators need information on the role of managerial accounting in creating and maintaining competitive success. In addition to helping practitioners (decision makers and management accountants) and educators, the descriptive research and empirical evidence presented in this study is an exploratory basis for researchers who want to pursue accounting research in the area of coordinated global manufacturing.

LIMITATIONS

Limitations of any research should be considered when interpreting results. Because a survey method is used, no control group or experimental manipulation in a controlled research environment exists. However, the survey instrument was extensively pre-tested to reduce internal validity problems. Even after the extensive pre-testing and

modification of the survey, its length and the potential problem with reverse-worded items can cause difficulties in interpreting results. Also, if survey responses were inadvertently received from multiple strategic business units from the same firm, the results which are dependent on firm information could be biased by inclusion of these responses in the results.

Generalizability is limited because survey data were gathered only from U.S. companies in Mexico rather than many geographic locations. Also, choosing Mexico as a relatively simple environment limits any conclusions about more complex global settings. Results should be interpreted with care because the method used to prepare the mailing list did not necessarily provide a truly random sample. For example, responses by industry did not exactly match reported statistics for industry breakdown for U.S.-Mexican production sharing.

Both of the information constructs used were new and have not been developed and tested in prior research. The final Strategic Locationing Sophistication construct consisted of only eight of 18 survey items. Future improvements in these constructs might allow for more powerful statistical tests and sustainable conclusions.

In measuring Strategic Locationing Sophistication and Managerial Accounting Competence, no attempt has been made to include the cost of providing the information. Information is not costless, and managerial accounting

systems which are the most sophisticated or competent may not be optimal in terms of the cost/benefit tradeoffs. Conclusions drawn about the level of managerial accounting information that should be provided for any one company are dependent on the costs of the information as well as the benefits it provides.

Finally, the Competitive Position construct was operationalized through perceptual survey items, not through objective, numerical data. Actual company performance is not measured or used. Such data can often be difficult to gather. Some survey respondents were reluctant to give perceptual data, and if actual performance data is requested on a survey, many participants might refuse to give it because it is proprietary information. Also, some of the business units surveyed may not have such information separate from the company as a whole. Since perceptual measures were used, any lack of correlation between the perceptual measure and actual performance limits the conclusions that can be drawn. However, Dess and Robinson (1984) did find a significant positive correlation between subjective and objective measures of organizational performance. Although they support using objective measures when available, they do suggest the consideration of subjective perceptual measures when objective measures are unavailable and if the alternative is to remove firm performance from the research design.

DIRECTIONS FOR FUTURE RESEARCH

The exploratory nature of this study implies that there are many directions for future research. Because the Strategic Locationing Sophistication construct and the Managerial Accounting Competence construct are new, further research could refine the measures used for these constructs.

Additional research on the linkage between strategic and operational information would be valuable for firms involved in global operations. If firms with better strategic planning are really able to provide better operational information, these firms might find a competitive advantage.

Logistics is an important part of a global conversion system. Additional research on logistics-related information in global environments would also be beneficial. Managers need to understand what logistics information is available, how it is used, what additional information should be gathered, how and at what managerial level logistics decisions are made, and how accountants can interface with logistics managers to improve logistics performance and costs.

Because the research model was tested in only one specific setting, future research could extend this model into other production sharing settings. This research could help determine similarities and differences in global production sharing settings.

In conclusion, since little is known about how accounting information systems support global operations, future research should focus on global environments. The potential for managerial accounting information systems to add value through the value chain and to provide global companies with a competitive advantage is a rich research area.

APPENDIX

May 1, 1992

^F1^

^F2^

Dear ^F1^:

We are currently conducting research on global competitiveness--a topic of significant interest to many U.S. companies. This research is designed to better understand the relationships among information system capabilities, manufacturing and logistics competence, and overall firm performance in a global setting.

Many world-class companies have established production operations in Mexico as an integral part of their competitive strategy. Because your firm operates a production facility in Mexico, we are asking you to participate in this study. Your participation is essential to the study's success. The U.S. Department of Education is funding this research through a grant from the Center for International Business Education and Research at Michigan State University.

The questionnaire was designed to collect the necessary information in the minimum amount of time possible. The questionnaire has been pre-tested and should take 30-45 minutes to complete.

We appreciate your cooperation and ask that you respond within two weeks using the business-reply envelope provided. All responses will be held in the strictest confidence.

Thank you for your support.

Sincerely,

Sheldon R. Smith
Project Coordinator

Stanley E. Fawcett, Ph.D.
Project Director

Understanding the Competitive Potential of Production Sharing in Mexico

Two weeks ago, we mailed you a survey regarding your Mexican production operations. If you have already returned the survey, thank you very much for your time and effort.

If you have not yet completed and returned this survey, please take time to fill it out and return it today. Your participation is vital to the study's success. If you need another survey, please call and we will be happy to mail you one. Thank you.

Sincerely, Sheldon R. Smith, Project Coordinator
 Stanley E. Fawcett, Ph.D., Project Director

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June 1, 1992

^F1^

^F2^

Dear ^F1^:

About a month ago I wrote to you seeking information regarding your firm's Mexican production activities. This information will be used to better understand the implications of North American Free Trade and will provide valuable insight into the design of North American manufacturing strategies.

I am writing again to ask for your assistance in filling out the enclosed survey and to remind you that your firm's production experience in Mexico is vital to this study's success. If you have already returned a completed survey from the previous mailing, I would like to thank you for your help. If you have not returned a completed questionnaire, please take time to do so today.

Your cooperation is greatly appreciated. Please respond via the enclosed business-reply envelope.

Sincerely,

Sheldon R. Smith
Project Coordinator

June 19, 1992

^F1^

^F2^

Dear ^F1^:

During the past two months I have written to you seeking information concerning your Mexican production activities. Although the response has been substantial, many of the questionnaires have not yet been completed and returned. For this study to provide the greatest insight into firm performance in global manufacturing, your participation is needed.

I expect to begin the data analysis phase of this study soon. Therefore, I again ask for your assistance. I am enclosing a copy of the questionnaire and a reply envelope. If you have already returned a completed questionnaire from the previous mailings, thank you for your help. If you have not returned a completed questionnaire, please take time to do so today.

Your cooperation is greatly appreciated.

Sincerely,

Sheldon R. Smith
Project Coordinator

**UNDERSTANDING THE COMPETITIVE POTENTIAL OF
PRODUCTION SHARING IN MEXICO**

General Information/Instructions

1. When completing the questionnaire, please do so with respect to the business unit in which you have decision-making authority. This business unit could include one or more Mexican facilities. Please remain consistent in your responses (they should all refer to the same business unit).
2. Please answer all questions as accurately as you can. An approximate answer is better than no answer, since incomplete questionnaires create serious analysis problems. If appropriate, please seek information from colleagues who have access to more accurate information.
3. Your input is important whether you have little or extensive experience with Mexican production operations. There are no "right" or "wrong" answers. Firms operate under varied circumstances and respond to similar situations differently. Our goal is to understand these differences. Most of the survey questions follow a standard format, asking you to check a box or circle a response. The survey should take 30-45 minutes to complete.
4. All of your responses will be kept strictly confidential.

If you would like a summary of the study findings, please enclose your business card in the return envelope. Your assistance is greatly appreciated.

If you have any questions, you can contact me at:

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UNDERSTANDING THE COMPETITIVE POTENTIAL OF PRODUCTION SHARING IN MEXICO

1. What is your level of managerial responsibility within the organization? (check one)
 - ☐ Plant Manager
 - ☐ Division Manager
 - ☐ Corporate Manager

2. What do you consider to be your area of expertise? (check one)

☐ Accounting/Finance	☐ Manufacturing/Production
☐ Engineering	☐ Marketing
☐ Materials Management/Physical Distribution (logistics)	☐ Other, please specify _____

3. What is the primary industry in which your products compete? (check one)

☐ Apparel (SIC 36/38)	☐ Machinery, except electric (SIC 35)
☐ Electronic/Electric (SIC 36/38)	☐ Furniture (SIC 25)
☐ Metals (SIC 34)	☐ Food Products (SIC 20)
☐ Transportation Equipment (SIC 37)	☐ Other, please specify _____

4. Considering your firm's business strategy and competitive environment, indicate the relative importance of the following *manufacturing-related* priorities to your firm's long-term success by allocating 100 points among them. For example, if all of the priorities are equally important, give each priority 20 points ($100 \div 5 = 20$). Priorities with greater competitive importance should receive higher point allocations. Please make sure the total points allocated is 100.
 - _____ Flexible / Responsive Production
 - _____ High-Quality Production
 - _____ Low-Cost Production
 - _____ Dependability (due-date performance)
 - _____ Innovation (rapid new product introduction and process uniqueness)

5. Considering your firm's business strategy and competitive environment, indicate the relative importance of the following *logistics-related* priorities to your firm's long-term success by allocating 100 points among them. For example, if all of the priorities are equally important, give each priority 20 points ($100 \div 5 = 20$). Priorities with greater competitive importance should receive higher point allocations. Please make sure the total points allocated is 100.
 - _____ Flexible / Responsive Logistics (quick response)
 - _____ High-Quality Customer Service (customer success)
 - _____ Logistics Cost Leadership
 - _____ Rapid and Reliable Delivery (on-time performance)
 - _____ Service Innovation

6. How long has your business unit operated an assembly/manufacturing facility(ies) in Mexico? _____ years

7. How many workers are employed in your business unit's Mexican facility(ies)? _____ number of employees

8. How many separate Mexican facilities does your business unit operate? _____ facilities on the U.S. - Mexico border
 _____ facilities in the interior of Mexico

9. Does your business unit own or rent the physical buildings that make up the Mexican facilities? (check all that apply)
 - ☐ Rent, _____ number of facilities
 - ☐ Own, _____ number of facilities

10. Indicate the competitive performance of your business unit's Mexican operations in the following areas as compared to leading industry competitors. Circle the appropriate response.

	Relative to leading competitors						
	Significantly Better						Significantly Worse
Ability to consistently meet production schedule	7	6	5	4	3	2	1
Ability to meet promised due dates	7	6	5	4	3	2	1
Ability to take advantage of production economies of scale	7	6	5	4	3	2	1
Aggressiveness of R&D and concurrent engineering programs	7	6	5	4	3	2	1
Appropriateness of process technology (advanced, unique process)	7	6	5	4	3	2	1
Backordered products (smaller backlog is better)	7	6	5	4	3	2	1
Changeover time from one product type or output volume to another	7	6	5	4	3	2	1
Defect rate (fewer defective parts per million is better)	7	6	5	4	3	2	1
Labor productivity	7	6	5	4	3	2	1
Manufacturing system adaptability	7	6	5	4	3	2	1
New product development lead times (shorter lead times are better)	7	6	5	4	3	2	1
Products consistently meet customer expectations	7	6	5	4	3	2	1
Products consistently meet design specifications	7	6	5	4	3	2	1
Throughput lead times (shorter cycle times are better)	7	6	5	4	3	2	1
Unit cost (lower cost is better)	7	6	5	4	3	2	1

	Relative to leading competitors						
	Significantly Better						Significantly Worse
Ability to deliver expedited shipments	7	6	5	4	3	2	1
Aggressiveness in increasing the value-added content of logistics services	7	6	5	4	3	2	1
Aggressiveness in the reduction of order cycle time (logistics cycle time)	7	6	5	4	3	2	1
Customer satisfaction provided by logistics services	7	6	5	4	3	2	1
Delivery lead times for goods shipped to and from your Mexican operations	7	6	5	4	3	2	1
Inventory costs (raw materials, finished goods, and pipeline)	7	6	5	4	3	2	1
Logistics labor productivity	7	6	5	4	3	2	1
Logistics system's ability to provide new and better logistics services	7	6	5	4	3	2	1
Logistics system's ability to accommodate special or non-routine requests	7	6	5	4	3	2	1
Logistics system's ability to handle unexpected events	7	6	5	4	3	2	1
Logistics system's ability to provide rapid response to customer requests	7	6	5	4	3	2	1
Logistics system's ability to enhance customer success	7	6	5	4	3	2	1
Number of logistics related complaints (fewer is better)	7	6	5	4	3	2	1
On-time delivery performance (percent of on-time deliveries)	7	6	5	4	3	2	1
Transportation costs (lower costs are better)	7	6	5	4	3	2	1

11. What is the primary ownership relationship of your Mexican operations? (check one)

- ☐ 100% U.S. ownership
☐ Shelter/subcontract operation(s)
☐ Other, please specify _____

12. How would you classify the primary technology level of your Mexican operations? (check one)

- ☐ High-technology
☐ Medium-technology
☐ Low-technology

13. What percent of the products assembled/manufactured in your Mexican operation(s) are sold in the following markets?

U.S. market %

Mexican market %

Other % Please specify major market(s) _____

14. What primary role in the production process does your Mexican facility(ies) fulfill? (check all that apply)

- ☐ Fabrication of component parts
☐ Assembly of subassemblies
☐ Assembly of finished goods
☐ Integrated manufacturing operations

15. Estimate the percent allocation of total operating costs among the following activities for your Mexican operations. (should equal 100 percent)

Administration %

Distribution/Logistics ... %

Marketing %

Production %

16. Estimate the percent allocation of total production costs among the following areas for your Mexican operations. (should equal 100 percent)

Direct Labor %

Materials %

Overhead %

17. Does your firm develop specific, written business plans? YES NO If so, how long has your firm been developing and using business plans? (check one)

- ☐ up to 3 years
☐ 4 to 5 years
☐ 6 or more years

18. What is your firm's planning horizon? (i.e. How many years are covered in your firm's business plan?)

- ☐ 1 to 3 years
☐ 4 to 5 years
☐ 6 or more years

19. Evaluate the level of planning used in the design and establishment of your Mexican Production Operations. (Formal planning procedures involve extensive analysis of risks and benefits, documentation of alternatives, and communication of the firm's objectives and strategy implementation process to all relevant management levels.) Please circle the appropriate response.

	Very Formal					Not Formal	
	7	6	5	4	3	2	1
Overall Level of Strategic Planning	7	6	5	4	3	2	1
Planning for Country Choice—Facility Location	7	6	5	4	3	2	1
Planning for Logistics and Physical Distribution System	7	6	5	4	3	2	1
Planning for Production and Manufacturing Control System	7	6	5	4	3	2	1
Planning for Purchasing and Materials Management System	7	6	5	4	3	2	1
Planning for Marketing System	7	6	5	4	3	2	1
Planning for Financial Performance Evaluation	7	6	5	4	3	2	1

20. The following items are often considered to be important to strategic decision making regarding the location of activities in a firm's global manufacturing network. Indicate how well your firm's information system(s) provides useful information for each.

	Very Well					Very Poorly	
Cross-national economic conditions	7	6	5	4	3	2	1
Political stability	7	6	5	4	3	2	1
Competitors' strategies	7	6	5	4	3	2	1
Global technology developments	7	6	5	4	3	2	1
Global transportation rates (logistics costs)	7	6	5	4	3	2	1
Exchange rates	7	6	5	4	3	2	1
Cross-national productivity	7	6	5	4	3	2	1
Production quality across countries	7	6	5	4	3	2	1
Labor unionization	7	6	5	4	3	2	1
Potential sales in foreign market	7	6	5	4	3	2	1
Governmental policies:							
currency convertibility	7	6	5	4	3	2	1
domestic content laws	7	6	5	4	3	2	1
foreign ownership laws	7	6	5	4	3	2	1
tariffs/quotas	7	6	5	4	3	2	1
tax issues	7	6	5	4	3	2	1
Opportunities for comparative advantage:							
cross-national labor rates	7	6	5	4	3	2	1
cross-national materials input costs	7	6	5	4	3	2	1
cross-national resource availability	7	6	5	4	3	2	1

21. Indicate how well your firm's information system(s) provides useful information concerning the following manufacturing-related issues. Useful information enables managers to make operating decisions that will lead to long-term competitive success (the rating should be specific to the information provided concerning your Mexican operations).

	Provision of Information					Very Poorly	
	Very Well						
Actual changeover times to different products	7	6	5	4	3	2	1
Backorder performance (e.g. number of days to fill backorders)	7	6	5	4	3	2	1
Changes in important production costs including labor and materials	7	6	5	4	3	2	1
Cost of manufacturing system flexibility	7	6	5	4	3	2	1
Cost of quality (includes cost of poor quality and cost of improving quality)	7	6	5	4	3	2	1
Costs of missing promised production due dates	7	6	5	4	3	2	1
Costs of product and process innovation	7	6	5	4	3	2	1
Due-date performance (e.g. percent of due dates met)	7	6	5	4	3	2	1
Manufacturing cycle times	7	6	5	4	3	2	1
Process control (information used to identify problems in the production process)	7	6	5	4	3	2	1
Product Costing (labor, materials, and overhead) for items produced in Mexico	7	6	5	4	3	2	1
Production defect rates	7	6	5	4	3	2	1
R&D effectiveness	7	6	5	4	3	2	1
Time-to-market performance (product development lead times)	7	6	5	4	3	2	1
Total labor costs (fully loaded wages plus training costs)	7	6	5	4	3	2	1

22. Indicate how well your firm's information system(s) provides useful information concerning the following logistics-related issues. Useful information enables managers to make operating decisions that will lead to long-term competitive success (the rating should be specific to the information provided concerning your Mexican operations).

	Provision of Information						
	Very Well			Very Poorly			
Quick response (e.g. length of time to respond to customer inquiries; percent of order changes that can be handled immediately)	7	6	5	4	3	2	1
Cost of flexible and responsive logistics system	7	6	5	4	3	2	1
Cost of logistics service innovation	7	6	5	4	3	2	1
Cost of quality logistics customer service	7	6	5	4	3	2	1
Cost of rapid and reliable delivery	7	6	5	4	3	2	1
Delivery Performance (e.g. percent of orders delivered on time)	7	6	5	4	3	2	1
Expediting performance (e.g. length of time to deliver expedited shipments) ...	7	6	5	4	3	2	1
Logistics cycle time analysis (information used to reduce order cycle times)	7	6	5	4	3	2	1
Logistics impact on customer (information collected directly from customers) ..	7	6	5	4	3	2	1
Logistics service customization (e.g. number and type of special requests handled)	7	6	5	4	3	2	1
Logistics-related customer complaints (e.g. number and type of complaints) ...	7	6	5	4	3	2	1
Order system costs (e.g. cost per order; order costs as a percent of sales)	7	6	5	4	3	2	1
Total logistics cost information for items to and from Mexico	7	6	5	4	3	2	1
Transportation costs (e.g. as a percent of sales; modal/carrier comparison)	7	6	5	4	3	2	1
Value analysis (information used to increase the value added by logistics services)	7	6	5	4	3	2	1

For questions 23-49, indicate the extent to which you agree with each of the following statements.

Agree	Strongly Disagree					Strongly	
23. Your Mexican operations have helped the firm achieve above average growth in market share.	7	6	5	4	3	2	1
24. Your firm makes extensive use of written, long-range plans to help improve overall performance.	7	6	5	4	3	2	1
25. Your firm seeks to locate specific production activities in countries that provide a comparative advantage for the given activity.	7	6	5	4	3	2	1
26. Your firm does not view foreign production as necessary to remaining competitive.	7	6	5	4	3	2	1
27. Management has performed an analysis of strengths and weaknesses and matched them to environmental opportunities and threats.	7	6	5	4	3	2	1
28. Production sharing in Mexico has led to an above average rate of growth in sales for your firm.	7	6	5	4	3	2	1
29. Economic globalization has had no important impact on your firm's competitive strategy.	7	6	5	4	3	2	1
30. Your firm places production facilities in foreign countries in order to gain access to international markets and to develop a positive image as a local player in the different markets.	7	6	5	4	3	2	1
31. Your Mexican operations have achieved above average levels of customer service when compared to competitors' (similar) foreign production operations.	7	6	5	4	3	2	1
32. Economic globalization has had no impact on the competitive pressure faced by your firm.	7	6	5	4	3	2	1
33. Your Mexican operations have helped the firm achieve above average improvement in overall competitive position.	7	6	5	4	3	2	1
34. Your firm is seldom challenged in the marketplace by low-cost competitors from other countries.	7	6	5	4	3	2	1
35. Your firm uses a continual planning process that incorporates feedback from past experience.	7	6	5	4	3	2	1

	Strongly Agree						Strongly Disagree
36. Your firm is often challenged in the marketplace by foreign competitors with a differential advantage based on quality, flexibility, or technological innovation.	7	6	5	4	3	2	1
37. Production sharing in Mexico has led to an above average rate of growth in return on total assets for your firm.	7	6	5	4	3	2	1
38. Your firm's approach to global manufacturing has been formalized and incorporated into your firm's competitive strategy.	7	6	5	4	3	2	1
39. Your firm has a formalized planning process that evaluates environmental constraints, firm resources, and organizational goals.	7	6	5	4	3	2	1
40. Economic globalization has greatly increased your firm's ability to gain access to materials and labor in foreign countries.	7	6	5	4	3	2	1
41. Your firm does not actively seek to add value to products by acquiring the "best" mix of factor inputs—low-cost or high-quality—available worldwide.	7	6	5	4	3	2	1
42. Your Mexican operations have achieved above average cost reductions when compared to competitors' (similar) foreign production operations.	7	6	5	4	3	2	1
43. Your firm places production facilities in foreign countries in order to overcome protectionist barriers such as quotas, tariffs, and domestic content laws.	7	6	5	4	3	2	1
44. Your firm's Mexican operations have helped it achieve above average levels of product quality compared to competitors' (similar) foreign production operations.	7	6	5	4	3	2	1
45. Economic globalization has greatly increased your firm's ability to enter and develop markets in different areas of the world.	7	6	5	4	3	2	1
46. Your firm feels foreign production is essential to compete with low-cost foreign manufacturers.	7	6	5	4	3	2	1
47. Top management emphasizes global manufacturing strategy within the overall corporate strategy.	7	6	5	4	3	2	1
48. Your firm uses written short-range plans and budgets to manage and control operations.	7	6	5	4	3	2	1
49. Your firm does not view foreign production as essential to improving its access to global markets.	7	6	5	4	3	2	1
50. In what other regions of the world does your company operate production facilities? (check all that apply)							
☐ Mainland Asia (China, India, etc.)	☐ Europe						
☐ Canada	☐ South America						
☐ Caribbean Basin	☐ Pacific Basin (Australia, Hong Kong, Japan, etc.)						
51. Evaluate the overall success of your Mexican operations. (check one)							
☐ Greatly exceeded expectations	☐ Below expectations						
☐ Moderately exceeded expectations	☐ Failure						
☐ Fulfilled expectations	☐ Do not know at this time						

Thank you for your time and thoughtfulness in completing this questionnaire. Confidentiality will be protected. If you would like to receive a summary of the findings, please return your business card or provide your address/phone number below.

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