

GLOBALIZATION OF INTERNATIONAL ENGINEERING AND CONSTRUCTION FIRMS  
FOR BUILDING THEIR COMPETITIVENESS

by

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## ABSTRACT

The goals of this dissertation are first, to establish a theoretical framework for analyzing globalization of international engineering and construction (E&C) firms, second to examine the extent to which E&C firms are moving toward globalization as defined in the framework, and third to provide strategic implications for management of such moves (including maintaining or enhancing competitiveness as well as the implications for organization).

In contrast to the conviction that competition in the E&C industry is "multi-domestic" (i.e., firms compete on a country-by-country basis), this thesis demonstrates that international E&C firms are global in three elements, geographically, internally, and externally (i.e., they compete worldwide in coordinated ways.) Many E&C firms are geographically global, undertaking projects in vast geographic markets. Quite a few firms are also internally global, coordinating internal activities dispersed in large geographic areas. Moreover, numerous E&C firms are externally global by coordinating flows of external inputs to projects, such as labor, materials, equipment, financial capital, and knowledge (or services) sourced externally from various locations worldwide.

The study has found that as E&C firms start to geographically globalize, their organizational capability based on configuration and coordination of internal activities and external inputs, becomes increasingly important. Many international E&C firms consider that coordination of internal activities and external inputs is as important as other well-known sources of competitiveness, such as project management. Equally important, such coordination sustains other well-known sources of competitiveness. This finding suggests that international E&C firms must globalize in order for them to maintain or enhance competitiveness.

This study roughly classified international E&C firms into three groups. The first two types of firms are global in all three elements, one type competing on the basis of efficient operation internally and externally, and the other competing on the basis of advantages specific to their home countries (possibly driven by home country sourcing in conjunction with home governments' subsidies). The third type, a few in number, is global only geographically, and competes on the basis of exceptional knowledge of local conditions derived from local presence. As E&C firms globalize in the three elements, rigid distinctions among headquarters, subsidiaries, and project offices, may no longer be appropriate. Rather, organizations seem to be becoming increasingly flexible in terms of where and how internal activities are achieved and where and how external inputs are incorporated.

This Supervisor: Dr. Fred Moavenzadeh  
Title: Professor in Civil Engineering

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# Chapter 1

## Introduction

### 1.1 Globalization and Global Strategies

Globalization has been one of the most frequently addressed themes in the business world as well as in academia in the 1980s. Many industries are now referred to as "global" such as automobiles, commercial aircraft, computers and semiconductors, communication equipment, and consumer electronics, and many firms in these industries have advocated their own global strategies.<sup>1</sup>

In the E&C industry, too, a concern with globalization has been developing rapidly. Certain firms have taken the concept farther than others. For example, Fluor Corp. of the U.S., after a massive restructuring of its business and organization in the mid-1980s, now see its business in terms of truly "global," geographic markets and manages its organizations across geographic distances as well as business segments. Technological advances in telecommunications and computers certainly have helped Fluor to configure its worldwide operation so as to move work to where its people are rather than move the people to where the work.<sup>2</sup> SAE-Sadelmi of Italy, a subsidiary of Swiss-based electrical multinational Asea Brown Boveri, gains leverage from its parent's geographical configuration of market and internal resources.<sup>3</sup>

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<sup>1</sup>.Such as Federal Express Corp. of the U.S.(Business Week, 2/13/89, pp.66-72), L.M. Ericsson of Sweden (Financial Times 11/25/89), Yamaichi Securities of Japan (Business Week, 7/17/89, p.42).

<sup>2</sup>. Engineering New Record (2/23/89).

<sup>3</sup>. Engineering New Record (6/30/88).

Unfortunately, however, the term "globalization" seems to be used without a clear definition of what globalization is. Among the concepts that are implied in much of the literature on globalization are: 1) an expansion of a firm's geographical market; 2) a mere replacement for the older term, "internationalization"; 3) issues related to globalization, such as trade liberalization or communication technology advances (considered to be the "infrastructure" on which globalization occurs); and 4) advantages and costs in a particular industry.

None of these discussions deals in a comprehensive manner with the theoretical mechanism of globalization. In the E&C industry, too, despite the growing concern of international E&C firms in regard to globalization and the complex forces shaping the contour of the international competition, there are virtually no studies dealing with the international competitiveness of E&C firms from the standpoint of globalization. As shown next, even studies pertaining to the international competitiveness of E&C firms are very limited in number and scope.

A mechanism which this study propose is: Globalization must be addressed at the firm level from where any change in competition takes place within an industry; globalization occurs as an outcome of firms' efforts to gain competitive advantage in the international competition; globalization must be defined in three elements, geographically, internally, and externally, that is, how widely a firm compete geographically, how well the firm coordinate its configured internal activities, and how well the firm coordinate its configured external inputs. Then, global strategies are formulation of planning and implementation of such planning to achieve globalization.

## 1.2 The Environment of the International Engineering and Construction (E&C) Industry

The 1980s have been a decade of turmoil and complexity in the international E&C industry. On the demand side, the decade has been characterized by several significant changes. For example, there has been a considerable shrinkage in the international market, most notably in the Middle East and developing countries in Africa and Latin America. Also, protectionist sentiment has arisen in major developed countries. Yet there have been countervailing efforts to eliminate barriers to trade, particularly in services, including those provided by E&C firms, through the untiring efforts of UNCTAD (United Nations Conference on Trade and Development), GATT (General Agreement on Tariffs and Trade), and OECD (Organization for Economic Co-operation and Development)<sup>4</sup>. The decade has seen the gradual opening of the Japanese market as pressure has been brought to bear on the Japanese government and industry. Also, Europe has been preparing for the unification of its markets, which have been so fragmented and closed to even to other EEC member countries so that only a tiny fraction of contracts has been awarded to non-indigenous (or any other) European firms.<sup>5</sup>

On the supply side, the 1980s have been a period of re-orientation by many firms. Certain nationalities have become less aggressive in the international market place, most notably Korean firms, and U.S. firms, which are undergoing major restructuring (mostly downsizing).<sup>6</sup> Japanese firms have increased the

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4. Gibbs, Murray (1985), Mayes, David G. (1987), and OECD (March 1987) and (TC/WP(87)68, October 1987).

5. For example, only 2.6 percent of the whole European construction market was awarded to non-indigenous European firms. (Source: International Construction Week, October 1988)

6. For example, Engineering News Record (ENR), 1/2/86, pp.10 - 12.

number and range of cooperative agreements with firms of other nationalities.<sup>7</sup> The U.S. market has been changed by continuous acquisitions of U.S. firms by foreign firms.<sup>8</sup>

Data reported by Engineering News Record (ENR) highlights some of these incidents. As Exhibit 1.2.1 shows, the size of the international markets, measured by the erected values of facilities involved in new contracts awarded to the top 250 international contractors, peaked in 1981 and declined every year thereafter until 1988.<sup>9</sup> The international market shrank by 45 percent of the peak value in the period.

Exhibit 1.2.1 Foreign Contracts Awarded to the Top 250 International Contractors

	(\$ billion)							
Year	1981	1982	1983	1984	1985	1986	1987	1988
Contract Values	134.3	123.1	93.6	80.5	81.6	73.9	73.9	94.1

Note: The figures are based on erected values of facilities included in the contracts acquired by the top 250 contractors.

Source: Engineering News Record (various issues).

<sup>7</sup>. Such cooperation agreements include those between Shimizu Construction Co. and Parsons Corp.(U.S.), Tobishima Corp. and DUMEZ (France), Ohbayashi-Gumi and Fluor Daniel (U.S.), Kumagai-Gumi and Turner Corp.(U.S.), Hazama-Gumi, Ltd. and Morrison Knudsen Corp.(U.S.) as well as Daewoo Corp.(Korea), Aoki Construction Corp. and Tishman Realty & Construction Co. Inc., Taisei Construction, Corp. and Skidmore, Owings & Merrill (U.S. - design firm), Toda Construction Co. and Schal Associates Inc. (U.S. - design firm), Fujita Corp. and Daniel, Mann, Johnson & Mendenhall (U.S.- design firm), and many others. All agreements were made after 1987. They cooperate primarily in Japan, but they do in the U.S as well, such as a venture between Shimizu and Persons and several between Aoki and Tishman. (Source: Nihon Keizai Shinbun, various issues, and ENR, 4/13/89 and 10/19/89).

<sup>8</sup>. Ten U.S. firms have been acquired each year in the 1980s.(Source: BAR-OR, Emmanuel, 1988) These acquisitions seem to be made by firms of many nationalities including Japanese firms, but primarily made by European firms. (Source: ENR, 3/31/88, 5/12/88, 7/20/88, 7/6/89, 8/3/89, 11/2/89)

<sup>9</sup>. Although the figures are not identical to the values of contracts actually acquired by the firms, they are good enough to show a remarkable shrinkage of the whole international market shared by these firms in the period.



Changes in demand for E&C by regions are presented in Exhibit 1.2.2. The markets in the Middle East, Africa, and Latin America have continued to decline between 1981 and 1987. This is in part a consequence of Third World debt and the declining price of oil and other natural resources which are the major source of national income of these countries. However, it is also the outcome of the technological maturation of indigenous E&C firms in these regions. Local firms have started to compete on the basis of low costs against firms in developed countries; and government policies in these regions have worked favorably for local firms.<sup>10</sup>

Exhibit 1.2.2 Foreign Contracts Awarded to the Top 250 International Contractors by Geographic Markets  
(\$ billion/percentage in parentheses)

Area/Year	1981	1982	1983	1984	1985	1986	1987	1988
Middle East	49.7 (37.0)	51.2 (41.6)	33.0 (35.3)	26.6 (33.0)	21.6 (26.5)	16.1 (21.8)	13.4 (18.1)	17.4 (18.5)
Asia	22.8 (17.0)	23.5 (19.1)	15.4 (16.5)	18.3 (22.7)	17.8 (21.8)	17.3 (23.4)	15.5 (21.0)	20.5 (21.8)
Africa	25.5 (19.0)	17.7 (19.1)	21.4 (16.5)	12.5 (22.7)	15.3 (21.8)	13.1 (23.4)	9.0 (21.0)	10.1 (21.8)
Europe	10.7 ( 8.0)	n.a. (n.a.)	n.a. (n.a.)	9.2 (11.4)	10.0 (12.3)	11.9 (16.1)	17.2 (23.3)	19.4 (20.6)
North America	6.7 ( 5.0)	n.a. (n.a.)	n.a. (n.a.)	8.5 (10.6)	10.2 (12.5)	10.4 (14.1)	11.5 (15.6)	12.7 (13.5)
Latin America	18.8 (14.0)	10.3 ( 8.4)	6.3 ( 6.7)	5.4 ( 6.7)	6.6 ( 8.1)	5.2 ( 7.0)	7.4 (10.0)	14.0 (14.9)
Total	134.3 (100)	123.1 (100)	93.6 (100)	80.5 (100)	81.6 (100)	73.9 (100)	73.9 (100)	94.1 (100)

Note: The figures are based on erected values of facilities included in the contracts acquired by the top 250 contractors.

Source: Ibid.

The size of the Middle East market declined the farthest, to a mere 27 percent of its peak level in 1987. The share of the Middle East market in the entire international market, too, declined from over 40 percent in 1982 to only 18 percent in 1987. In addition, the prolonged Iran-Iraq war apparently affected the

<sup>10</sup>. United States Office of Technology Assessment (1987).

continuation or feasibility of many projects in the region. In contrast, the European and North American markets became increasingly important to international E&C firms. In particular, the European and Asian markets have become the largest after 1987.

Exhibit 1.2.3 summarizes the change in the market shares by nationality of E&C firms. Contracts awarded to Korean firms continued to decline to one tenth of their peak and their market share continued to drop, from 11 percent in 1982 to only 1.5 percent in 1988, primarily because of their dependence on the Middle East market. The declining presence of U.S. firms, though not marked as the Koreans, showed a moderate comeback in 1988, but U.S. firms lost a large volume of contracts between 1982 and 1987. In contrast, European and Japanese firms increased their market shares in the same period.

Outlined here is a brief review of the recent environment of the international E&C industry on which this study will base the discussion.

Exhibit 1.2.3 Shares of International E&amp;C Market by Nationality of E&amp;C Firms

(\$ billion/percentage in parentheses)

	1982	1983	1984	1985	1986	1987	1988
U.S.	44.9 (36.5)	29.4 (31.4)	30.7 (38.1)	28.2 (34.6)	22.6 (30.6)	18.1 (24.5)	25.9 (27.5)
France	11.4 (9.3)	10.0 (10.7)	5.3 ( 6.6)	6.7 ( 8.2)	7.1 ( 9.6)	8.6 ( 8.0)	11.1 (11.8)
Germany	9.5 ( 7.7)	5.4 ( 5.8)	4.8 ( 6.0)	5.4 ( 6.6)	5.5 ( 7.4)	5.9 ( 8.0)	8.1 ( 8.6)
Italy	7.8 ( 6.3)	7.2 ( 7.7)	6.8 ( 8.4)	8.7 (10.7)	7.4 (10.0)	9.2 (12.4)	13.3 (14.1)
U.K.	7.5 ( 6.1)	6.4 ( 6.8)	5.6 ( 7.0)	5.6 ( 6.9)	7.0 ( 9.5)	7.9 (10.7)	9.4 (10.0)
Netherlands	2.0 ( 1.6)	2.5 ( 2.7)	1.2 ( 1.5)	1.4 ( 1.7)	1.1 ( 1.5)	1.4 ( 1.9)	1.6 ( 1.7)
Turkey	2.7 ( 2.2)	3.4 ( 3.6)	1.9 ( 2.4)	1.6 ( 2.0)	2.2 ( 3.0)	0.8 ( 1.1)	1.0 ( 1.1)
Japan	9.3 ( 7.6)	8.7 ( 9.3)	7.3 ( 9.1)	11.6 (14.2)	9.4 (12.7)	9.9 (13.4)	11.6 (12.7)
Korea	13.8 (11.2)	10.4 (11.2)	8.2 (10.2)	4.8 ( 5.9)	2.6 ( 3.5)	2.1 ( 2.8)	1.4 ( 1.5)
Others	14.2 (11.5)	10.2 (10.9)	8.7 (10.8)	7.6 (9.3)	9.0 (12.2)	10.0 (13.5)	10.7 (11.4)
Total	123.3 (100)	93.6 (100)	80.5 (100)	81.6 (100)	73.9 (100)	73.9 (100)	94.1 (100)

Note: The figures are based on erected values of facilities included in the contracts acquired by the top 250 contractors.

Source: Ibid.

### 1.3 Development of Competitive Assessment of International E&C Firms

A large part of the literature addressing the international competitiveness of E&C firms consistently emphasizes three sources of competitiveness, 1) technological or engineering capability in executing processes of design and construction, 2) government policies and support, and 3) financial packaging capability (often associated with government policies).

Moavenzadeh (1985) argues the importance of R&D which may sustain the technological competitiveness of U.S. E&C firms. He suggests promising areas in which E&C firms can potentially gain technological leadership, such as computer technology (most notably the application of expert systems), robotics, and advanced materials. Tatum (1986, 1987a,b,c) also argues that advanced technology, particularly an application of computer technology and robotics is a key to the international competitiveness of E&C firms because of the demand associated with the increasing technical complexity of constructed facilities, clients who demand advanced technology for their international competitiveness, and E&C firms' need to compete against foreign firms in the U.S. market.

The Department of Commerce (1984) suggests that U.S. E&C firms must maintain their reputation in developing and applying advanced design and construction technology and concentrate on large, technology-intensive projects. This study also points out the importance of the role of the U.S. government in providing competitive project financing and support through R&D. Studies emanating from the United States Office of Technology Assessment (OTA) (1987) and National Research Council (1988) emphasize similar points, although the OTA study cautions against relying on government support for long-term competitiveness.

Demacopoulos and Moavenzadeh (1985) suggests that innovative financing schemes will be an increasing challenge to international E&C firms seeking to remain competitive as will E&C firm's ability to manage their exposure to various risks stemming from their involvement in financing projects. Demacopoulos (1989) emphasizes that foreign exchange management capability may shape an increasingly important part of the main thrust of international competitiveness for E&C firms.

Seymour (1987) using Dunning's "eclectic theory," one of the most popular multinational enterprise theories<sup>11</sup>, suggests three kinds of international competitive advantages for E&C firms: those specific to the firm, location (most notably the home countries of E&C firms), and internalization (particularly the decisions on the modes serving foreign markets such as export, licensing, and FDI), with the third advantage interacting with the first two. While his work is an interesting attempt to analyze the international strategies of E&C firms in terms of general theories of internationalization, it is an application of the theory rather than an enhancement of it, and it suffers from the static nature of the eclectic theory itself. Strassmann et al (1988) builds on Seymour's work and provides a good description of the historical development of E&C firms of many countries, and adds a tactical strategic element to the three sources of competitiveness. However, its discussion of strategy focuses primarily on the level of the project rather than the firm.

To recapitulate, the existing literature on the E&C firm offers no comprehensive analysis, theoretical or empirical, of the globalization of international E&C firms.

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<sup>11</sup>. Multinational enterprise theories are reviewed in Chapter 2.

## **1.4 Production of the E&C Firms**

This section analyzes the international production of an E&C firm in order to provide a basis on which to establish a theoretical framework for globalization. Our knowledge of the characteristics of international E&C production is limited to that of the final output of E&C production and to a "macro"-view of the results of the international competition of E&C firms (such as a value of contracts acquired by French firms in the Middle East). As a result, our picture of international competitiveness is static and limited as we have seen in the previous section.

The missing link in the discussion of international production and competitiveness of E&C firms has two parts, we need to know how an E&C firm is organized to perform international E&C activities within the firm and second, the degree to which the way the firm is organized contributes to shaping its international competitiveness. These are crucial elements in considering why globalization of firms occurs in the E&C industry.

### **1.4.1 Established Characteristic of International Production of E&C Firms**

#### **1) Customization and Experience-Good Characteristics**

It is well known that each output of E&C production is customized to best fit the features, quality, cost, and location a client requires. Thus, a whole set of E&C production activities happens only once for one particular output. As a result, customization of construction activities makes an output of E&C production an "experience good." Compared to a "search good," whose quality is evident on inspection before purchase, the quality of an "experience good" is determined only by consuming or using it after purchase (or completion of production).

It should be noted that customization of production also makes the services provided by an E&C firm "experience goods" from the client's perspective because the quality of the services cannot be established by the client until a planned output is completed and actually used. The "experience goods" characteristic of services provided by an E&C firm makes the past experience and reputation of the E&C firm an important source of competitiveness. Also, uncertainty and transaction costs for the client (or costs incurred in searching for the most appropriate E&C firm) seem to be closely related to bidding procedures, from submission of a pre-qualification to the final decision-making, and bonding systems, e.g., bid bonds, performance bonds.

However, it is important to note that customization and "experience goods" characteristics of production are not limited to the activities of E&C firms. The production of many large capital goods, such as ships or heavy equipment (e.g., a turbine for a nuclear power plant) more or less shares the same characteristics.

## 2) Immobility of the Final Outputs of E&C

Final outputs of E&C are usually immobile. Once they are built, they remain in place. Of course, there are certain mobile outputs, such as floating plants or floating decks which could be built at shipyards, propel themselves or be tugged to the planned locations, and connected to the seabeds or shores. These are transported like other capital goods, e.g., heavy machines and equipment, ships, and airplanes. However, they are rather exceptional.

Immobility of the final output necessitates the production of the final output at its planned location. A large part of E&C production, not only physical production activities but also those considered to be services, such as project management activities and supervision of design, must take place at the location where the output is to be built.

In an international project, the immobility of the final output requires an E&C firm to produce services in a foreign location. Consequently, the firm must put itself in a situation similar to that of a manufacturing firm making a foreign direct investment. Although the production of an E&C firm is usually done on a contract basis rather than on an equity basis like that of many manufacturers and the duration of the production is not as long as that of manufacturing production, an E&C firm is exposed to the same risks and difficulties faced by any firms making a foreign direct investment. Risks and difficulties may be posed by the political environment in the host country, foreign exchange, differences in language, culture, and business infrastructure, and so on.

### 3) Large Fixed Capital

Compared to final outputs in other industries, such as consumer products and even heavy capital equipment, a final E&C output requires a substantial capital expenditure although the size of the capital expenditure depends on the size, type (e.g., design and construction for a nuclear power plant may cost much more than for a dam), and planned features of an output.

When a foreign client cannot afford to finance the design and construction of an output (as seen in many developing countries in the 1980s), an international E&C firm may have an incentive to integrate backward in financing a project in order to acquire a contract to build the facility. The importance of finance as a means to acquire projects has been emphasized by several studies as indicated in Chapter 1. These studies suggest that the ways of financing a project and ways in which an E&C firm is involved in financing a project vary considerably depending on the conditions specific to each project.<sup>12</sup>

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12. For a complete discussion, see Demacopoulos and Moavenzadeh (1985).



Also, from the view of economic development in a host country, the impact of constructing a facility on the local economy may be large, depending on the size of capital expenditure. A host country may be concerned with employment in the construction sector, supply of materials and equipment used for the facility, and benefits to indigenous E&C firms in the country with respect to its share of a contract, technology transfer, and the impact on the competitiveness of the indigenous E&C firms. The host country government may intervene in the ways in which contractors, engineers, subcontractors, and suppliers are chosen and where labor, materials, and equipment are sourced.

#### 4) Specialization and Diversification in Product Segments

E&C firms construct physical facilities in all industrial sectors (and housing for consumers) so that the final outputs of E&C are of many kinds. Conventionally, these outputs have been conveniently divided into two categories by type of owners, private and public. The former includes individual, commercial, and production facilities while the latter are intended for public uses. The former usually includes residential houses (for single or multiple families), office buildings, hotels and motels, educational buildings, farm facilities, industrial facilities, and utilities, e.g., telephone, telegraph, railroad, electric power, gas, and petroleum pipelines. The latter includes multi-unit housing, industrial and educational facilities, hospitals, highways and streets, military facilities, and sewer and water supply systems. There are some duplications in segment between public and private depending on the policies of a government.

To the extent that construction in different segments requires different expertise and such expertise assures acquisition of contracts, firms in the

construction industry have an incentive to specialize in certain segments both in physical production and engineering and/or management.

However, demand for a particular kind of facility is generally influenced by two different factors, those specific to the industry to which the facility belongs and the country in which it is located.<sup>13</sup> The latter influences demand for all kinds of facilities although the intensity of such influences may vary by segment. Subsequently demand for a certain kind of facility is subject to complex fluctuations. To minimize such risk, firms may diversify into several product segments. However, determining the optimal degree of specialization and diversification is a complex decision. The segments in which a firm chooses to compete may depend on the balance between its internal resources and the competitive environment in the segment.

#### 5) Specialization and Vertical Integration in Functions

In the E&C industry, there are, in general, four kinds of firms. First, there are the so-called speciality contractors specializing in physical erection of facilities. Each usually specializes one of different kinds of work, such as drilling and placing piles, erecting steel structures, placing concrete forms, peuring concrete, finishing floors and walls, and so on. Second, contractors specialize in managing labor, speciality contractors, and suppliers which belong to other industries and provide materials and equipment for the physical erection of facilities. Third, design firms specialize in designing (-- architectural and

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<sup>13</sup>. For example, demand for infrastructure facility (e.g., highways) may be influenced by industry factors, such as size, age, and condition of the stock, future increase in need, time period over which the facility is expected to service, response of demand to price, and so on, and country factors, such as balance of payments, budgets of public and private organizations, prices of natural resources to the extent a country relies on it economically, and government industrial policies. For a complete economic analysis of demand for different segments, see Hillebrandt (1974), pp.39-81.

engineering --) facilities. Fourth, engineering firms specialize in designing and performing feasibility studies and other pre-construction activities for industrial and other complex facilities, such as chemical or oil refinery plants for the former and airports for the latter. These firms perform different functions in constructing a facility.

However, the distinction between these types of firms is often blurred through vertical integration in functions. For example, an engineering firm, which is considered a design firm vertically integrated backward into all sorts of pre-construction activities, may engage in project management and procurement while a contractor acquires the ability to design a facility and perform many pre-construction studies. Also, a contractor quite often hires workers and performs specific physical construction works by itself. Furthermore, the border of the construction industry itself is becoming blurred as firms gain the ability to provide a financial package, which might otherwise be provided by a client or financial institutions. The degree of a firm's specialization vis-a-vis vertical integration of functions depends on the types of contracts in which the firm engages, a client's request to an E&C firm to perform particular functions, contracts which are more likely to be gained by a vertically integrated (or specialized) firm; and a decision of a firm on function(s) which it emphasizes as part of its competitive strategy.

#### **1.4.2 Additional Characteristic of International Production of E&C Firms**

In addition to the above five characteristics, there are three aspects of the production of E&C firms, that have received relatively little attention in the literature in this industry. They are as follows.

### 1) Ambiguity of Goods and Service Production of E&C Firms

Given the specialization of functions of E&C firms, there is a difficulty in defining E&C production: Although the E&C industry is usually categorized as a service industry, firms in the E&C industry produce both goods and services. Like manufacturing firms, the specialty contractors produce a large amount of physical output while contractors and engineering firms may not produce any physical output directly. In addition, there are significant physical inputs, such as materials and equipment, into the construction process from suppliers, and the final outputs of the industry are goods. Unfortunately, theoretical treatment of E&C production has not been sufficient enough to address this ambiguity in a systematic way.

It is important to determine whether the E&C industry is a service, manufacturing, or distinctive industry which involve aspects of both, and how E&C production can be compared to that in other industries. If the E&C industry and its production are unique, it is theoretically not advisable and is probably misleading to apply ideas established for other industries to the E&C industry and its firms.

Fortunately, the study of services, though not fully fledged, provides an idea for resolving these issues. The theoretical framework of globalization to be presented in Chapter 3, develops this idea into a comprehensive conceptualization for the E&C industry.

### 2) International Involvement of an E&C Firm

Manufacturing firms usually serve foreign markets in three primary modes: export, foreign direct investment (FDI) including equity-base joint venture, and others requiring a loose commitment with a local firm (e.g., technical training, patent licensing, franchising, management service

agreements, and non-equity cooperative agreements). These alternatives enable manufacturing firms to serve foreign markets. Selection of a mode is subject to the economic, political, and strategic discretion of the management of these firms.

In the construction industry, the ways in which a foreign market may be served seem to be less straightforward because of the unique production process and subsequent industrial structure of the industry. For example, Seymour (1987) defined modes of foreign involvement based on the terms and concepts used in manufacturing firms, such as FDI, joint venture, licensing, etc. However, his straightforward application of such modes failed to provide an appropriate interpretation of the mode for construction. Seymour's analysis (1987, pp.106-128, 177-196) underestimates the importance of the fact that production in the construction industry is basically carried out on a contractual basis, even in a turn-key contract. Of course, construction on an equity basis exists, such as in a B.O.T.(Build-Operate-Transfer) contract, but this is a means to finance a project when a client cannot afford to. Consequently, Seymour thinks that a joint venture in construction is formed on an equity basis like the joint venture production of automobiles. However, a joint venture is a form of production available to a firm regardless of the degree of equity participation of the firm in any industry.

Possible reasons for his somewhat idiosyncratic approach may be as follows: First, he focused only on the heavy civil sector in which firms may hire labor itself and engage in physical production. However, such a form of production is limited to certain heavy civil sectors (such as dams) Also, even projects in the heavy civil sector are usually not carried out on an equity basis. Second, and related to the first reason, he seems to have overestimated the motivation for vertical integration implied by the "internalization" concept (one of several influential MNE theories which we will review in the next chapter) relative to the motivations for specialization. However, such a misunderstanding

is not limited to Seymour. Casson's work (1987, pp.153-186) also overestimated the incentive for vertical integration in applying internalization concepts to U.K. construction firms. The work of Strassmann et al (1988, pp.227-228) also overlooks the implication of the internalization concept for the international construction industry.

In considering the globalization of E&C firms, it is important to define modes of foreign involvement more precisely and to suggest the differences in how each mode may work for the construction industry compared to other industries. For example, establishing a foreign subsidiary may be considered FDI but unlike manufacturing, for construction such FDI does not necessarily mean involvement of the subsidiary in physical production of a facility. Also, the export of E&C services may not necessarily be performed by transferring personnel from headquarters, for example, because technological advances in telecommunication enable engineering personnel to perform various engineering work from a far. In fact, Bechtel Group has set up a computer and satellite communications network which enables it to coordinate the activities of engineers in India, project managers in San Francisco, and construction supervisors on site in Saudi Arabia and to transfer substantial amount of E&C work to other units of the firm.<sup>14</sup>

More importantly, when a firm's geographic market becomes worldwide, the modes of international involvement of the firm may be different. For example, it may not be feasible to serve a large number of countries only through the export mode due to limited market surveillance, or more practically, to trade barriers and the rise of protectionism in certain countries. Also, establishing subsidiaries and duplicate activities in 50 countries may not be an optimal solution

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<sup>14</sup>.UNCTC (1988), in the footnote at page 442.

for a firm concerned with overhead costs. We are not aware of a mode or a mix of modes through which any E&C firm has served a large geographic market.

An appropriate explanation of the complex modes of foreign involvement of E&C firms may be constructed through combining aspects and insights from trade theory, MNE theory, which deals with FDI and modes of foreign involvement, and the study of services, which provides a clue to understanding how trade in E&C services takes place.

### 3) International Organization of an E&C Firm

Conventionally, the international organizational units of the E&C firm are classified into three primary forms, headquarters, foreign subsidiary, and project office, based on the roles played. Twenty years ago, an E&C firm might be organized in such a way as headquarters performed all pre-construction activities and exported E&C services through its project offices set up at the locations of projects, or subsidiaries, which were replicas of headquarters, carried out a large part of the headquarters' role while the project offices sourced all necessary inputs in the host country and performed all project management activities. In this situation, the competitive advantages of E&C firms would be nothing more than the static ones described earlier (e.g., project management or engineering expertise and financial packaging capability).

In the 1980s, however, this kind of rigid organizations did not seem to be appropriate any more. Technology changed dramatically in this decade. E&C firms operate in much larger geographic markets. They compete in a complex environment as presented earlier in this chapter. The role of each organizational unit has also changed dramatically, and the rigid distinctions between headquarters, subsidiary, and the project office may mean little to E&C firms. For example, technological advances in computers, allowing calculations and

management of large amount of data to be performed in much shorter periods, may drive firms to integrate certain activities at fewer locations.

Such an integration of activities may necessitate geographic separation of activities which otherwise would be duplicated at each organizational unit. Firms may have coordinate activities performed at several locations to complete a project at one location. Also, E&C firms which compete on the basis of firm-specific knowledge, may need to coordinate such knowledge over their whole organization to be competitive in a large geographic area. Moreover, E&C firms which are diversified into many product segments (as is often the case in the E&C industry) may face complex decisions on duplication vis-a-vis integration and coordination of multiple kinds of firm-specific knowledge.

In addition, as mentioned in the case of Bechtel, technological advances in communication not only allow firms to transmit work done at one location to multiple locations simultaneously but also give them the flexibility to decide where to perform a particular activity. Most importantly, the reasons for giving to headquarters and subsidiaries duplicated roles may diminish; each project office may not need a whole set of engineering and project management capability. We are simply not aware of how international production takes place within the modern E&C firm.

The framework proposed in this study is designed to provide a theory for considering where internal activities and external inputs may be located; the extent to which activities and inputs are coordinated; and more importantly, how the way in which an E&C firm is organized may shape its competitiveness in the "global" marketplace. The empirical part of this research shows the realities of competition among international E&C firms.



## 1.5 Objectives of the Research

The objectives of this research are as follows:

- 1) To establish a theoretical framework of globalization for E&C firms, in which issues of globalization of E&C firms are treated in a systematic manner. The framework defines and explains the modes of globalization, reasons why and ways how the firms become global in each mode, and the competitiveness obtained by becoming global.
- 2) Using the framework, to examine empirically the degree of globalization of the E&C firms and industry, and the extent to which international competitiveness generated by global strategies is significant compared to other well-known sources of competitiveness, such as expertise in engineering, project management, financial packaging.
- 3) To provide practical and academic implications for formulating and implementing global strategies for E&C firms, based on the theoretical framework and the data obtained from the empirical analysis.
- 4) To demonstrate the production characteristics of E&C firms, known to have idiosyncratic forms of production and industrial relations, are comparable to manufacturing and service firms in order to facilitate studies comparing E&C firms and other industries.

## 1.6 Research Methodology

This study establishes a theoretical framework for globalization of E&C firms taking into account four different strands of management and economic studies.

1. Porter's model of globalization, the most widely known comprehensive theoretical model, provides a basic concept of the competitive advantages gained by global strategies, in which a firm locates and how it links activities. Other studies following Porter, though limited in number, help understanding globalization and provide practical inputs to Porter's model from various aspects, such as organization, marketing, finance, and production.
2. Trade theory suggests that trade patterns are determined by national differentials in factor costs and technology, which may also explain a large part of the trade patterns in E&C services. Comparative assessment of trade pattern between developing and developed countries and that between developed countries provides a theoretical foothold for considering the transformation of E&C firms' geographic markets in the 1980s, from developing to developed countries. In addition, intra-firm trade provides a good theoretical ground for analyzing the essential attributes of global strategies, "coordination".
3. Multinational enterprise (MNE) theory provides prolific theoretical ingredients for a model of globalization for an E&C firm from economic, managerial, and organizational viewpoints. MNE theory suggests that to deal with various external market imperfections, such firms create their own internal markets; Their internal markets provide them with opportunities to "coordinate" flows of goods, services, capital, and information, essential aspects of "coordination". Also, MNE theory, especially the concept of

"internalization" of markets for knowledge, explains the horizontal expansion of market and organization of an E&C firm.

4. The study of services explains a large part of the idiosyncratic nature of E&C firms' production, which is comprised of goods and service production. It puts E&C firms on ground comparable to firms in other industries. It elucidates the modes of international involvement of service firms, and thus of E&C firms.

The model is empirically analyzed using data obtained from E&C firms which actually operate in international markets. To obtain such data, a questionnaire was designed and sent to the top international E&C firms identified in Engineering News Record's (ENR) annual survey of "Top International Contractors". Then, out of the firms which responded to the questionnaire, intensive interviews were conducted with executives of the firms which agreed to such interviews, to complement the points which may not have been adequately examined by the questionnaire.

## 1.7 The Structure of The Research

Chapter 2 reviews the four strands of studies addressed above. The chapter explains the distinctive characteristics of production of E&C identified in the previous section. More importantly, however, it sets out the theoretical basis on which a model of globalization may be built.

Chapter 3 proposes a theoretical model of globalization of E&C firms. The model is comprised of three elements of globalization, and the mechanism, process, and factors by which E&C firms globalize. Two propositions are presented for analyses in the following two chapters.

Chapter 4 empirically analyzes a large part of the prediction made by the theoretical model using the data obtained from the questionnaire survey.

Chapter 5 uses the interview data to examine the remaining part of the theoretical predictions in the model and illuminates issues important in implementing global strategies.

Chapter 6, after summarizing the result of the empirical analysis, discuss the validity of the model. The chapter analyzes its strategic implications for the globalization of E&C firms. Finally, the chapter suggests promising future studies which may explore the issues of globalization.

Finally, two appendices are attached to the study. Appendix A shows the result of a correlation analysis among several key variables of globalization, such as an E&C firm's foreign revenue, market presence (number of countries with foreign subsidiaries), and foreign markets captured (number of countries with projects undertaken). The result illuminates the relationship between nationalization and globalization. Appendix B presents the text of the questionnaire used in the field survey.

## **CHAPTER 2**

### **LITERATURE REVIEW**

This chapter reviews four kinds of studies, studies of globalization, trade theory, MNE theories, and studies of services, which altogether explain the distinctive characteristics of E&C production outlined in the previous chapter and provide a theoretical basis on which a theoretical model of globalization may be established.

#### **2.1 Literature Review on Globalization and Global Strategy**

This section reviews studies of globalization that have appeared in the 1980s. The most important study is that developed by Michael Porter. He provides the most widely known and comprehensive theoretical basis for the study of globalization, although several adjustments are needed to render the theory applicable to the study of globalization of E&C firms. Other studies deal with the influences and implications of globalization for particular firms, functions they perform, and industries.

##### **2.1.1 Michael Porter's Framework for Globalization**

Porter's (1986) framework for globalization builds on his earlier work on competitive strategy (1980, 1985). It is based on three distinctive concepts: 1) value chain, 2) configuration and coordination, and 3) global and multi-domestic competition. These concepts are derived from his theoretical and empirical studies of business and industrial organization.

### 2.1.1.1 Concept of Value Chain

Porter (1985, 1986) developed the concept of the "value chain" in which a firm is disaggregated into several pieces, or "value activities". Value activities are technologically and physically distinct activities performed within a firm. They include such things as sales people's selling the product, service technicians' performing repairs, scientists' designing products or processes in the laboratory, and accountants' keeping the books.<sup>1</sup> A value activity represents not only a function of human activity but the costs associated with the activity. More specifically, each value activity consists of costs of maintaining the human resources (i.e., labor and management) to perform the activity; purchased inputs; and technology.<sup>2</sup> An entire value chain represents the total revenue, and consists of a total cost (a collection of value activities) and a profit. (See Exhibit 2.1.1 below.)

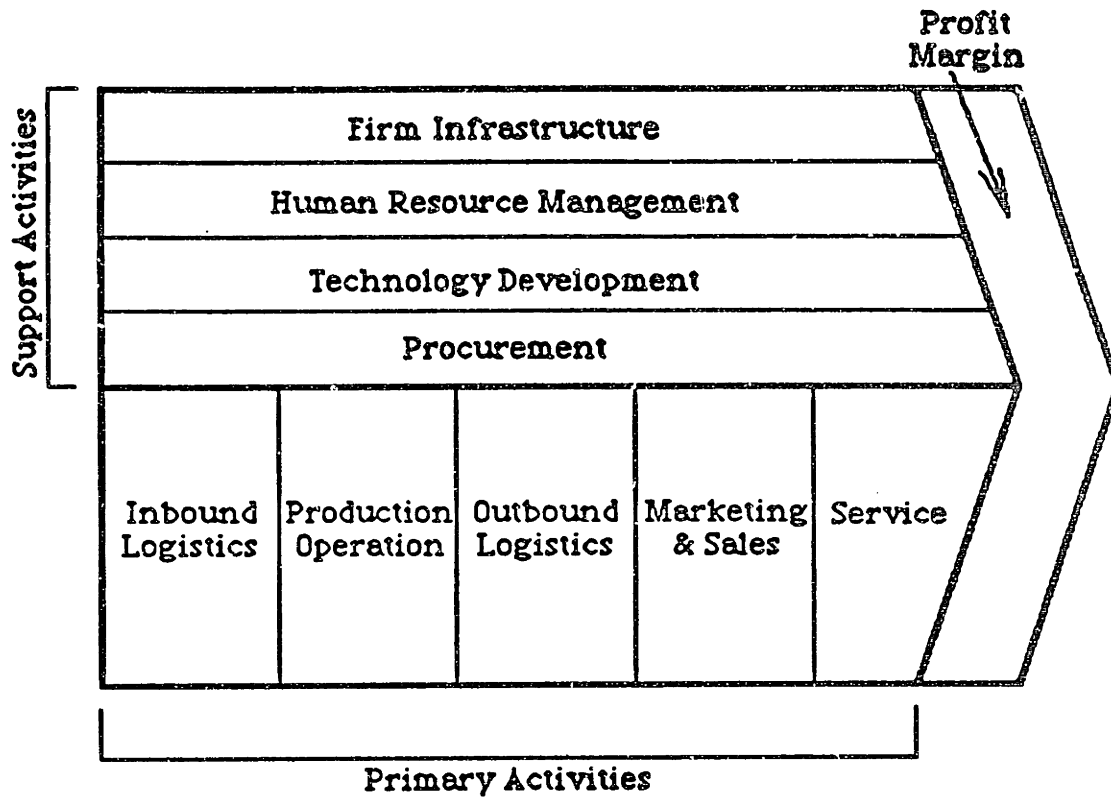
Value activities fall into two broad categories, primary and support. Primary activities (the lower half of the chart in Exhibit 2.1.1) are activities related to the physical creation of the product, their sale and transfer to the buyer, and after-sale assistance while support activities (the upper half of the chart) are those which allow the primary activities to take place on an on-going basis. Porter divides the primary and support activities into five general categories each, as shown in the figure. Each category is divided into the number of distinct value activities for analysis.

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1. Porter (1986), p.19.

2. The separation of technology from human resources is arbitrary because human resources already embody a large part of technology. This point is developed in the value chain concept presented in Chapter 3.

Exhibit 2.1.1 Generic Value Chain



Note: A definition of each entry is provided as following.

Primary Activities:

- (1) Inbound Logistics - Receiving, storing, and allocating intermediate inputs, material handling, warehousing, inventory control, and vehicle scheduling.
- (2) Production Operation - Transforming inputs into the final product form, assembly, packaging, equipment maintenance, testing, and facility operation.
- (3) Outbound Logistics - Collecting, storing, and physically distributing the products to buyers, finished goods warehousing, material handling, delivery vehicle operation, order processing, and scheduling.
- (4) Marketing and Sales - Providing a means by which buyers can purchase the product and inducing them to do so, e.g., advertising, promotion, sales force, quoting, channel selection and relations, and pricing.
- (5) Service - Providing service to enhance or maintain the value of the product, e.g., installation, repair, training, parts supply, and product adjustment.

Support Activities:

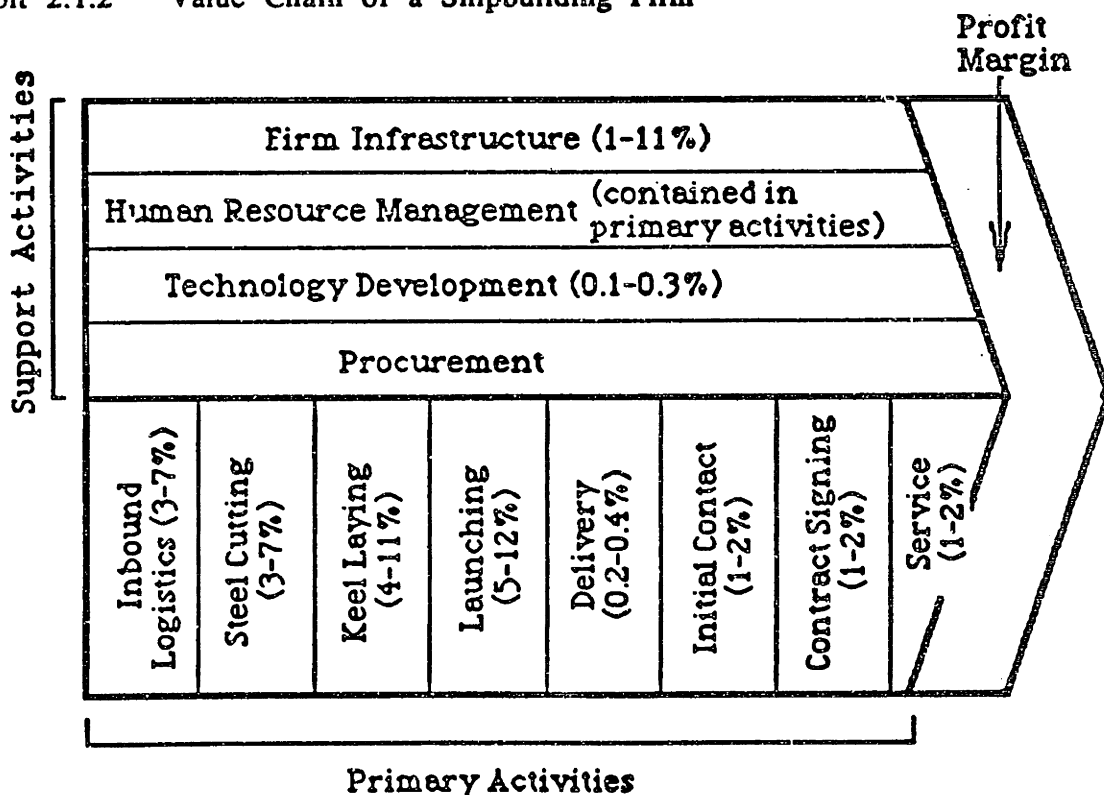
- (1) Procurement - Purchasing inputs used in the firm's value chain (but not inputs themselves).
- (2) Technology Development - Improving the product and the process of the firm.
- (3) Human Resource Management - recruiting, hiring, training, and compensating all types of personnel.
- (4) Firm Infrastructure - General management, planning, finance, accounting, legal, government affairs, and quality management.

Source: Porter (1985), pp.36-45.

Porter's value chain concept has several advantages. It makes it possible to analyze 1) a firm's cost competitiveness gained from each value activity; 2) relationships between activities within a firm, e.g., linkages between up-stream and down-stream activities, and activities in different product segments; 3) relationships between activities of a firm, of the buyers of its outputs, and of the sellers of its inputs; and 4) activities separated by geographic distances (most important to the study of globalization).

However, Porter's inclusion of costs in the value chain, particularly costs of inputs into each activity, is a double-edged sword. The inclusion of costs in the value chain provides an "approximate" idea of how various costs are borne at a glance. In addition, the inclusion of inputs highlights the relative importance of costs borne for certain activities or inputs. (Exhibit 2.1.2 is an example of a value chain of a shipbuilding firm from Porter (1986).)

Exhibit 2.1.2 Value Chain of a Shipbuilding Firm





However, in practice, it is often not so easy to obtain a cost figure borne solely in each activity for several reasons (e.g., difference between classifications of value activities and organizational units for which data are accumulated). Accounting cost and profit, which Porter seems to adopt, are influenced by factors other than value activities and inputs, such the asset and liability structure of a firm, so that a presentation of cost in a value chain only roughly approximates the cost structure of a firm. Furthermore, the inclusion of inputs does not represent the diversity of contracts that typify the E&C industry. For example, materials, equipment, and works of subcontractors are purchased as inputs to an E&C firm based on a lump-sum contract while they are not if based on a fee-based construction management (CM) contract.

#### 2.1.1.2 Concept of Global versus Multi-domestic Competition

Porter identifies two types of industries, global and multi-domestic.<sup>3</sup> Global industries are those in which firms compete against each other on a worldwide basis. Multi-domestic industries are those in which firms compete with in each country (or small group of countries), essentially independent of competition in other countries.<sup>4</sup>

In a multi-domestic industry, an international firm may take advantage of the one-time transfer of know-how acquired in its home country, but the competitive outcome over time is determined by conditions in each country, and thus multi-domestic. At this point, a firm manages its international activities as a portfolio. In a global industry, very often, a firm's competitive position in one

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<sup>3</sup>The distinction between global and multi-domestic competition along with their naming appeared first in Hout, Porter, and Rudden (1982) and was elaborated theoretically in Porter (1986).

<sup>4</sup> Porter (1986), p.18.

country is significantly influenced by the outcome in other country. A firm may integrate its activities in various ways on a worldwide basis to capture the linkages among countries.<sup>5</sup> From the standpoint of the firm, the distinction between multi-domestic and global industries becomes clearer when the concepts of configuration and coordination are introduced.

### 2.1.1.3 Concept of Configuration and Coordination

The concepts of configuration and coordination play an integral part in Porter's global strategy model. Configuration refers to the geographic location of each activity in the value chain of a firm. Configuration options range from concentration, i.e., performing all activities in one location, possibly in the firm's home country and serving the world market primarily by export, to dispersion, i.e., performing activities in every country. In the extreme case of dispersed configurations, a firm creates a complete value chain in each country. Concentration of activities is driven by factors such as economies of scale and proprietary learning in an activity; a comparative advantage for performing a certain activity; and a close relationship between activities, such as R&D and production; homogeneous product needs; lower transport and storage costs; less nationalistic purchasing (or nomination of firms), and so on. Dispersion of activities is the result of a low level of intensity in these factors.

Coordination refers to how activities performed in different countries are coordinated with each other. Coordination ranges from low to high, and options for coordination also vary from none to many by types of coordination and activities to be coordinated. Although Porter's definition of coordination is not quite clear, he provides examples of coordination issues as listed here:

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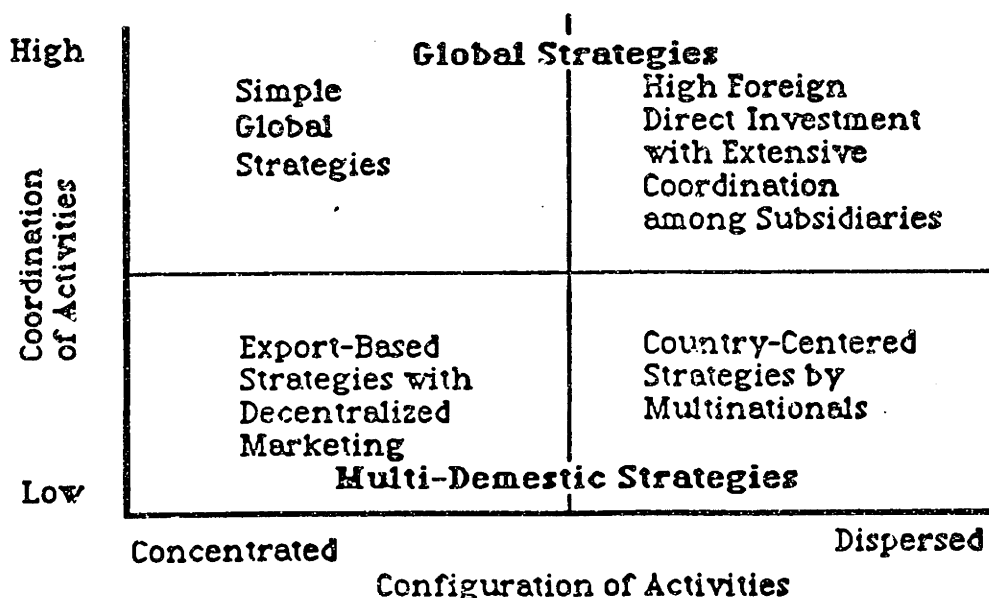
<sup>5</sup>.Porter (1986), p.19.

Value Activity	Coordination
Operations	Allocation of production tasks among dispersed facilities Networking of international plants Transferring process technology and production know-how among plants
Marketing and sales	Commonality of brand name worldwide Similarity of channels and product positioning worldwide Coordination of pricing in different countries
Service	Similarity of service standards and procedures worldwide
Technology Development	Allocation of research tasks among dispersed R&C centers Interchanging R&C centers Sequence of product introductions around the world
Procurement	Transferring knowledge about input markets Coordinating purchases of common items

Source: Porter (1986), p.26.

The firm faces an array of options in both configuration and coordination, and its strategic position can be plotted on a two-dimension grid. Depending on the firm's choice of options for the combination of configuration and coordination, the firm is roughly categorized as either global or multi-domestic. Exhibit 2.1.3 illustrates the point.

Exhibit 2.1.3 Configuration and Coordination of Activities



The upper half of the chart represents global strategies while the lower half represents multi-domestic strategies. The simple global strategy is represented in the upper-left quadrant in the figure. A firm there may concentrate many activities in its home country and serve the world market only by export. Its products are coordinated through intensive standardization.

The complex global strategy is reflected in the upper-right quadrant. A firm may perform most of its production activities in separate foreign countries but headquarters coordinates the dispersed activities, either across or within the value chain activities. The headquarters of such a firm may coordinate intra-firm shipping of parts, components, and even finished products among multiple plants within the firm.

Global strategies may vary considerably between extreme upper-left and upper right corners. Also, the degree of globalization moves down the vertical axis.

In contrast, the simple multi-domestic strategy may be seen in the lower-left quadrant. Such a firm may perform many activities in its home country and place only marketing or sales activities abroad. In the lower-right quadrant representing the country-centered strategy are firms with independent strategies for local markets. Headquarters monitors the performance of its unit in each country, and treats its international operations as it would be a portfolio.

In short, a firm concentrating activities in one or two locations to serve the world can reap economies of scale; increase the rate of cumulative learning; simplify coordination with other activities; and reap benefits from performing the activity in a country where a comparative advantage to performing the activity. Coordinating dispersed activities in various ways can lead to accumulation and transfer of knowledge, a consistent image with buyers, flexibility in competitive response, and other benefits. Like global strategies,

multi-domestic strategies are numerous in kinds as the positions from left to right indicate. As a firm's position ascends, the multi-domestic characteristics of a firm diminish.

#### 2.1.1.4 Shortcomings of Porter's Model of Global Strategy

Despite the many attractive characteristics of Porter's model, several shortcomings must be overcome for it to be truly applicable to the E&C industry. There are five:

1. The concept of coordination, one of the key concepts in Porter's model, is not precisely defined, nor are motivations for coordination elaborated.
2. Porter's globalization model refers to industry rather than firm. However, how and why firms expand into foreign markets seem to be crucial questions to determining the configuration of activities of the firms.
3. Although both configuration and coordination are important sources of competitiveness firm may obtain from global strategies, Porter fails to explain first, that the true yardstick of a firm's globalization is the degree to which its activities are coordinated and second, that differing configurations provide only variations to global strategies.
4. Porter's model is applicable to single value chain (product line) firms, not to a multi-business firms. However, many international firms, including E&C firms, are diversified in product-segments which cannot be explained by a simplistic value chain.
5. Porter's model of global strategy (particularly his value chain) incorporates only the costs of inputs. However, inputs are substitutes for internal activities; they may form their own configuration and coordination as do internal activities, and influence the global strategy of a firm. That is, the

supply of inputs can be highly concentrated or highly dispersed; firms can coordinate their suppliers' activities very closely with their own, or very loosely. In an industry like E&C, where so much of the value added comes from suppliers, it is essential to map the configuration and coordination of external as well as internal value-adding activities.

Any model of globalization that builds on Porter's work must therefore be adjusted to accommodate E&C firms.

### 3.1.2 Other Studies of Globalization

Porter's edited volume contains several chapters which take the basic concept of globalization and provide insights from specific viewpoints, for example, for a specific industry or for a particular function. Some of the studies also provide cases of how globalization evolved over time in certain industries. Those with greatest relevance for E&C firms are summarized below.

#### 2.1.2.1 Manufacturing Operation

Flaherty's (1986) cases show how global strategies work, especially what coordination means, how coordination works at the operational level, and what drives firms to adopt global strategies. The specific types of manufacturing coordination in her cases are very interesting. They include adjustment of production quantity in the intra-firm trade of semi- and finished products and the shared use of information about technology support activities among facilities at different locations.<sup>6</sup> The types of coordination seem to be associated with 1)

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<sup>6</sup>. This includes procurement, aggregate production planning, daily production planning and expediting, quality assurance, employee management and

vertical integration between plants, or intra-firm trade; 2) adjustment of production quantity among multiple plants (i.e., serving one country by having multiple plants produce similar products); 3) sharing information of vendors and an excellent procurement practice of one plant with other plants; and 4) sharing and exchanging technological information among multiple plants.

Flaherty found that firms tended to gain new competitive advantages by adopting global strategies when their international competitive positions were jeopardized (e.g., more international competition, smaller profits, higher interest rates, rising material costs, more rapid product changes, and pressure to reduce inventory). She also suggested that similarity in products line and production technology among multiple production plants for manufacturing are effective forms of coordination. Coordination among different product-segments seems to be difficult at the production level. She points out that when in firms where manufacturing units in different countries had become accustomed to acting fairly independently, it was more difficult to adopt and implement global strategy.

#### 2.1.2.2 Marketing

Basing their work on a field survey of successful international firms, Takeuchi and Porter (1986) address three marketing issues important in global strategy. The issues are associated with 1) configuration of marketing activities; 2) coordination of marketing activities performed in different countries; and 3) linkages of marketing to configuration and coordination of other activities.

First, although there is considerable difference of opinion between those supporting localized and centralized marketing, Takeuchi and Porter argue

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development, manufacturing engineering, product design and improvement, process design and improvement, and new product and process introduction.

marketing activities must be done both locally and centrally. Although dispersion of marketing activities to each country in which a firm competes is usually necessary, certain marketing activities may be better performed centrally, particularly by a skilled marketing group stationed at world or regional headquarters, if 1) the complexity of the marketing task is very high; 2) large orders (or an order of large value) are placed at one time; and 3) purchases are made infrequently.

Second, Takeuchi and Porter list practical examples of important marketing coordinations. These include sharing and exchanging information among countries and regions about clients (especially important multinational clients), market demand, trends in technology, successful new product introductions, and early market signals by competitors. Possible advantages generated by sharing such information include economies of scale in the use of the marketing forces, reduction of marketing costs, increased opportunity, and a competitive advantage of offering multinational clients a single contact.

Third, Takeuchi and Porter raise four major roles linking marketing to other activities: 1) supporting the development of universal products to be sold worldwide by providing information on client needs; 2) creating demand for more universal products; 3) identifying segments which enable the sale of universal products; and 4) providing services and local accessories to effectively tailor standard products to local needs.

### 2.1.2.3 Organization

Bartlett (1986) provides organizational challenges to global firms. He criticizes Stopford and Wells' "stage model", which has been a benchmark for the design of organizations of multinational enterprises, as too universal and simple a



solution. He claims that the stage model, based only on the product and geographic dimensions for diverse and complex problems, is not appropriate for global firms.

Bartlett suggests three broad constraints that influence the configuration and coordination of a firm, 1) industry characteristics, 2) strategic position of a firm in the industry; and 3) a firm's administrative heritage. In discussing the last factor, Bartlett contrasts the development of a typical multinational whose major international expansion occurred in the interwar years and a Japanese multinational that made its main international thrust in the 1960s and 1970s.

Bartlett argues that, given the complex and diverse demands and pressures of the competitive environment in the 1980s, international firms were often buffeted by conflicting organizational forces, those driving firms to coordinate activities on a worldwide basis, and those stimulating firms toward greater degrees of national differentials and responsiveness; Porter's "complex global strategy" was the most promising but demanding strategy for the 1980s and should be in the 1990s from an organizational point of view. He also argues that "multi-domestic" and "simple global" strategies cannot respond effectively to the environment; Firms adopting the "multi-domestic" strategy will suffer from duplication of effort, inefficiency of operations, and barriers to international learning while firms following the "simple global strategy" may have difficulty in responding appropriately to diverse worldwide demand, thus overloading their capabilities.

Implementation of the "complex global strategy," requires three distinctive organizational characteristics. First, the management of a firm must develop the ability to sense and analyze diverse and often conflicting demand and opportunities. Second, a firm must establish an interdependent worldwide organization in which each of the units is a source of ideas, skills, capabilities, and knowledge that can be harnessed for the benefit of the total organization

(e.g., an innovative national lab to be the firm's center for new products and process development and a creative subsidiary marketing group to play a leading role in developing worldwide marketing strategy). Third, having established management groups representing multiple perspectives, and a dispersed configuration based on distributed and interdependent activities and different organizational capabilities, a firm requires a management process that can resolve the diversity of interests and perspectives and integrate the dispersed responsibilities.

Porter and Fuller (1986) examine globalization from the view point of coalitions, which are formal, long-term alliances between firms that link aspects of their businesses but fall short of mergers. They assert that the benefits of coalitions are enhanced by global competition in conjunction with high R&D expenditure, economies of scale and learning in different parts of production performed by different firms; and different comparative advantages captured by firms from different countries. They predict that coalitions involving multiple activities and multiple countries will become more prevalent and that coalitions among firms from developed countries will overtake those between developed and developing country firms.

#### **2.1.2.4 Government Relations**

Encarnation and Wells (1986) assert that as many industries globalize, foreign governments become more active and increase their ability to monitor the terms to which firms agree in other countries. This means that an incident associated with any national unit of a firm (or of a competing firm) may affect the negotiations entered by the same firm in another country.

Mahini and Wells (1986) suggest that globalization of industries pushes firms to coordinate government relations through their central units. For the successful international firms they surveyed, headquarters played an important role in coordinating government relations. Only a firm with a strong bargaining position (e.g., a monopoly position with respect to important technology or major markets) can resist local governments' requests, such as sharing ownership with local firms and local purchases of certain components. Only firms with small and multi-domestic operations can successfully adopt a country-by-country approach to local governments.

Doz (1986) uses a survey of European multinationals involved in business with foreign public sectors to his assertion that firms with low to medium levels of sales to foreign public sectors tend to take global (or coordinated) strategies while firms with high levels of such sales tend to take a multi-domestic (or national responsive) strategies. Moreover, even small firms take global strategies if they are not involved in foreign public sector markets. A diversity of policies among foreign governments induces a diversity of configuration and coordination of firms as well.

#### 2.1.2.5 Finance

Lessard (1986) looks at the finance function in the global competition, and identifies its roles as: 1) to provide a yardstick for judging current and prospective operations; 2) to raise funds required for such operations; and 3) to add value by exploiting distortions in financial markets, e.g., reducing taxes,<sup>7</sup> and

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<sup>7</sup>He argues that insofar as financial markets are not fully integrated (or as financing concessions differ among countries) the ability of global competitors to span these markets will increase the likelihood that they can identify and exploit financing bargains. Also, refer to the review of his works related to MNE theory in a later section.

4) managing the foreign exchange risks inherent in the firm's worldwide activities.

He argues that global competition generally increases a firm's exposure to exchange rate volatility so that hedging foreign exchange risks becomes more important for firms pursuing a global strategy than for those involved in multi-domestic competition. Lessard suggests four fundamental options for managing operating exposure (as distinct from the more commonly studied accounting exposure and transaction exposure): 1) Configure individual business to have the flexibility to increase production and sourcing in countries as they become low-cost venues as exchange rates swing. 2) Configure individual businesses to reduce operating exposure by matching costs and revenues. 3) Select a portfolio of businesses with offsetting exposures. 4) Use financial instruments, such as currency forwards, swaps, currency options, and borrowing local currencies. While these options do not necessarily constitute competitive advantages of the global firms, they are important methods for remaining competitive.

## 2.2 Literature Review of Trade Theory

Trade theory is a well developed field in international economics, and its scope is very diverse. However, literature dealing with trade in E&C services is curiously nonexistent even though construction is an important economic sector in most national economies and imports of E&C services are crucial to the economic development of many developing countries. Among the many modifications to the classic trade theory, however, is some recent work on trade in services, which have attempted only to apply a modified Heckscher-Ohlin model of comparative advantage to inter-industry trade in a limited number of service industries. These studies, although limited in scope, raise some important issues for the study of globalization of E&C firms, particularly the geographical configuration of E&C services production.

However, of more importance for this study are those dealing with intra-industry and intra-firm trade. Studies on intra-industry trade provides an insight to the transformation of E&C service trade from between developed and developing countries to between developed countries. Studies on intra-firm trade illuminate practical meanings of "coordination," a key concept in globalization.

### 2.2.1 Trade in Services

The first quantitative attempt to assess the relative importance of production factors in shaping comparative advantages in services was done by Sapir and Lutz (1981). Applying a simple econometric model to a small number of service industries and countries, they concluded that the main factor determining trade patterns is the availability of physical and human capital. The industrialized countries usually enjoy a strong competitive edge in service trades based on their comparative advantages stemming from their abundant physical and human

capital. Also, they argue that developing countries, if successful in accumulating these two kinds of capital, have good prospect for exporting services. Hindley and Smith (1984) support Sapir and Lutz's finding, and assert that firms in construction are often able to compete by combining their physical assets and knowledge with labor sourced in developing countries.

These two arguments seem to be very appropriate to the E&C services. Casual observation of the trend in the flow of E&C services in the past two decades clearly shows that international E&C services are exported primarily by the E&C firms in developed countries which have had massive markets for E&C in their home countries, such as the U.S., Western European countries, and Japan, to developing countries. Also, the emergence of E&C firms with export capability in developing countries, such as Korea, China, India, Turkey, and Yugoslavia, supports the second half of their argument.

### **2.2.2 Intra-Industry and Intra-Firm Trade**

Intra-industry and intra-firm trade are the most salient forms of trade which appeared after the Second World War and challenged the prediction of the orthodox trade theory. Intra-industry trade of E&C service poses interesting implications for the theory of trade between developed countries; concepts of intra-firm trade are enhanced by studying internal coordination associated with flows of goods and services within the E&C firm.

#### **2.2.2.1 Intra-Industry Trade**

Intra-industry trade is defined as the two-way trade of similar products between countries with similar high income levels. This type of trade is significant to the E&C industry because in addition to the trade from developed

countries to developing countries, in the 1980s E&C firms from developed countries have also penetrated each other's markets.<sup>1</sup>

### Reasons for intra-industry trade

Grubel and Lloyd (1975) found that in the current industrial classification, such as SITC (Standard Industrial Trade Classification), intra-industry trade exists in the data not only at the aggregated level (i.e., one-digit class), but also at the lowest level (seven-digit class) and that intra-industry trade cannot be explained by the orthodox trade theory. They suggested factors which explain intra-industry trade in addition to the data classification problems<sup>2</sup>: 1) differentiated products associated often with economies of scale of production, and different tastes and demand; 2) geographic dispersion of vertically integrated production<sup>3</sup> between several countries based on economies of scale combined with comparative advantages; and 3) homogeneous products, relative transportation costs, and so on.

The factors determining intra-industry trade, especially 1) and 3), are quite applicable to intra-industry trade in the E&C industry, such as between the U.S.

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<sup>1</sup>.A limited number of cases, for example National Research Council (1988), pp.81-84, "Foreign Contracts Bouncing Back," July 13, 1989 and "Foreign Contracts Hold Steady," July 7, 1988, Engineering News Record, as well as the field interviews made for this study show that mode of entry is not necessarily through trade but may be through local production of E&C services by E&C firms' own subsidiaries and branches as well as through local firms acquired by an E&C company for this purpose.

<sup>2</sup>.Certain intermediate products and finished products are classified within the same industry class. Helpman and Krugman (1986, p.255) argue that there is no intra-industry trade for narrowly defined product categories. However, if middle products and finished manufactured products are lumped together in the industrial classification, there will also be intra-industry trade.

<sup>3</sup>.Dispersion of vertically integrated production is distinguished from vertical integration by the point that in the former kind of production, the rapid pace of technological change enabling economies of production has made it both possible and desirable to split up the process involved in the production of certain manufactured goods into a much larger number of separate activities, and to perform them at different locations.

and U.K. Namely, intra-industry trade of the E&C services takes place whether the services are differentiated or homogeneous. In other words, if E&C services are truly differentiated (or proprietary), firms from developed countries providing such services can penetrate markets in other developed countries. Also, if the E&C services from developed countries are homogeneous, E&C firms can penetrate markets in other developed countries by combining other factors, such as reputations, past performances, or bid prices.

However, the intra-industry trade of the E&C service is more complicated. In addition to the fact that most services are produced at the project site rather than physically exported, it is often observed that local branches and subsidiaries produce a part of E&C services (e.g., marketing, engineering) locally on a long-term basis. Furthermore, such a local production of E&C services may sometimes be carried out through acquired national firms. Unfortunately, there are not many intensive studies of the relationship between intra-industry trade and intra-industry FDI.<sup>4</sup>

#### Regional and industry differences

There are significant inter-country as well as inter-industry differences in intra-industry trade, and a large number of empirical studies have attempted to obtain determinants for inter-country and inter-industry differences in intra-industry trade. Grimwade (1989) summarizes empirically identified factors influencing such differences. Factors affecting country differences in the level of intra-industry trade include: 1) per capita income; 2) stage of economic development; 3) geographical proximity; and 4) economic integration of

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<sup>4</sup>.Dunning (1982) shows only a minor correlation but Rugman (1985) shows a much stronger one. However, there are some theoretical linkages in that both arise from market imperfection, e.g., intra-industry trade from differentiation and economies of scale and intra-industry FDI from market imperfections for intangibles assets or knowledge in principle.(Grimwade 1989, pp.216-233)



countries, e.g., EC (European Community), LAFTA (Latin American Free Trade Area), and CACM (Central American Common Market).<sup>5</sup> Factors characterizing the industries include: 1) degree of product differentiation; 2) extent of economies of scale; 3) importance of FDI; 4) trade barriers; and 5) transportation cost.<sup>6</sup>

We must wait for major research dealing with determinant factors in the E&C industry. However, casual observation of the industry suggests that industry-difference factors are stronger than country-difference factors in determining trends for intra-industry flows of E&C services. For example, 3) and 4) for the former seem not to apply to the E&C industry. In 1987 the top non-national European firms captured only \$9.9 billion (2.6 percent) of the whole European construction market of \$380 billion<sup>7</sup> despite the existence of the EC and geographical proximity of its member countries, while they seized \$29.8 billion in more distant foreign regions in the same year.<sup>8</sup> In contrast, the significant non-tariff barriers affecting the E&C industry in EC, the importance of local production, and the importance of the degree of differentiation in the E&C industry, all for the latter, seem to influence intra-industry trade flows.

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<sup>5</sup>. Higher per capita income leads to greater demand for variety of products; as the stage of economic development becomes more advanced, the importance of manufacturing, which has higher intra-industry trade than services, rises. The stage of economic development has also high correlation with per capita income; the argument on homogeneous products applies; and economic integration, which is, of course, associated with exemption of tariffs, leads to a high level of intra-industry trade.

<sup>6</sup>. The more products are differentiated, the more intra-industry trade occurs. More economies of scale production leads to more industry specialization, thus more intra-industry trade. The relationship of off-shore production, or vertically disintegrated production over multiple countries has a strong correlation with intra-industry trade. Also, lower tariff barriers lead to more off-shore production and intra-industry trade. Lower transportation cost leads to more two-way trade depending on price, seasonal factors, and so on.

<sup>7</sup>. International Construction Week, October 1988.

<sup>8</sup>. Engineering News Record, July 7, 1988. The values captured by the European firms are based on total project costs based on level of responsibility set by Engineering News Record so that the values do not necessarily mean the values of contracts acquired by the firms.

### 2.2.2.2 Intra-Firm Trade

Intra-firm trade is defined as trade among affiliates of the same multinational enterprise (MNE), and it accounts for a significant portion of the entire trade of some countries.<sup>9</sup> Intra-firm trade is important to the study of globalization in the E&C industry because it is closely related to internal coordination. When there is intra-firm trade, it must be coordinated in some way. Furthermore, if we consider intra-firm service trade in addition to intra-firm goods trade, it is possible to explicate more accurately the internal coordination within an E&C firm associated with internal service flows which characterize the production of an E&C firm. Moreover, motivations and needs for coordination across activities argued in Porter's model of value chain, which has been reviewed earlier in this chapter, will become clearer.

Casson (1986, 1987) argues that significant intra-firm trade takes place in the extracting industries, such as petroleum and mining because the economic rationale for vertical integration by MNE justifies intra-firm trade. Elements of the rationale include the superiority of internal coordination in the supply of raw materials over the rigid contractual arrangements for demand fluctuations; securing quality of raw materials; and benefits of transfer pricing.

UNCTC (1988) reports that intra-firm trade is concentrated in the machinery industries<sup>10</sup>, such as automobile and home electric appliances, which

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<sup>9</sup>.In the early 1980s, the share of intra-firm trade in U.S. exports was around 30% and the proportion of imports accounted for approximately 40%. In Japan, intra-firm trade accounted for between a quarter and a third in the same period.(UNCTC 1988, p.91)

<sup>10</sup>.For example, in the U.S. exports and imports taking the form of intra-firm trade in non-electrical machinery industry accounted for 51.4% and 74.2% of all exports and imports in the sector respectively in the early 1980s, 32.5% and 55.7% in electrical machinery respectively. In transportation machinery industry, intra-industry export accounted for 43.6% (import number was not available.) (UNCTC 1988, p.93.)

have adopted a dispersion of vertically integrated production processes. It is asserted that these industries are characterized by high technology, economies of scale production, and products comprising a large number of parts and components. UNCTC also reports an increase in foreign affiliates for marketing and sales as well as after-sales activities -- a forward and backward integration. When the production processes are considered at activity level, a picture of vertically integrated firm may look very similar to a disaggregated view of a firm demonstrated in the value chain by Porter.

Casson (1986) provides general reasons for intra-firm trade: 1) technological development, e.g., emergence of assemblies of a large number of standardized components; 2) improved transport systems, e.g., large bulk transport and reduction of costs and time; 3) lower coordination costs, e.g., improved computer-linked communication systems and production control, improvement of production management practices; 4) reduced barriers to trade; and 5) creation of new low-cost industrial sites in newly industrialized countries as bases of "off-shore" production. Factors in this list apply primarily to manufacturers, but reduced communication costs seem to apply to firms in numerous industries including the E&C industry.

For this research, the most interesting model of a vertically integrated MNE is provided by Helpman and Krugman (1985). The model, although rough as a model to be used for strategic thinking, incorporates trade theory and MNE theory as well as trade in goods and services, and shares many common variables with the theoretical model of global E&C firm developed in Chapter 3. In the Helpman and Krugman model, parts of a vertically integrated firm with production facilities in more than one country trade finished goods, intermediate goods, and invisibles which comprises "headquarter services," such as top management,

strategy making, production planning, sourcing, distribution, R&D, and other support activities (e.g., personnel training, accounting, and others).

The headquarter services are the dynamic form of human capital in the static production function model, in which labor, capital, and human capital constitute a production function. It is implicitly assumed that the headquarter services comprise the special knowledge which enables the firm to compete successfully with its counterparts. The firm has to adapt the knowledge to many units at different locations in order to render it suitable for the production of a variety of the finished products. Once adapted, this input becomes a firm-specific asset.

In the model, not only intermediate and finished goods but also services are traded internally between the affiliates and the headquarters. Intermediate services, such as semi-finished technical and managerial data and information obtained at either side, are traded internally for further processing, and for finished services,<sup>11</sup> such as technology arising from R&D and decision making regarding marketing strategy. Policy created by management flows from headquarters to other parts of the firm. Financial capital flows between the two parties as well.

This model provides an important insight into the working of the internal coordination in the theoretical model of global firms developed later in Chapter 3, especially associated with the coordination of internal activities and external inputs within the global E&C firm. In the model, internal flows of intermediate

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<sup>11</sup>As we see later in this chapter, in Nusbaumer's model, services can be classified by knowledge-contents or degree of processing. Once classified, services can be roughly grouped into raw, intermediate, and finished services. Raw services are identical to work by unskilled labor, which is shared by both services and goods-producing activities. Real raw services, which can be differentiated from goods, are intermediate services. Intermediate services are analogous to complex production activities including collection and application of data and elementary structuring of these data into what is called information.

and finished goods and services must be coordinated to accommodate the vertical structure of activities within the firm and to effectively appropriate the firm-specific knowledge.

Note that this model resembles Porter's value-chain model of the firm. The practical meaning assigned to coordination is valuable in establishing a theoretical model of a global firm. Also, if service production activities are considered comparable to goods production activities, as posted in the next section of this chapter, it is possible to incorporate many kinds of production generated by an E&C firm into one model as will be seen in the value chain of an E&C firm in the next chapter.

### 2.3 Literature Review of Theory of Multinational Enterprise (MNE)

The section reviews the literature dealing with foreign direct investment and multinational enterprises, generally called MNE theory. Despite the large body of literature produced on this topic since the 1960s, no single theory has emerged that completely explains MNE. However, combination of several theories together covers many aspects of FDI and MNE. This section lays out the theories and concepts based on market imperfections and other influential theories which extend the market imperfection approach. It is important to selectively review the large literature on MNE in order to put theoretical and empirical flesh on the bones of the model of the globalization of E&C firms developed in the following chapters.

#### 2.3.1 Basic Theory of MNE

The generally accepted definition of an MNE is: an enterprise which owns and controls activities in different countries.<sup>1</sup> However, definitions of a MNE vary depending on the focus, such as operational, organizational structure, performance, and behavioral aspects of a MNE.

The modern theory of MNE can be traced back to Hymer's (1960) seminal work, in which he distinguished portfolio investment and foreign direct investment and identified market imperfections in product and factor markets as necessary conditions for the creation of a MNE.<sup>2</sup> His work was later extended by Kindleberger (1969). The so-called Hymer-Kindleberger theory argues: Product

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1. Buckley and Casson (1976), p.1.

2. Against the classical theory postulating that international capital movements were motivated either by interest differentials for securities of equal risk or by trade imbalances, Hymer pointed out that the factors in the classical theory do not hold, e.g. cross FDI exists between two countries; FDI occurs in only specific industries; few firms achieve FDI, and FDI in industries with significant concentrations of large firms.

and factor market imperfections induce FDI, and thus create MNEs. Market imperfections may occur naturally but they are more often created by strategies of firms and policies of governments.<sup>1</sup> For firms to overcome the difficulties of doing business abroad, they should have competitive advantages which national firms do not have, such as 1) low costs through economies of scale arising from the large size of the firm; 2) managerial and marketing expertise; 3) superior technology owing to massive R&D; 4) financial strength; or 5) differentiated products.

### 2.3.2 Extension to Transaction Cost Approach

The market imperfection approach of Hymer and Kindleberger was subsequently extended in many ways by other scholars. Among these amplifications, the most influential is the application of "transaction cost theory" to the multinational enterprise, primarily by Buckley and Casson (1976, 1981, 1985), Calvet (1981), Dunning (1977, 1981), Rugman (1976, 1981, 1982), Caves (1982), Teese (1981, 1983) and others.

The core of the transaction cost theory is "internalization." The concept is defined as follows: internalization of a market refers to the replacement of arm's length contractual relationships, which impose significant transaction costs to the firm, with managerial coordination within the firm. Internalization occurs to the extent that the benefits of further internalization are outweighed by the costs

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1. Examples include firms in oligopolistic industries seeking unique competitive advantages through product differentiation, preemptive investments to capture foreign raw material sources, governments' tariff and non-tariff barriers to trade, preferential purchasing policies, tax incentives, and capital market controls.

to the firm.<sup>1</sup> Thus, the firm is defined as an organization allocating intermediate products (both goods and services) without exchange of ownership; in the way this firm avoids the transaction costs of exchanging ownership between firms in allocating intermediate inputs.

The concept can easily be extended to the international arena, in which transaction costs (or imperfections) influence the performance of the firm significantly. A firm may internalize the market by making FDI (by acquiring a local firm or starting production by itself) in the foreign country to cope with the market imperfection. This is how a MNE emerges. At that point, MNE is defined as the firm which trades intermediate inputs and coordinate the flows of intermediate inputs internationally beyond national boundaries without exchange of ownership.

Casson (1985) argues that MNE is ubiquitous in two kinds of industries which favor internalization of markets. One is the industry in which proprietary information is an important source of competitiveness. The other is the industry in which multi-stage production processes are prevalent under economies of scale of production or with capital-intensive techniques. In the former kinds of industries, significant transaction costs stem from inadequacies in the patent system securing property right for information and necessitate maintenance of secrecy, and create the problem of buyer uncertainty. Furthermore, since knowledge is a "public good",<sup>2</sup> its exploitation logically may be an international operation; internalization of the knowledge market will require the firm that has

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1. The concept is based on the theory of the firm, namely the *raison d'être* of the firm by Coase (1937) and the transaction cost economics by Williamson (1975, 1981).

2. For the public goods nature of knowledge, see Johnson (1970).



the knowledge to operate a network of similar plants on a world-wide basis to appropriate the knowledge<sup>1</sup>.

Internalization in the latter industries arises from the dispersion of vertically integrated structure of production and significant transactions between production steps. While dispersion of vertical integration is justified for several economic reasons<sup>2</sup>, the superiority of internal coordination to arm's length transactions in the external market in linking the steps in production drives the firm to operate the entire production system across different locations under the same ownership.

The internalization concept has important implications for the globalization of the E&C firm. First, knowledge-intensive production may lead to the internalization of markets and subsequently to the internal coordination of the flows of intermediate products, including knowledge, beyond national boundaries. The international E&C firm sells the management and engineering know-how to coordinate labor, materials and equipment (or suppliers), services (or subcontractors), and even financial capital sourced worldwide in order to physically create facilities in foreign countries. Seen in this light, the E&C industry is a knowledge-intensive industry. An international firm will require significant internal coordination to make maximum use of its knowledge.

Second, dispersion of a vertically integrated structure of production also leads to significant internal coordination of the flows of goods and services

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1. Buckley and Casson (1976), p.35 and p.45.

2. These include the facts that increasing return to scale production necessitates price discrimination and creates bilateral monopoly; intertemporal coordination is required to deal with the time lag between the points when demand is recognized and actual production is done; and the capital-intensive industries need alleviation of uncertainty for the use of such capital investment. However, location itself is often determined by such macro-economic reasons as those predicted by Heckscher-Ohlin model. For more discussion on macroeconomic reasons, see the location factors by Dunning (1981), for example.

within the firm. As shown in Chapter 4, there are quite a few international E&C firms which actually locate their (service) production process in different locations and coordinate them worldwide.

Therefore, against the conventional view that international E&C firms must operate on a stand-alone basis in each country due to the importance of local conditions specific to the E&C business, such a firm could actually be tightly coordinated across national boundaries, at least around its knowledge and dispersion of vertically integrated production.

Third, the "public good" nature of knowledge provides an impetus for E&C firm to operate worldwide to exploit fully its proprietary knowledge. A natural extension of this is that the more knowledge-intensive the E&C firm is, and the more proprietary the knowledge is, the greater the tendency of international operation of the E&C firm to become geographically global is. Worldwide coordination thus become associated with the possession of proprietary knowledge.

Fourth, internal coordination is merely an option for a MNE, that is, the type, extent, and structure of coordination depend on the ability and policy of management as well as on the sophistication of the corporate system to organize an internal market and to cope effectively with the problems of multi-plant and multi-currency corporate accounting.<sup>1</sup> Furthermore, such managerial ability and effectiveness of the corporate system could become an international competitive advantage unique to the firm.

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<sup>1</sup>.Buckley and Casson (1976), pp.43-44.

### 2.3.3 Extension to Market Imperfections in Financial Markets

Looking beyond the imperfection in goods markets, several authors have emphasized the imperfections in the external financial market and the working of the internal financial market of MNE. This raises the issue of coordination from the financial point of view, and sheds light on risk diversification and the advantages associated with coordination in the internal financial markets.

Rutenberg (1970) and Robbins and Stobaugh (1973) pointed out that one of the salient characteristics of a MNE is its creation of an internal financial market in which the MNE may use its discretion transferring capital through a choice of channels and timing of transactions. Lessard (1979) points out the relationship between internal transfers of real goods and internal financial transfers. The internal transactions of real goods or factors, ranging from finished products to vaguely defined intangible factors such as management skills, is accompanied by internal financial transfers giving rise to certain financial claims.<sup>1</sup> Lessard also points out that financial transfers within an MNE also support real transfers to other internal organizational units from outside the corporate system with the MNE acting as a financial intermediary.

Lessard and Shapiro (1984) identify the kinds of coordination that a MNE must accomplish with respect to finance. In order to gain an advantage over local firms and other MNEs, a MNE must achieve four major goals: minimizing taxes, managing currency and political risks, and exploiting financial market distortions. To achieve them, a MNE uses its discretionary options of timing and channels for the transfers of capital and profits, and through arbitrages, takes advantage of imperfections in the financial markets to minimize taxes, manipulate currencies associated with foreign exchange controls by local

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1. Lessard (1979), p.427.

governments, and find the lowest interest rates, favorable credit and equity, by taking advantage of imperfections in the financial markets.<sup>1</sup> Lessard and Shapiro (1984) and Lessard (1986) extend the argument: One of the advantages of MNE which coordinate internal financial markets is the reduction of several kinds of risks specific to international operations, e.g. foreign exchange, political, and fund-sourcing risks.

The market imperfection approach to the financial market illuminates another facet of global strategies. First, as the E&C firm becomes engaged in international service production, the E&C firm internalizes the financial market in addition to the market for knowledge. To gain competitive advantages, the E&C firm coordinates internal financial transfers which accompany the transfers of real products (goods and services). Also, internal financial flows associated with transfers from outside the corporate system are coordinated as well (i.e., goods and services sourced outside the firm)

Second, financial coordination of the E&C firm includes, in addition to transfers of capital, arbitrage in taxes, currencies associated with foreign

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<sup>1</sup> Differences in tax systems among countries provide an opportunity for MNE to arbitrage, for the purpose of minimizing overall taxes, regarding host-country income relative to withholding taxes, home-country corporate taxes on foreign source income including effects of credits and deferrals, and home-country taxes at the investor level on the treatment of corporate profits. If a host-country imposes exchange controls maintaining its exchange rate at certain level, MNE, with its multiple channels for funds transfers, gain higher cash flows than firms lacking such an internal mechanism. Also, when distortions in interest rates or restrictions on credit exist, an MNE gains an advantage by transferring funds with favorable interest rates or circumventing restrictions by borrowing funds where available and shifting them to countries with the restrictions. Similarly, an MNE gains advantages by coordination in gaining equity in the way it reduces risks through diversification, which may not be available to individual investors due to the presence of barriers. As risks are lowered, diversification provides the MNE with a lower required rate of return, reflected in the price paid by individual investors, not only lower than local firms but also than other MNEs. For more discussion, see Demacopoulos (1989).

exchange controls by local governments, interest rates, credit, and equity. It is also important to the E&C firm to broaden fund sources to reduce costs and risks.

#### 2.3.4 Extension to Organizational Forms of MNE

The organizational approach of the MNE theory provides useful insights for this thesis to this thesis. Based on the transaction cost approach similar to Buckley, Casson, Dunning, and other authors, Caves (1982) provides an organizational model of MNEs, in which he categorizes MNEs into three classes, horizontal, vertical, and diversified.

The horizontal MNE, in Caves' definition, is a multi-plant firm producing essentially the same line of goods from its plants in different countries. While locations of plants are justified by various location factors, placing the plants under common administrative control is justified by the "intangible assets" of the firm. Intangible assets include technology or knowledge about how to produce a cheaper or better product at given input prices, or how to produce a given product at lower cost than other firms. The intangible assets may take several forms, such as patented process or design, know-how shared among employees, marketing skills, registered trademark or brand, and top management's ability. The firm is forced to use its intangible assets within its organization because of the market imperfections for the intangible assets (or high transaction costs for selling it).

The vertically integrated MNE produces outputs in some of its plants and transfers them as inputs to other plants. This form of MNE eliminates the high contracting costs and uncertainties that would mar arm's length transactions, stretching from anonymous spot market transactions through a variety of long-term contractual arrangements.

The third type of MNE is the diversified firm in which plants' outputs are neither vertically nor horizontally related to one another. While going multinational in any form could bring some kind of diversification of risks, the ultimate diversification gain would accrue to the MNE which acquired a foreign subsidiary diversified in product line as well as geographical space.

Caves' model of MNE provides three different configurations of activities and coordination required for each configuration when an E&C firm is producing services in multiple countries. In horizontal firms, activities performed in each country are basically identical and these activities are complete in each plant except for intangible assets coordinated worldwide, possibly by headquarters. This is the E&C firm with dispersed configuration in which most activities are achieved locally. The local units use the common firm name, the construction management know-how shared by the human resources of the E&C firm, or other types of intangible assets.

In the vertically integrated E&C firm, outputs produced in one location are sent to other locations within the firm, e.g. engineering performed at headquarters, is correctly incorporated into the physical execution of construction at a project site. Coordination brings the whole production together.

In the diversified E&C firm, there is little coordination among foreign subsidiaries and headquarters or project offices and headquarters. Therefore, the diversified E&C firm manages its whole international operation more like a portfolio and its foreign units behave independently.

### 2.3.5 Behavioral Approach

The MNE theory based on a behavioral approach sheds a slightly different light on geographic expansion. In studying 38 US firms, Aharoni (1966) identified a set of motivations to make FDI. He argues that such motivations include 1) a strong interest by one or several high-ranking executives inside the organization; 2) an outside proposal, provided it comes from a source that cannot be easily ignored, such as proposals from foreign governments, distributors of the company's products, and its clients; 3) fear of losing a market; 4) the "bandwagon" effect, i.e., very successful foreign activities of a competing firm; and 5) strong competition from abroad in the firm's home market.<sup>1</sup> He argues that it is very difficult to isolate a single motivation for looking abroad and that the FDI decision usually results from a chain of events, incomplete information, activities of different persons, and a combination of several motivating forces, some of which work for and the rest against the decision. Also, he argues that there is no simple functional relationship between any one force and the FDI decision; the impact of any one of these forces depends on social and organizational structures, previous events in the firm's history, and other problem areas facing the company at the time this force is encountered.<sup>2</sup> The motivations identified by Aharoni seems accurate for E&C firm expanding internationally, at least in the initial impetus to increase foreign involvement as we go over the history of the international E&C industry.<sup>3</sup>

Aharoni also points out auxiliary motivations for firms' international expansion pertaining to unutilized resources within the firm: 1) creation of a

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<sup>1</sup>.Aharoni (1966), pp.54-55.

<sup>2</sup>. Ibid., p.55.

<sup>3</sup>.For example, see Korean Institute of Construction Technology (1985), Strassmann, Paul W., and Jill Wells (Ed.) (1988), Locas, Chester L., (1986), Urry, S.A. and A.F.C. Sharratt (Ed.) (1980), and Stallworthy E.A. and O.P.Kharbanda (1985).

market for components and other products; 2) utilization of old machinery; 3) capitalization of know-how, or spreading of R&D and other fixed costs; and 4) indirect return to a lost market through investment in a country having commercial agreements with these lost territories.<sup>1</sup> Although the first auxiliary motivation is quite specific to manufacturing, others intuitively fit the international involvement of the E&C firm very well, especially 2) and 3) from the viewpoint of economies of scale in knowledge, human resources, and durable facilities.<sup>2</sup> The fourth motivation is also evident when an E&C firm establishes a local firm as its subsidiary to be a "bridge" in the export of construction services, materials and equipment, or financial capital to a particular foreign market which is not accessible from the home country of the firm.

One of the contributions of the Hymer-Kindleberger theory is that it facilitates the development of MNE theory based on industrial organization, particularly in instances of oligopolistic behavior of MNE in making FDI. FDI made for oligopolistic reasons is called defensive FDI, and there are numerous strands of theories which deal with it.

The product life cycle models created by Vernon provide a clue to the transition from domestic to foreign production, in terms of cost differentials (first model, Vernon, 1966) and oligopolistic behavior (in the second model, Vernon, 1971, 1974), although the two models have suffered considerable criticism for simplifying the dynamic process of production. The socioeconomic development, economies of scale, and oligopolistic competition, found in most advanced

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<sup>1</sup>.Ibid., pp.70-71.

<sup>2</sup>.Caves (1982) makes a similar point: Whatever fixed assets the firm acquires shape its future expansion path by attaching to it "capacity" that affects the returns it expects from various expansions of its activities; and the use of these capacities and the minimizing of information costs and risks are strong influences on the path of expansion, determining which firms go the multinational route and which do not.(Caves 1982, pp.68-69)



industrial countries, lead firms in these countries to perform intensive R&D. New, technologically advanced, and often differentiated products are introduced. The new products are first marketed in the home country. Close coordination of production and sales is required while the product is improved and the production process standardized. After a certain time lag, the product is exported. As the new product reaches maturity, competition by nearly similar products narrows profit margins and threatens both export and the home market. At this stage, the oligopolistic response to competitors' actions become a major issue. All firms seek foreign production locations where market imperfections in the cost of factors of production may lower unit production costs. This leads to "bandwagon" or "follow-the-leader" movements.

Such oligopolistic behavior is emphasized by other scholars. The "follow-the-leader" motivation for starting foreign production was further developed by Knickerbocker (1973).<sup>1</sup> He argues that competitors in an oligopolistic industry are motivated by a desire to deny any competitive advantages to the leader as well as other competitors. The "follow the leader" model seems to predict that when a market segment is oligopolistic, an E&C firm in the segment starts a foreign operation in the same geographic market as that in which its counterpart has started operation. E&C firms competing in their oligopolistic home market, e.g., Japanese E&C firms, seem to expand their international activities in conformance with this motivation (at least the largest firms seem to behave this way).

However, the market in which the E&C firm protects its share may not necessarily be the home market but the global market. Balassa (1966) suggests a "growth-to-survive" motivation. Based on comparison of FDI from Europe to the U.S. and from the U.S. to Europe between 1950 and 1964, he concludes that firms

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<sup>1</sup> "Follow the leader" motivation is closely related to "bandwagon" motivation found by Aharoni (1966), reviewed earlier.

make FDI when its saturated oligopolistic home market does not allow it to expand its domestic share without provoking destructive retaliation by its domestic competitors. Although the cost of entering foreign markets may be substantial, under these circumstances it will be easier for the firm to carve out a new market abroad, especially if the growth rate of the foreign market is large.<sup>1</sup>

While the firm faces the basic choice between FDI and trade, the motivation outlined by Balassa seems to explain the motivation for the geographic expansion of E&C firms today. A good example is the international involvement of Japanese general contractors in the 1970s through the mid 1980s. When the Japanese domestic market, which is fairly oligopolistic, particularly the segment in which the largest general contractors compete, went into a long slump after the oil crisis of 1973, many large general contractors entered the Middle East and South-East Asian markets.<sup>2</sup>

Although not based on oligopolistic behavior, a similar motive is "follow-the-customer". UNCTC (1988) reports that as customers expand their business abroad, firms with which they have done business at home may continue to serve them in foreign markets as well. Examples are numerous, particularly in service industries, such as banking, advertising, legal, consulting, and accounting. MNEs in these industries first ventured abroad primarily to supply migrating or travelling individuals or foreign affiliates of their home customers with services previously supplied to their parent firms in the domestic market.<sup>3</sup> The E&C firms

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<sup>1</sup>In the mid 1960s when Balassa wrote this article, the reasons why firms chose FDI were: lower production costs in Europe than in the U.S., transportation costs, tariffs imposed to goods exported from outside EEC and their elimination on intra-EEC trade, and expectation of growth of the EEC market, among which Balassa concluded the growth expectation by the U.S. firms was the largest, if not the only, reason.

<sup>2</sup>For the historic development of Japanese contractors' international involvement, see Hasegawa (1988), pp.81-106, Tsuchiya and Yajima (1986), pp.121-148, Sugimoto (1986), pp.38-92.

<sup>3</sup>UNCTC (1988), p.431.

may not be exceptions; for example, U.S. E&C firms followed the U.S. oil companies in Europe and Latin America; Korean E&C firms chased after the U.S. Army Corps of Engineers in Vietnam, Guam, and Saudi Arabia; and Japanese E&C firms tracked Japanese industrial and commercial customers in South-East Asia, the U.S. and Europe.<sup>1</sup>

### 2.3.6 Treatment of the E&C Industry and Forms of Foreign Involvement

There is a branch of MNE theory that deals with choices of modes for serving foreign markets, including trade, FDI, licensing, management contracts, franchising, joint venture, and so on. Non-equity forms of FDI are a dominant phenomenon in the 1980s.<sup>2</sup> Also, choices of modes are a crucial issue for the study of globalization since they determine the configuration of internal activities of the firm. Unfortunately, the literature on MNE theory dealing with the alternatives is limited in number and depth. Furthermore, some of the authors dealing with modes of international involvement in the construction industry seem not to understand the nature of production in the industry.

Hirsch (1976) compares only FDI and trade, and his conclusion are too simplistic.<sup>3</sup> Lall (1980), utilizing the data on the international involvement of U.S. industries, extends Hirsch's argument. However, his model remains only qualitative and shows a relative preference for FDI and trade, with a very small

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1. For the E&C firms-customers relationships in the international E&C, See Grassmann and Wells (1988).

2. UNCTC (1988), p.67.

3. His model is a simple two-country model based on the discounted-present-value-like formula for production cost, firm-specific know-how which represents a sunk cost to its owner but a real cost to rivals, marketing cost, and cost of control. He concludes that the invest-export decision tends to be pro-export when the market is in a high-cost country while the decision is opposite when the market is a low-cost country.

number of variables.<sup>1</sup> Buckley and Casson (1981) provide a model pertaining to the switch among trade, FDI, and licensing, but the model fails to incorporate the complexity of modal choices as does Lall's model.<sup>2</sup> Magee (1977) extended Vernon's product cycle model and provided an industry cycle model but the scope is limited to only technology-intensive industry.<sup>3</sup> As we see, the existing economic studies on MNE lack insight into alternative forms of serving foreign markets partly because of the lack of tools to examine the complexity of the firm and partly because the studies' focus on manufacturing industries.

More importantly, some of the existing economic studies which incorporate construction industries in the discussion of modal choices fail to account for the unique nature of production in construction industry, i.e., its division of labor. For example, Seymour (1987)<sup>4</sup> and UNCTC (1988)<sup>5</sup> consider the true FDI of E&C firms (i.e., establishing foreign subsidiaries or branches substituting various services by headquarters) and various forms of contracts (i.e., managing physical installation of facilities) at the same level of modal choices. Also, joint ventures of management contracts are considered as if they were identical to the equity-based joint ventures of manufacturing production. Moreover, they also fail to recognize that turnkey contracts are a substitute for management contracts but not for FDI.

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1. He concludes: the "transferability" of monopolistic advantage does influence the export-FDI choice; technological intensity serves to promote both exports and FDI, but on balance it favors exports; product differentiation advantage is highly transferable, thus promotes FDI; and the combination of technological and product-differentiation factors exercises the largest effects on FDI and is the main "engine of growth" behind the overseas expansion of U.S. industry.

2. Their model improves Vernon's Product Cycle model, which provides a cost-based rationale for switching, in providing consideration to market and product conditions versus switching costs. But they admit the simplicity of the model so that the time-frame decision process would be more complicated.

3. Magee (1977), pp.316-317.

4. Seymour (1987), pp.106-126.

5. UNCTC (1988), pp.425-444.

Production in the construction industry and activities of the E&C firm associated with forms of international involvement are developed in Chapter 3.

In summary, as we have seen, MNE theory provides substantial theoretical bases for the study of globalization of the E&C firm. In essence, MNEs exist because of the market imperfections, and their existence creates different market imperfections. A MNE is an organization possessing internal markets in which substantial tangibles and intangibles, i.e., goods, labor, human capital, knowledge, brand name, and financial capital are transferred. For its competitiveness, considerable coordination is required for a MNE to transfer tangibles and intangibles effectively within the entire organization. Effective coordination within its internal market thus becomes its major source of competitiveness over local and other multinational firms although how and to what extent a firm coordinates internal activities depends on the policy of its management, organizational ability, and historical development path.

Geographic expansion of a E&C firm addressed in the next chapter can be explained theoretically by the characteristics of E&C production, based on the special knowledge it commands and its behavioral motivations stimulating international expansion. A large part of the theoretical base of the configuration and coordination of a firm's activities are shaped by the knowledge components of E&C production as transaction cost approach explains, and are associated with the structure of its activities (i.e., horizontal, vertical, and diversified). The financial aspect of MNE provides a further theoretical basis for the configuration and coordination of an E&C firm.

Despite the substantial contributions of the MNE theory to the study of globalization, it has shortcomings as well. MNE theory accounts for only a narrow scope of production of firms, specifically physical production. The theoretical

analysis of FDI by service firms is only marginal, and so is the treatment of the construction industry. Moreover, MNE theory fails to accommodate the characteristics of production in the construction industry associated with alternative forms (particularly looser forms, e.g., cooperation, than FDI) of foreign involvement. There have been no intensive studies testing MNE theory for these.

Also, the MNE theory assumes too rigid a distinction between a firm's internal activities and external markets. For example, the MNE theory does not explain how external inputs (i.e., substitutes to internal activities) affect the structure and working of firm's internal activities; MNE theory does not very well accommodate other forms of international involvement (e.g., various cooperations with other firms) despite the fact that as the competition in an industry become global, competing firms are likely to become more interdependent.

## 2.4 Literature Review of the Studies of Services

This last section of the literature review turns to the studies of services. Studies of services are essential to this study for understanding how E&C activities, which consist of a unique combination of physical production and service production, are incorporated into the general framework of globalization. Understanding service production within the E&C firm is also crucial to comprehending the internal flows of goods and services, which must be coordinated in a global E&C firm.

### 2.4.1 General Characteristics of Services

The development of the theoretical and statistical study of services first requires a precise definition of services. Defining services, however, seems to be not as straightforward as defining goods.<sup>1</sup> While there are several conventional definitions available, none of them is satisfactory. For example, one definition we often encounter is "non-traded " or "non-traded goods". Many international statistics still deal with services as either a part of the residuals of goods or as investment.<sup>2</sup> However, in reality some services are traded, and services are neither goods nor mere investment. Another definition is based on the invisible or intangible nature of service outputs. However, there are certain tangibles or

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<sup>1</sup>Krommenacker (1984) explains the complex nature of services. Services encompass an extremely heterogeneous grouping of economic sectors with different production processes, customers, suppliers, and market channels. Services are provided in many ways; some services can be provided in a number of ways, such as those provided through physical media (e.g., films, tapes, blueprints, publications), some through electronic communications (e.g., data, commercial information); some through individuals (e.g., engineering, management, consulting); and some through capital facilities (air and land transportation). Also, he argues that historically services have been treated as parasitic and residual sector.

<sup>2</sup>Such examples include U.S. international transactions in the U.S. Congress, Economic Report of the President.

goods, such as computer disks or books, which represent reified services. Moreover, there are services which produce considerable physical outputs, such as construction or utility.

Furthermore, despite the statistical necessity, it is as difficult to classify services as it is to define them. Again, there are currently several methods for classifying services, developed by international organizations collecting data and by individual scholars.<sup>3</sup> None of them provides a classification system as comprehensive as that for goods. The best developed and most comprehensive theory identifying various types of international transactions in services and relationships between services and goods production, are by Nusbaumer (1987a and 1987b).

#### 2.4.2 Model of Services by Nusbaumer

Nusbaumer (1987b) suggests classification of services by degree of processing or degree of knowledge contents in the activities in order to identify various types of international transactions in services and the leverage effect of their association with goods production.

Nusbaumer suggests that since knowledge-content requirement for jobs in goods- and services-producing firms do not differ, an appropriate and realistic distinction between service activities and goods-producing activities might be the type of enterprises in which such labor services are employed. Within any firm, either service- or goods-producing, service activities exist. However, such service

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<sup>3</sup>For example, IMF (International Monetary Fund) classified services based on types of international transactions associated with the supply of services while ISIC (International Standard Industrial Classification) used by descriptions of nonphysical output. However, recognizable criteria are missing in both cases. Also, it identifies other classifying methods based on functional characteristics of physical goods, functional characteristics of services themselves, and technical characteristics of services production and trade. However, these do not rest on data. (Nusbaumer 1987b, p.69-86)



activities may not be called as services unless they are purchased from service firms in the external market.

Nusbaumer's analysis considers industries which are conventionally categorized as services but produce a large amount of physical outputs, such as construction. He identifies two primary reasons why construction is usually considered services:

- 1) Institutional: Because a contractor deals with both physical production (through employing construction workers directly) and services (associated with management of physical production and often, design of facilities), it is in practice difficult to separate the two kinds of work in the output of a single firm. Insofar as a contractor is conventionally considered a service firm, its entire set of activities should be considered services.
- 2) Record keeping: Most statistics do not separate physical and service outputs of construction, in a manner convenient for statistics. It is statistically more appropriate to include the total value of construction outputs as one entry in the service category rather than lose the service content.

This perspective, when combined with Nusbaumer's model of services, provides a very rich insight into the production process of E&C firms. Construction activities can be divided into two principal groups of activities, one associated with physical production (goods-producing activities), and the other considered to be service activities. Activities directly related to physical erection of facilities by speciality subcontractors, e.g., activities of carpenters, steel-bar workers, and workers pouring concrete, are considered goods-producing activities while the activities of a project manager working for a prime contractor and coordinating all activities for the entire project are considered service activities. Note, however, that even activities of carpenters may

conventionally be categorized as a service if the subcontracting firms employing the carpenters are considered to be service firms. Contractors who hire subcontractors are considered to be service firms. Also, subcontractors theoretically do not differ much from prime contractors since subcontracting firms provide a service of managing workers as well.

The perspective provides a good explanation of the structure of the construction industry, and particularly the E&C industry, as it incorporates the division of labor in the E&C industry and the diversity of functions of contractors. First, management activity is a spin-off from the whole stream of construction activities. Construction firms in the early years of the industry might have performed both physical and management activities in-house. However, as entrepreneurs commercialized expertise in management by establishing firms specializing in management, such firms came to exist as pure service firms, leaving most of the goods-producing activities to other firms which became specialized in their own very narrowly defined physical work.

Second, the emergence of service firms through commercialization in the construction industry suggests that many service activities achieved within prime contractors, engineering firms, and owners are subject to such commercialization and emergence of service firms specialty service activity. The issue is whether the services in the E&C industry will be divided among service entrepreneurs, or whether E&C firms gain greater flexibility by incorporating these services in a vertically integrated structure, both on a long-term and short-term (project) basis. These points will be further developed in establishing a theoretical model of E&C activities in Chapter 3.

### 2.4.3 Trade in Services

Sampson and Snape (1985) divide international trade in services into four categories according to how they are traded. Transactions between a service renderer and receiver occur:

- 1) without the movement of either service renderer or receiver. In this case, services are produced in the exporting country and then traded internationally, e.g., consulting, architectural and engineering services contained in documents, drawings, floppy disks, calculation sheets, or sent through various communication networks, such as satellite communication or computer networks;
- 2) when the renderers of the service move to the receiver's location. This includes services performed in the host country (e.g., management of physical construction at a project office) by the renderers but without physical transmission of the services as in 1);
- 3) with the movement of the receivers of services, e.g., services obtained by tourists, foreign students, medical services; and
- 4) with the movement of both renderers and receivers, e.g., a surgeon and a patient meeting in a third country.

The four basic modes of trade in services arise from the general nature of services addressed earlier, namely, intangibility and non-storeability or perishability of services. As far as the intangibles of a service activity are packaged in a physical form, the service may be traded internationally much the same way goods are traded. The first category above includes this type of service. However, if the service cannot be physically transmitted, either provider or receiver or both must be in the same place for services to be rendered. For

example, if a service can be embodied only in a human being, the physical movement of at least one of the two parties is a necessary condition for the service to be performed.

Note that when the service renderer moves, issues arise which are very similar to those encountered by firms moving their resources abroad to make a FDI. Therefore, if service-producing activities are properly defined as comparable to goods-producing activities, production of services is very similar to FDI for goods production in terms of the location of production and the exposure of the service rendering firm to various international and local environments. This type of service production may be called "quasi-FDI." In contrast, to continually service foreign markets, the firm must establish its own organizational units in the foreign countries on a long-term basis. This is a traditionally defined FDI.

In terms of foreign involvement in services, then, traditional FDI is not necessarily a substitute for trade but a complement for some kinds of services including construction, which can be done by temporary movement of renderers (quasi-FDI). However, for other kinds of services, e.g., banking, FDI is a substitute for trade. Moreover, the nature of regulations of these services (addressed later in this section) even require the service renderers to have a permanent presence in foreign countries.

Geographical configuration is particularly important in discussing service production activities. When services can be embodied in goods and other physical forms, the service renderer need not move; service production activities can be concentrated at a single location, most typically at the headquarters of the firm rendering the services. When services cannot be embodied in physical forms, service production activities must take place locally, either temporarily (quasi-FDI) for one-time transfer of services or permanent transfer (FDI) to establish a permanent status in foreign countries.

In the service industry, therefore, it is important to distinguish between locations of activities for quasi-FDI and for FDI. However, as the world economy expands, activities (both temporary and permanent) becomes more fragmented, and the location and coordination of activities stemming from quasi-FDI and FDI become important factors shaping competitiveness among international service firms. In other words, globalization is an issue not only for manufacturing firms but also for service firms.

Data by UNCTC (1988) demonstrates the recent expansion of permanent FDI in the service industry and suggests the importance of the issue of globalization for service firms. By the mid-1980s, about 40% of the world's total FDI stock of about \$700 billion (at the beginning of the 1970s the number was a quarter of this total and in the early 1950s less than 20%) and about 50% of annual FDI flows of about \$50 billion were in services.<sup>4</sup> UNCTC argues that the expansion of FDI in services is attributable to: 1) liberalization of the investment policies of several countries; 2) the increased use of trans-border data flows; 3) higher expenditures for services accompanying higher personal incomes, 4) the increasing importance of technology, information and software as inputs to the production of goods and services; 5) greater involvement of non-service firms in services (that is, commercialization of services by goods-producing firms discussed earlier), and 6) the emergence of more specialized firms along with the needs for more complex and specialized services (commercialization associated with division of labor in services discussed earlier).<sup>5</sup>

The mode of international involvement and market presence apply particularly well to the E&C firms. An E&C firm may concentrate activities at headquarters in its home country and export (or transfer) services packed into

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4. UNCTC 1988, p.370

5. Ibid., pp.425-444.

drawings, calculation sheets, or documents. Pure engineering firms might choose this form of E&C service production. However, if physical embodiment of services is hard to achieve, the firm must send their people to foreign countries and let them produce services there. E&C firms producing services experience problems (and opportunities) similar to those of manufacturing firms making FDI abroad. Like them, the E&C firm wishing to supply services in foreign countries on a continual basis for commercial reasons (and often to cope with local regulations), may have to set up organizational units in the countries. The newly established unit will replace many of the factors of production, or personnel which had rendered the same services on a temporary basis. This is the traditionally defined FDI by the E&C firm. Then, the activities will be fragmented on a permanent basis. Because there are two kinds (or service- and goods-production) of E&C activities, the firm must cope with a more complex configuration of activities than manufacturing firms have, and their global strategy may be expected to be more complex. We develop the argument regarding the foreign involvement of E&C firm and the configuration and coordination of activities in Chapter 3.

#### 2.4.4 Regulations and Barriers to Trade in Services

Issues of government regulations and barriers to trade are important to the globalization of E&C firms because they affect the mode of serving foreign countries and the geographic locations (or configuration) of service activities. Benz (1985) and Krommenacker (1984) argue that barriers to trade and regulation of services are almost equivalent in kind to those affecting goods industries, and their impact are equally crucial to the expansion of service activities.

In recent years, the efforts of GATT and OECD<sup>6</sup> have encouraged deregulation and the liberalization of trade and FDI in some service sectors, e.g., telecommunications, finance and insurance; however, many others remain firmly under government control or surveillance.<sup>7</sup> Unfortunately, these barriers to trade and regulations have increased in certain countries and in some specific aspects.<sup>8</sup> UNCTC (1988) addresses the main features of regulations and policies affecting services, particularly FDI in services: 1) Control of entry, establishment, and ownership; 2) nationality requirements (for firms); 3) policies bearing on the operations and competitive opportunities of foreign affiliates; 4) economic regulations affecting the scope of foreign participation; and 5) incentives and performance requirements.<sup>9</sup>

It is well known that governments have traditionally regulated financial services and national communications systems because they are considered important to the national economic development, as are agriculture, steel, and related defense industries.<sup>10</sup> Krommenacker (1984) suggests six major incentives to interventions for host countries to intervene in the import of services: 1) employment; 2) monetary and balance-of-payments control; 3) protection of indigenous infant industries; 4) protection of domestic consumers from risks; 5)

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<sup>6</sup>.Benz argues that the first impetus for negotiation on trade in services in the GATT and OECD came from the U.S. because the U.S. is the world's largest exporter of services and has the highest percentage of its population engaged in services. Benz (1985), p.98.

<sup>7</sup>.UNCTC (1988), p.433.

<sup>8</sup>.Barriers to trade in services are growing in scope and severity; barriers in developing countries and in industrial countries are similar, although more common and more severe in less developed countries. Restrictions in developed nations, however, tend to have a greater trade impact; and new barriers are beginning to arise over some previously unrestricted national service markets in the area of electronic communications and information transmittal. -- Center for Strategic and International Studies 1982.

<sup>9</sup>. UNCTC (1988), pp.473-483.

<sup>10</sup>.Benz (1985), p.99. Also, UNCTC (1988) suggests other basic reasons for government regulation of services, the main one being the crucial role played by services in the process and pattern of economic development.(p.471)

national security; and 6) cultural and social sensitivities. Government intervention provides further motivations for a firm to place activities locally. Moreover, configurations and coordination of activities are shaped by the specific content of government interventions and regulations.

Many service-producing firms must move or establish subsidiaries abroad for the sales of services, and because regulatory treatment of service sectors by many governments has historically made service firms more vulnerable to regulations than goods producing firms, which have trade and other alternatives to serve foreign markets. In practice, the major obstacles to service firms wishing to sell their services abroad are non-tariff barriers rather than tariffs and quotas.<sup>11</sup> Non-tariff barriers are crucial to service firms they regulate the processes of production and delivery of services rather than the characteristics of the products. It is often difficult, if not impossible, to distinguish between production and product in a service industry.<sup>12</sup>

Issues of government regulations, especially non-tariff barriers, in determining the location of service production are very important to E&C firms. That is, government regulations influence the configuration of the service production directly related to physical construction as well as to support activities. For example, a host government's discriminatory nomination of a national firm to build public facilities may lead to the establishment of a local firm by an international E&C firm. The effect on the global perspective of the firm is significant because the establishment of local firms may cause unnecessary fragmentation or dispersion of corporate resources thus complicating their coordination and directing the adoption of a multi-domestic

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<sup>11</sup>.Nusbaumer (1987a), p.21.

<sup>12</sup>.Nusbaumer (1987b), p.99.



approach whether or not it is best for the firm. This issue is extensively discussed in Chapter 3.

#### 2.4.5 Organizational Forms in Services

UNCTC (1988)<sup>13</sup> argues that over the past one or two decades, two mutually opposing phenomena have emerged, one towards majority- or wholly-owned affiliates and the other towards minority-owned affiliates or non-equity contractual relations; in general non-equity arrangements have become more common. The formation of majority/wholly-owned affiliates has been encouraged, first by the liberalization of government policies for foreign firms' making FDI, and second, by the reduced cost and the increasing ease of coordinating decision-making across national boundaries through advanced trans-border communications.

While the structure of a majority/wholly-owned affiliate necessitates fragmentation of corporate resources, a danger to coordination is compensated for by centralized control or monitoring through advanced communication systems and more sophisticated management systems. Many service activities, such as accounting, inventory control, and financial functions, which used to be done locally, may be now performed by parent firms in many industries. UNCTC argues that in such firms, applications of data communications and reduction of communication costs may enable parent corporations to perform even more services for their foreign affiliates, both in terms of internal support activities (such as accounting) and actual production for local organizations. Foreign affiliates may become mere information-input facilities linked, through

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<sup>13</sup>.pp.438-444.

communication systems, to regional or central headquarters, where most of the value-adding activities take place.

In contrast, a minority-ownership or non-equity approach has several valuable features<sup>14</sup>: first, development of appropriate contracts permits service firms to exercise control over their proprietary knowledge; second, equity participation may become less necessary as foreign domestic firms increase their ability to deliver services, and basic services become available in the country; third, increasingly expensive corporate infrastructure for services, e.g., communication networks, may force service firms to cooperate and share the risks, costs, and advantage of the infrastructure; fourth, advanced communication technology enables foreign firms to monitor and coordinate overseas projects without wholly controlled affiliates.

E&C firms now face more choices in selecting a form of multinational organization and more complex considerations for the choices. Although government regulations, in some cases, force the E&C firm to establish a certain kind of local presence, the firm may face an array of options between wholly/majority-owned and minority-owned affiliates or non-equity cooperations. However, when a firm wishes to cover a truly global market, minority-owned or non-equity cooperation may well be the wisest choices, as it combines low costs and risks with flexibility in serving geographically large markets.

In summary, the studies of services suggest several implications to be reflected in the theoretical framework of globalization. First, an E&C firm's

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<sup>14</sup>.UNCTC also points out that non-equity contractual relations are particularly important in a number of service industries, such as hotels, fast-food restaurants, accounting, and E&C.(Ibid., p.370)

decision to make or buy a service determines the degree of vertical integration in functions by which the firm competes. Second, forms of trade together with regulations and barriers to trade in service significantly influence the configuration and coordination of activities of an E&C firm. Third, the firm faces complex choices for its local presence, FDI and minority or non-equity foreign involvement. While the latter is more suitable for covering a geographically vast market in terms of risk, cost, and flexibility, the former may be offset by increased coordination through advanced communication technology.

## CHAPTER 3

### THEORETICAL FRAMEWORK FOR GLOBALIZATION

This chapter presents a theoretical framework for globalization of the E&C firm. First, several key terms are defined and the general characteristic of globalization for the E&C firm is presented. Second, this chapter sets out the value-chain of the E&C firm, an idea which will be repeatedly used in this study. Third, a theoretical model of globalization of the E&C firm is proposed. A precise definition of globalization for the E&C firm as well as of the constituent elements of globalization is proposed. Finally, two propositions are presented and theoretical predictions are made.

#### 3.1 Definitions of Terms and General Characteristics of Globalization for E&C Firm

##### 3.1.1 Definition of Globalization

Globalization for an E&C firm is defined by three elements, geographic, internal, and external globalization. The first element, geographic globalization, is associated only with the geographic market scope of an E&C firm. More precisely, geographic globalization means the process by which a firm expands its geographic market while the other two, internal and external globalization, represent how an E&C firm competes in its geographic scope of market.

The second element, internal globalization, is defined by how an E&C firm competes in the international market based on the advantages gained from configuration and coordination of internal activities of the firm. The degree of

internal globalization is determined by the extent to which the firm desperses and coordinates its internal activities for gaining competitiveness.

Then, the model proposed in this study adds the third element, external globalization. It is defined by how a firm competes in the international market based on the advantages gained from configuration and coordination of external inputs, i.e., goods (e.g., suppliers), services (e.g., subcontractors, consultants, and JV partners sourced from outside the E&C firm), and capital (e.g., banks and other financing organizations). Similar to internal globalization, while different sets of configuration of external inputs provide variations of external globalization, the degree of external globalization is determined by the extent to which the E&C firm coordinates the flows of external goods, services, and capital for its competitiveness.

Again, it is important to emphasize that geographic globalization is concerned only with where an E&C firm competes while the other two elements of globalization are concerned with how an E&C firm compete in the international market. Global strategies are those with which an E&C firm gains competitive advantages through different sets of configuration and coordination of internal activities and external inputs in the international market captured by geographic globalization of the firm. Also, it is important to remember that variety of specific global strategies are possible given different combinations of configuration and coordination. In addition, note that global strategies are numerous in degree as well as kind, because the intensity of coordination of internal activities and external inputs may vary greatly. A detail of each element of globalization is proposed in the theoretical model in the later section of this chapter.

Finally, it may be useful to present the relationship between the globalization of an E&C firm and the E&C industry (or a segment). The industry geographically globalizes as many firms in the industry compete worldwide (or

geographically globalize). Also, the industry may internally and externally globalize as many E&C firms start to compete based on the competitive advantages gained through configuration and coordination of internal activities and external inputs. Thus, a high frequency of encounters with the same competitors, the yardstick proposed by Porter to measure the degree of globalization of an industry, may be good for measuring the geographic globalization of the industry, but may not suffice for measuring other elements of globalization, because firms may compete worldwide on a multi-domestic basis, or on a country-by-country basis.

### **3.1.2 General Mechanism of Globalization**

Globalization of E&C firms is prompted by the interaction between factors external and internal to E&C firms. These factors provide E&C firms with pressure and incentives to adopt global strategies, with a solution to such pressure and incentives and to the challenges of competing in a large geographic area in a coordinated way. A good example of external factors may be geographic market expansion of clients of E&C firms. Following such clients, E&C firms may get an opportunity to expand their geographic markets. Also, emergence of global E&C firms, which compete worldwide based on the advantages gained from their coordinated operations, pressures other E&C firms to compete on the same ground for their survival as the global firms'.

Factors internal to E&C firms also provide incentives for firms to take managerial and organizational responses to the external factors to the firms. For example, given the external factors, E&C firms may recognize that their strategies, internal resources, and organizations are increasingly inappropriate to deal with a new environment. Also, they may find that certain innovations

would enable them to cope with the external factors by global strategies. A good example may be an introduction of advanced communication system, often in conjunction with the use of advanced computer technology. Advanced computer technology allows integration of certain activities (e.g., engineering, design, and procurement, at fewer locations), reduction in cost and time required, and enhanced quality control through more standardization of design. Combined with the advanced communication technology, firms may become able to transmit the work intensively performed by computers to be transmitted to multiple units of the firm within a second. Thereby, the communication and computer technology may significantly change locations of activities and the ways by which activities are performed across geographic distances. (External and internal factors and their interactions are intensively examined in conjunction with the development of the three elements of globalization in the later sections.)

It is worth emphasizing that although these internal and external factors affect all firms in the international E&C industry to some degree, firms may respond to the factors in different ways and with various levels of intensity due to factors specific to each firm, such as ability and historical style of management and historical development of internal assets and expertise of a firm as well as those specific to particular segment or nationality. Also, factors specific to a certain segment (e.g., proprietary engineering know-how in process plant segment, which may reduce the number of qualified firms and make them compete face-to-face worldwide) may strongly influence types and degree of globalization of firms within the segment. Therefore, it is possible that certain industry segments are global -- firms in the segment compete worldwide in a coordinated way -- while others are not.

### 3.1.3 Competitiveness and Globalization

The existing literature on the international E&C industry suggests that E&C firms compete in the international markets based on either firm-specific factors (e.g., know-how of project management, engineering expertise, and project financing, and proprietary knowledge generated by R&D) or home-country-specific factors (e.g., various forms of home governments' subsidies).

In contrast, this study attempts to suggest that competitiveness of E&C firms could also be determined by such decisions as how widely firms would seek markets geographically, which activities firms would perform, how firms would concentrate or disperse such activities, how well firms would integrate a chain of different but sequential internal activities vertically and horizontally, how firms would concentrate or disperse inputs, which complete the value-chain of an entire project, and how firms would coordinate flows of inputs for their geographically vast operations.

Under global strategies, the location of an organizational unit of an E&C firm, for example, may not be determined by the desire to obtain projects in the country of the location. Rather, the location may be determined to serve the firm's worldwide markets by taking advantage of certain advantages arising from the location, such as availability of engineers of good quality at low wages, easy access to the world capital market, or the country's good political relationship with Muslim countries.

In spite of the ceaseless clamors in the environment surrounding E&C firms, such as in exchange rates, factor costs, and demand fluctuation and political conditions in host countries, E&C firms would be able to maintain their competitiveness continually by global strategies.



### 3.1.4 Internationalization and Globalization

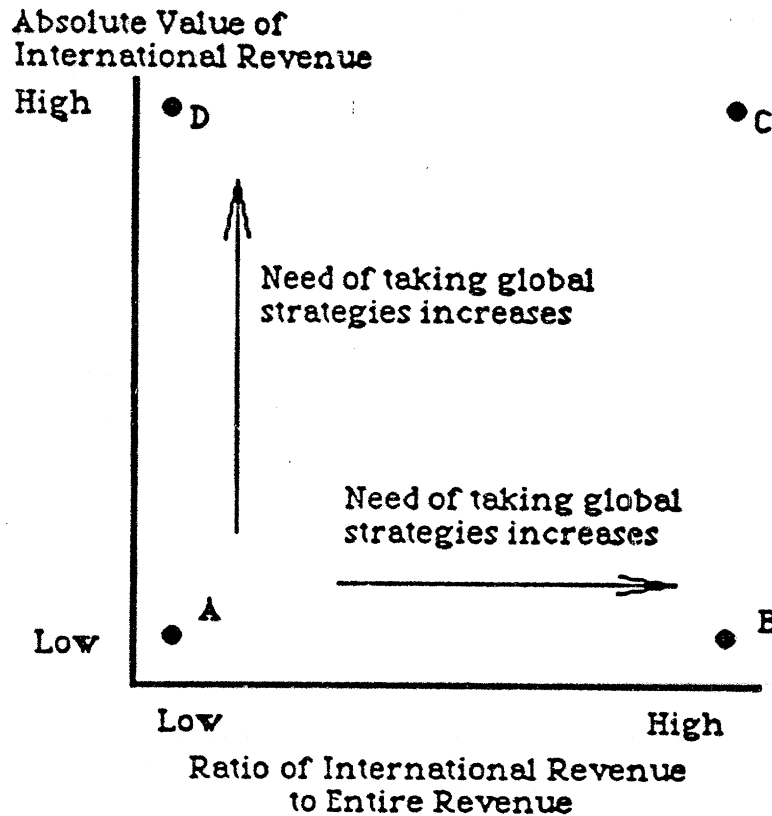
It may be useful to distinguish internationalization and globalization in order to illuminate the distinctive nature of globalization. The concept of internationalization is usually defined as the process through which a firm becomes involved in business in foreign markets. More often, internationalization is concerned with penetration of foreign markets by several alternative means, such as licensing, trade, joint venture, and FDI. Accordingly, it is considered that a firm is more international as it moves from being less to more committed to foreign markets, either by moving from licensing toward FDI or by increasing foreign sales. In other words, the degree of internationalization is measured by an increase in the stock (an accumulated value) of FDI made by the firm or by an increase in the absolute value of foreign sales of the firm (or percentage of foreign sales to its entire sales). Internationalization of a firm in terms of a stock of FDI is specifically called "multinationalization".

Globalization is essentially a category of internationalization. International strategies are diverse and include global strategies, which are aimed at gaining competitiveness by coordinating activities in a value chain (internal and external) that is dispersed across countries (such as marketing and R&D centers in several countries). Therefore, globalization is concerned with how widely a firm captures geographical, often "worldwide", markets rather than mere market penetration in terms of foreign sales or FDI, and leverages and advantages across its activities and inputs in various locations.

However, the degrees of internationalization or market penetration seems to influence at least the need of taking global strategies. Suppose that degree of internationalization of a firm is presented by the combination of the absolute value of international revenue and the ratio of the firm's international revenue

to its entire revenue as in Exhibit 3.1.1, with the two variables on the vertical axis and horizontal axis respectively.

Exhibit 3.1.1: Relationship between Global Strategies and Internationalization Represented by Absolute International Revenue and Ratio of International Revenue to Entire Revenue



A firm with a large international revenue, such as a firm at Point D in the exhibit, may realize more need for taking global strategies than a firm with a small international revenue, a firm at point A. It is because the former firm, for maintaining its competitiveness, may need to deal with the operational and managerial complexity that accompanies large scale, dispersed international operation. Also, a firm with a high ratio of international revenue (a firm at point B) may have a greater need to improve its competitive position by global strategies than a firm with small ratio (a firm at point A) because of the larger

effects of taking global strategy on the whole performance of the former firm. Similarly, a firm at point A, B, or D may have fewer incentives and less effectiveness of adopting global strategies than a firm at point C. (Correlation between an absolute value of foreign sales of a firm, percentage of foreign sales to its entire sales, and a stock of FDI made by the firm, and configuration of activities is examined in Appendix A of this study.)

### 3.2 Value-Chain and Production of E&C Firms

The concept of value-chain is used in this section and modified to accommodate the characteristics of E&C production, as a basis for the theoretical development of the globalization model to follow.

#### 3.2.1 Activities of E&C Firms

Different kinds of labor consume varying proportions of physical force and intellectual ability. When labor assumes a certain distinctive function, e.g., accounting, welding steel members, handling a machine, or procurement, within a firm, it is defined as an activity. Output of such an activity can be either goods or services. It is important to note that this definition allows to distinguish goods and services clearly and thereby put service and goods production activities on the comparable ground. In addition, an activity is the minimum unit constituting a value chain, which is explained in the next chapter.

Regarding activities of E&C firms, it is theoretically more accurate to categorize the activities of the E&C industry as producing both goods and services, although either type of production may, in the real world, be considered services insofar as the construction sector is considered to be a service sector. Also, it must be borne in mind that even a goods-producing E&C firm, or subcontractor, also performs services. Pouring concrete, driving a pile, or placing steel lines, are considered goods-producing activities, while the work of superintendents hired by the subcontractor to oversee these goods-producing activities under the supervision of an E&C firm may be considered to be services. Also, estimating, bidding, and other pre-bidding activities as well as the activities of general

administrators and top and medium management required by each subcontracting firm are surely service-activities.

Furthermore, E&C firms whose main products are services may engage in goods-production activities which otherwise could be done by subcontractors. In lump-sum contracts, for example, E&C firms often hire labor and superintendents, and thereby undertake physical production activities. Then, the E&C firm becomes more like a goods-producing firm.

### 3.2.2 Value Chain of an E&C Firm

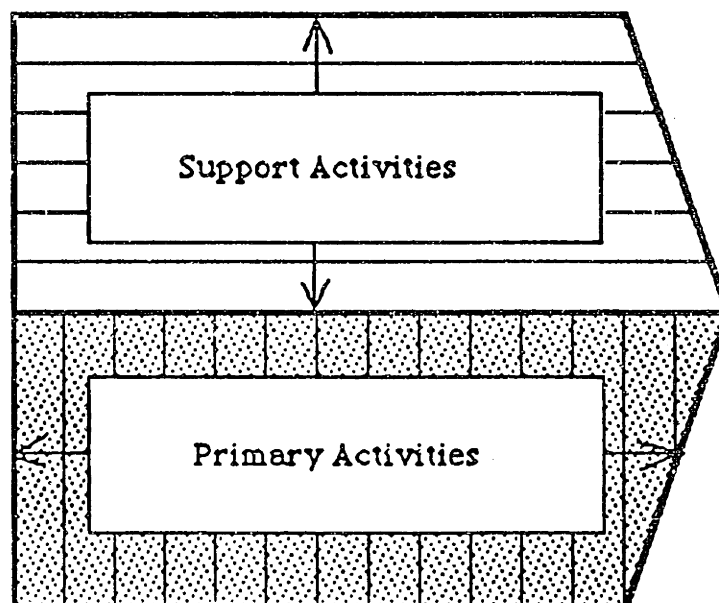
A value chain is a collection of activities achieving distinctive functions within an E&C firm. Each activity produces either services or goods, utilizing internal labor, capital, and human capital with a different mixing rate. Each activity not only incurs a certain cost for the use of labor, capital, and human capital but also adds value to their commercialized outputs, either goods or services.

It is worth mentioning that the value chain presented here differs from Porter's reviewed in the previous chapter. First, the value chain is used to demonstrate locations of activities and to analyze vertical and horizontal linkages of activities but not for cost structure of E&C firms. It is because cost analysis can be performed more effectively in other frameworks since costs are influenced by many factors which are not included in value chain framework (e.g., a firm's asset and liability structure). Second, the value chain thus does not include values of inputs. Mixing inputs and internal activities prevents a clear understanding of what a firm configure and coordinate internally and externally, a critical part of globalization. Furthermore, inputs in the E&C industry may not necessarily be inputs to an E&C firm (although they are inputs to a project), depending on types

of contracts in which they engage. For example, despite the importance of sourcing capability for an E&C firm to be selected, it is difficult to consider that the inputs purchased on a reimbursable contract by a firm are inputs to the firm.

A value chain for an E&C firm is drawn in much the same way as is Porter's value chain. Activities are divided into primary activities and support activities. (Refer to Exhibit 3.2.1.) Primary activities refer to the activities associated with the E&C service production (and goods production if it vertically integrates in physical production of construction). Support activities include activities of top management, all sorts of administrative activities (e.g., accounting, personnel, legal, and information system), and research and development. It is important to note that primary activities are linked from left to right to complete E&C production so that performance in one activity affects the performance in the following activities. Support activities are linked to primary activities in the way support activities sustain the primary activities.

Exhibit 3.2.1 Value Chain of an E&C Firm



Compared to support activities, the primary activities of E&C firms are difficult to specify, because of the great variation in the firms and vertical integration across firms. To elucidate, it is useful first to present the value-chain of an entire project, and then to present the value chain for the E&C firm itself. The presentation demonstrates the unique character of production in the construction industry and the role of the E&C firm in producing the final outputs relative to relationship between manufacturing firm and its outputs.

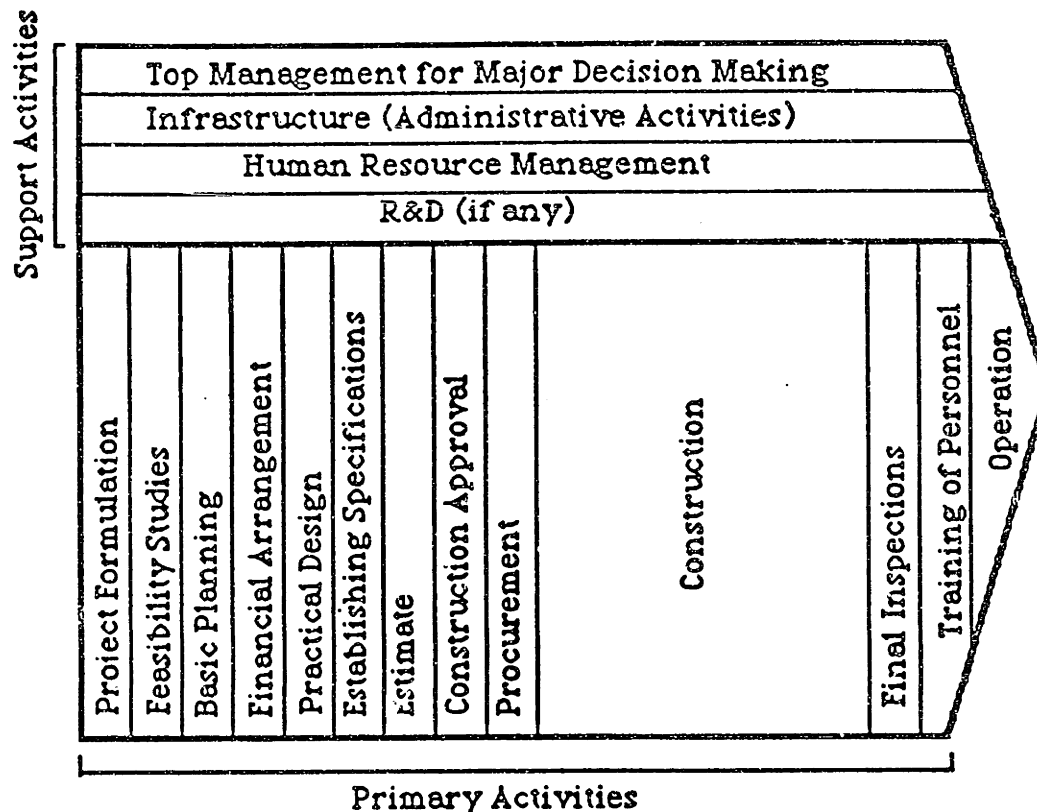
Exhibit 3.2.2 below illustrates a schematic view of a value-chain of a hypothetical E&C firm performing all the activities in a project. In other words, the imaginary E&C firm provides not only construction management activities but also activities which would usually be done by subcontractors and clients. The imaginary firm, by mobilizing internal labor and physical capital as well as its administrative hierarchy, performs planning, architectural and engineering design, and all kinds of legal approvals; raises capital for the project, executes physical production (construction); trains its staff for the completed facility; and finally, operates the facility. The hypothetical firm does the R&D for better engineering of the facility, and does all kinds of administrative activities to coordinate the primary activities.

The firm looks like a manufacturing firm, such as an automotive firm. For example, General Motors formulates production planning; performs marketing studies; designs automobiles, makes all specifications; procures materials, parts, and equipment; assembles, inspects, and sell automobiles. General Motors also educates its own workers, engages in R&D to improve the quality and design of the automobiles, and maintains a large administrative staff to coordinate the different activities taking place within the firm.

This kind of organization exists in the manufacturing industry but not in the real construction industry. In the construction industry, a number of firms

have emerged, specializing in a single or small number of functions, and each undertakes part of the value-chain.

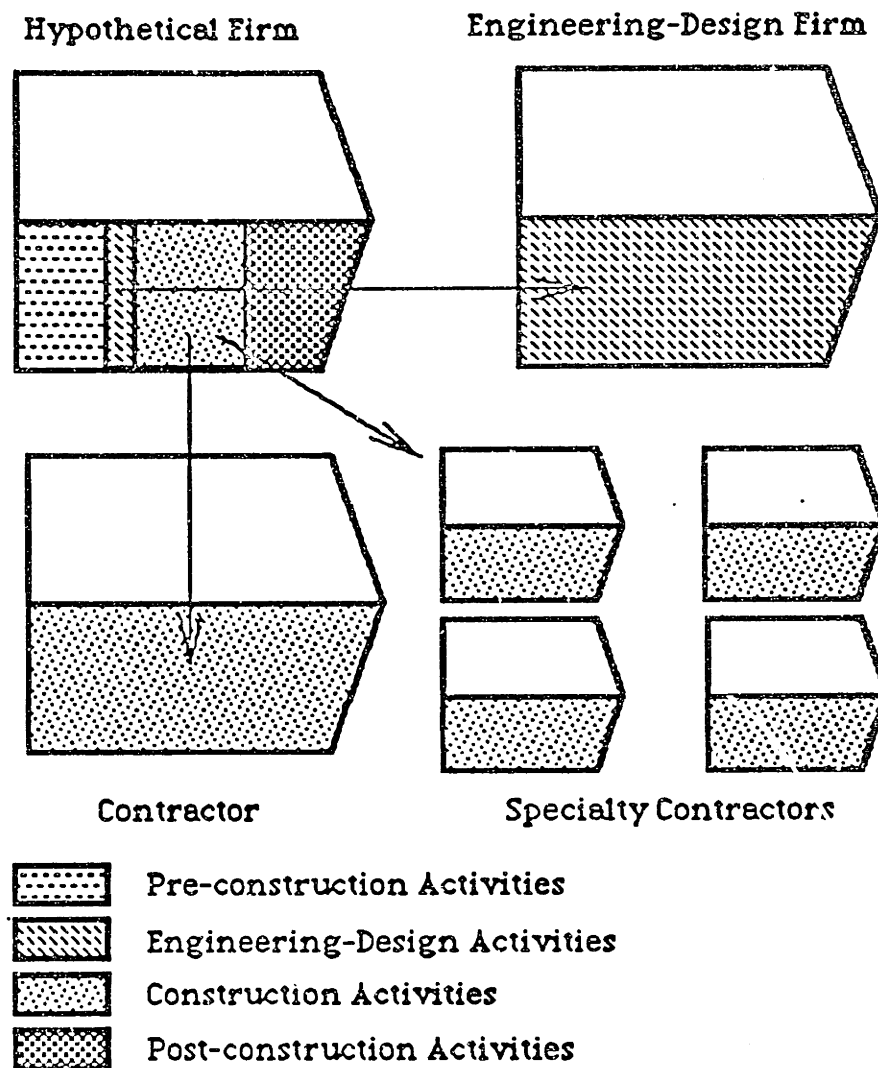
Exhibit 3.2.2 Value Chain of Hypothetical E&C Firm



Going back to Exhibit 3.2.2, "Construction activity" is divided into the activities involved in direct physical production and in managing firms providing physical production. The firms providing physical production directly are "subcontractors," and those managing such activities are "contractors". Often, the procurement activity is included in the activities which contractors and subcontractors perform. Engineering design firms produce only engineering design activities. The relationship in the value-chains between the hypothetical firm and a contractor as well as between the hypothetical firm and an engineering-design firm is illustrated in Exhibit 3.2.3.



Exhibit 3.2.3 Relationship between Hypothetical Firm, Engineering Design Firm, Contractor, and Subcontractor



Very often, the engineering-design firms vertically integrate upward into various pre-construction activities, placed to the left of "Construction" activities in the primary activities in Exhibit 3.2.3., because pre-construction activities, such as feasibility studies, can be best performed by those capable of designing the facility. The linkage between design and procurement also allows these firms to procure machines and equipment. Also, they are required to procure before they finish the design of facility because suppliers' production of certain machines and equipment takes longer time than others. While these firms usually

supervise the design aspect of physical erection of facilities at project locations, it may not be so difficult for many of them to further integrate downward into construction management activities because of the common activities between supervisory and construction management activities. Furthermore, these firms may perform activities after facilities are constructed. Because facilities are custom-designed by these firms, it may be natural that they provide services after constructing the facilities.

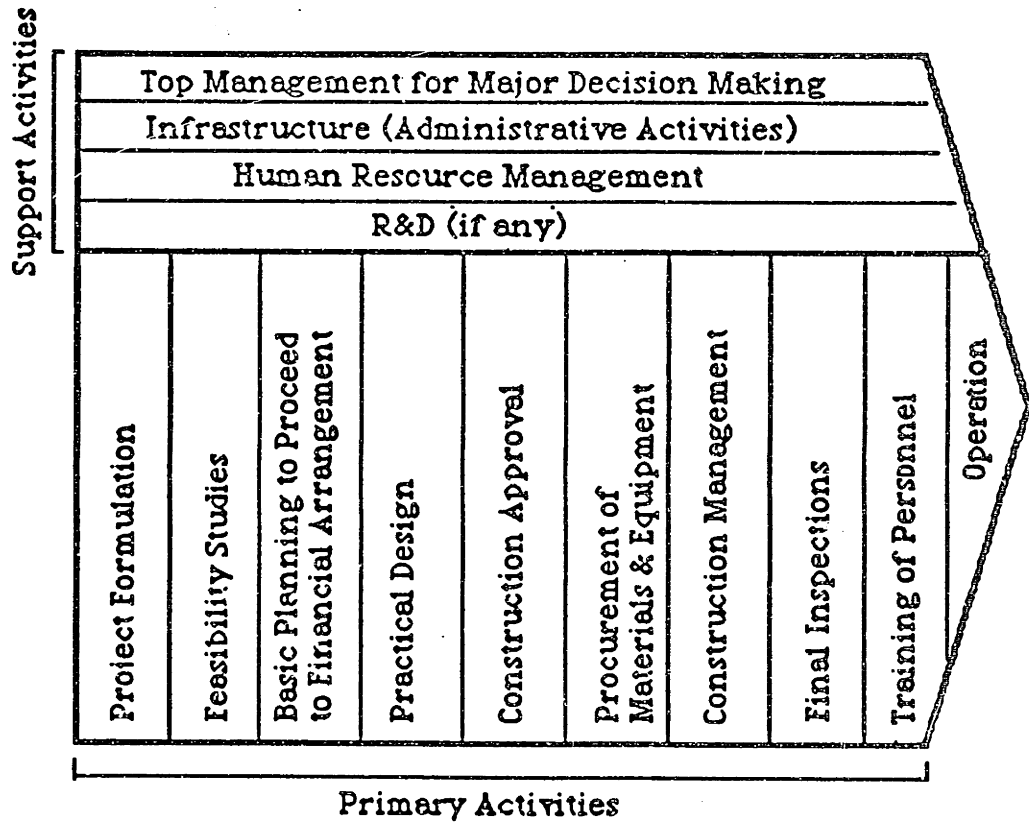
These very diversified engineering-design firms are known as "engineering contractors". They are usually engaged in market segments requiring strong engineering expertise (in chemical, petro- and biochemical, metallurgical, nuclear in addition to conventional structural and electrical engineering). They typically build manufacturing plants, chemical and petrochemical process plants, power plants, oil- and gas-related facilities, and marine facilities as well as heavy infrastructure, such as highways, railways, dams and other water-related facilities.

By contrast, "contractors" usually are engaged in the management of subcontractors who physically erect heavy facilities and general buildings as well as industrial facilities, requiring only general expertise of conventional engineering. However, contractors also vertically integrate into engineering design and other pre-construction activities as well as post-construction activities. Furthermore, both engineering firms and contractors often integrate into the financing of projects. Exhibit 3.2.4 illustrates a value-chain for a typical vertically integrated E&C firm in the real construction industry.

E&C firms, as defined briefly in Chapter 1 of this study, include contractors, engineering firms, and hybrids of contractors and engineering firms, but not speciality contractors (subcontractors), pure engineering design firms, or consultants specializing in narrowly expertise. However, degree of vertical

integration of E&C firms varies from firm to firm. While certain E&C firms, especially large ones, are vertically integrated, basically for a better chance to acquire projects while others concentrate on management of construction.

Exhibit 3.2.4 Value Chain of Typical Vertically Integrated E&C Firm



### 3.2.3 Importance of Inputs to E&C Firms

The value-chain of the whole project relative to the value-chain of an E&C firm suggests that competitiveness in terms of cost and differentiation also stems from inputs (i.e., materials, equipment, subcontractors, consultants, capital, etc.) sourced externally. Although an E&C firm may control the whole production process, it is important to remember that the monetary value added by the

services provided by the firm is very small compared to the whole value of a project, e.g., 8.5 to 16 percent in the infrastructure type projects.<sup>1</sup>

As clients select an E&C firm on the basis of its sourcing ability and price of all inputs required for a project, it is obvious that sourcing is very important activity. Particularly in international competition, how and where an E&C firm sources inputs seem to be a crucial factor in competition. Also, if the firm acquires a project on a lump-sum contract, the importance of inputs increases.

<sup>1</sup>. Percentage of values of E&C activities is given as below.

Type of activities	Costs as a percentage of total construction costs
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#### Infrastructure engineering

Feasibility study	0.5 - 2.0
Detailed design	3.0 - 6.0
Construction supervision	<u>5.0 - 8.0</u>
Total	8.5 - 16.0%

#### Architectural design

Architectural design and contract administration	<u>3.0 - 6.0</u>
Total	3.0 - 6.0%

#### Process or industrial type engineering

Feasibility studies	1.0 - 2.0
Design or process engineering	1.0 - 3.0
Detailed engineering, procurement and construction supervision	<u>8.0 - 12.0</u>
Total	10.0 - 17.0%

#### Procurement services

Procurement services	<u>1.0 - 5.0%</u>
Total	1.0 - 5.0%

(of cost of goods)

Source: International Trade Center (1986)

### **3.3 A Model of Globalization for E&C Firm**

In this section, a model of global strategies for an E&C firm is presented. The model is comprised of the three different elements of globalization: geographic, internal, and external globalization. Each element of globalization is proposed in detail, and the competitive advantage generated by each element is elaborated in the discussion.

#### **3.3.1 Geographic Globalization**

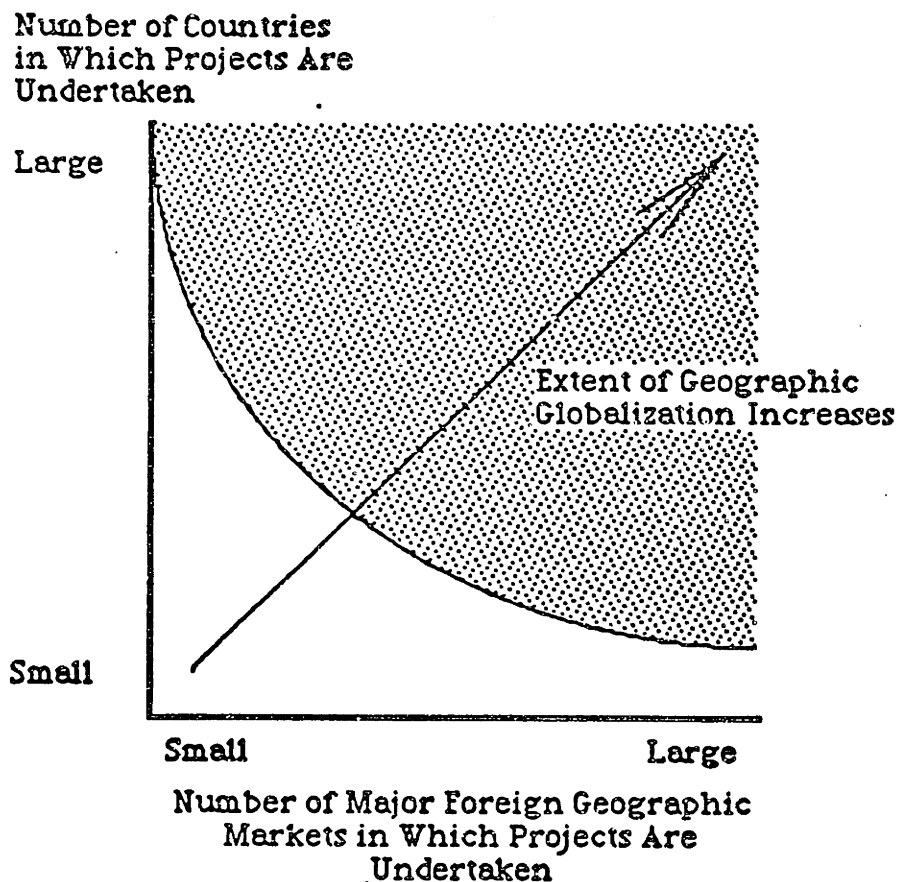
##### **3.3.1.1 Definition of Geographic Globalization**

Geographic globalization is the process by which a firm expands its geographic market and competes in vast geographic markets, at maximum "worldwide". Although "worldwide" is a matter of degree, it must be emphasized that a high degree of geographic globalization may cover a large number of countries and major foreign geographic markets, such as North America, Latin America, Europe, eastern bloc, the Middle East, Africa, and Asia. Thus, degree of geographic globalization is presented by the two-dimension diagram in Exhibit 3.3.1. Firms with a high degree of geographic globalization are located in the upper right corner of the diagram.

It is important to note that geographic globalization is not concerned with how a firm competes. A firm may compete either in a coordinated, multi-domestic, or a hybrid way. Therefore, strategies aiming to expand geographic market but not pertaining to how they compete may be called simply geographic global strategies. An expansion of a firm's market presence (e.g., setting up subsidiaries or branch offices) for access to the markets may be a good example although the firm's market presence surely influences how they compete -- in other words,

the configuration and coordination of activities in the second element of globalization.

Exhibit 3.3.1 Extent of Geographic Globalization of E&C Firms



### 3.3.1.2 Factors Driving Geographic Globalization of E&C Firms

There are several factors which drive E&C firms to expand their markets horizontally. Such factors are not only associated with economic rationales but also with behavioral and strategic characteristics of the firms.

#### 1) Macroeconomic Factors - Comparative and Absolute Advantages

Demand-supply relationships affecting the inter- and intra-industry trade aspects of E&C services provide a fairly plausible explanation for the horizontal expansion of E&C firms. First, the modified orthodox trade theory asserts that a

comparative advantage arises from the relative abundance of human resources with engineering and project management knowledge and experience in the developed countries (e.g., the U.S., Western European countries, and Japan) enabling them to export E&C services to developing countries. As E&C firms in developing countries accumulate engineering experience, they in turn begin to export E&C services to countries with less knowledge and experience. This has been demonstrated by the emergence of international E&C firms in Korea, China, India, Turkey, Yugoslavia, and New Zealand in the 1970s and 1980s.

However, knowledge, which constitutes a large part of E&C services, is a critical factor in their international expansion. It is the knowledge of how to provide E&C services that can only be gained by experience; such knowledge provides an absolute advantage to the E&C firms which have it. E&C firms originating in developed countries, or in countries which have already seen economic development and construction booms can gain this experience at home. Having gained this absolute advantage, they can then export their E&C services to developing countries. Moreover, as these firms accumulate knowledge obtained in their international operations, they gain a new dimension in their absolute advantage. Since the knowledge about how to perform E&C services does not exist in the developing countries, they have no choice but importing E&C services.

The absolute advantage also explains a part of the story of the intra-industry trade in E&C services, namely the two-way trade between developed countries (i.e., mutual invasions between the U.S. and European E&C firms to each one's market). First, if the absolute advantage is very significant, a firm may capture worldwide markets including other developed countries. However, for the E&C firm to possess a truly absolute advantage, it must usually specialize very narrowly and continually enhance its expertise. Second, although the knowledge possessed by an E&C firm from a developed country may far exceed that available

in developing countries, this advantage may not be so great in other developed countries where E&C firms have more or less similar knowledge. Therefore, E&C firms from developed countries might tap markets in other developed countries based on factors other than the absolute advantage. Factors that may explain intra-industry trade in E&C services more effectively include strategic and behavioral motivations which bring imperfect competition into the story.

## 2) The Imperfect Market for E&C Knowledge

The transaction cost approach of MNE theory, particularly associated with the imperfect market for knowledge, shares common variables with the absolute advantage approach and explains a good part of the geographic expansion of E&C firms. Market imperfection created by E&C expertise possessed by only one firm drives the E&C firm to exploit the market for its expertise and expand the production of services horizontally. Furthermore, the "public goods" nature of knowledge implies that E&C service production has little marginal cost of production; the logical outcome is a maximum international expansion. Simply said, the more market the E&C firm acquires and the more E&C services it produces, the smaller fixed costs the firm will have. A statement more appropriate to an E&C firm might be that the fixed cost of producing a firm's proprietary E&C services (i.e., the cost of maintaining human resources which are engaged in the production) can be best amortized by the maximum sales of their knowledge.<sup>2</sup> Insofar as the size of the home market for the knowledge (i.e., the size of the market segment which the expertise of the firm captures) limits the horizontal expansion of the sales of the E&C knowledge, the firm must exploit foreign markets, at maximum worldwide. In other words, the greater the size of fixed costs

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<sup>2</sup>For the E&C firm to effectively execute E&C services and to remain competitive, it must maintain the minimum best human resources which embody E&C expertise. Thus, they become a fixed cost to the firm.



relative to the size of the home market, the more aggressively the E&C firm must exploit the foreign markets. Therefore, the E&C firm which reserves large human resources must exploit worldwide markets to maintain its resources and continue to make profits. If the E&C knowledge is embodied in capital assets, such as a large computer network, the same rule applies to the firm's horizontal expansion.

### 3) Behavioral factors

The E&C firm may expand its geographical market by a complex behavioral factors as MNEs do.<sup>3</sup> First, a strong interest in foreign expansion on the part of some of a firm's high-ranking executives may lead the E&C firm to seek foreign markets. Second, it may receive outside proposals that cannot be easily ignored, such as invitations from foreign governments or the E&C firm's clients, and then may drive the E&C firm to expand its international expansion. Third, the "bandwagon" effect or "follow the leader" motivation (that is, a very successful operation by a competing firm abroad) may urge the E&C firm to follow the same path. Fourth, strong competition with foreign E&C firms in the E&C firm's home market may drive it to seek other markets; in other words, the E&C firm may expand its foreign market because of severe competition from abroad. Fifth, an E&C firm may attack the home markets of foreign counterparts to retaliate against their attack in its home market.

Similar to this motivation is "growth to survive," that is, the saturated, oligopolistic home market may drive the E&C firm abroad when an aggressive expansion at home provokes retaliation from the domestic counterparts. It also might be that expansion at home is simply impossible because the absolute size of

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<sup>3</sup>. For the theoretical justification of behavioral factors for MNEs to E&C firms, see the discussion in the review of studies on services in Chapter 2.

the home market is limited. This has been the case for many European E&C firms and Korean firms whose home markets are generally small.

Another important factor may be "follow the customer" motivation. As clients become geographically global, the E&C firm follows them into foreign markets and expands its foreign markets as the clients expand their operations worldwide. This seems to explain very accurately how certain U.S., Korean, and Japanese firms made inroads into major foreign markets since the 1960s.

Types of MNE organizations, especially diversified (or conglomerate) MNE organizations, provide suggestive parallels in considering the horizontal expansion of E&C firms. Since ultimate risk reduction through diversification may be obtained through diversification in products and geographical space, it is very likely that an E&C firm may diversify geographically in order to reduce the risks associated with fluctuation of demand and political uncertainty. Risks to supplies, i.e., channels of procurement of goods, services, and capital, are particularly subject to the effects of political unrest.

#### 4) Imperfection in the Financial Markets

Financial aspects of E&C firms provide a good reasons for operating on a worldwide basis. Maintaining the production of E&C services over geographically wide areas gives a firm an opportunity to gain a competitive edge over national and other international E&C firms as it learns to minimize taxes, manage foreign currency and political risks, and exploit the distortions in world foreign exchanges, equity, and credit markets.

An E&C firm may gain advantages by transferring funds with the most favorable interest rates or circumventing restrictions by borrowing funds where they are readily available and shifting them to countries with restrictions on borrowing. The successful E&C firm is discreet in "leading and lagging" transfers

of capital and profits, in choosing their channels, and in exploiting opportunities for arbitrage in taxes, currencies, interest rates, credit, and equity. Furthermore, diversification in the equity markets, as in geographical E&C markets, helps reduce risk. It may also lower the rate of return which must be shown to the investors.

#### 5) Strategic Motivation for Risk Reduction

Geographic globalization automatically provides E&C firms with a reduction of risks against fluctuations in geographic market demand. Since demand for certain kinds of facilities, such as industrial facilities, is strongly influenced by national factors<sup>4</sup>, firms with concentrated geographic markets may experience considerable ups and downs in acquired contracts. Geographic globalization may work for E&C firms as geographic diversification of risks although an adjustment of allocation of their internal resources remains as an issue of internal coordination in the second element of globalization.

### 3.3.2 Internal Globalization

Internal globalization is concerned with how E&C firms disperse various activities geographically and how they coordinate them over geographic distances. Different combinations of configuration and coordination provide different sources of competitiveness to firms while degree of internal globalization of the firms is determined by the extent of coordination of internal activities.

The concepts of configuration and coordination of internal activities deserve some elaboration here. First, this section addresses factors which affect

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<sup>4</sup>.See for example, Hillebrandt (1985).

patterns of configuration of internal activities. Second, coordination of internal activities is categorized into four distinctive kinds based on why the necessity of coordination arises.

### 3.3.2.1 Geographical Configuration of Activities

Configuration of activities refers where activities in the value-chain are located. The configuration of activities is analyzed under a headings, factors driving the E&C firm to concentrate or disperse activities. The factors are associated specifically with the ways in which the firm serves the market.

#### Factors Pushing E&C Firms to Concentrate or Disperse Activities

In general, E&C firm's activities managing the physical erection of facilities are usually performed at the project location while other activities, such as top management's activities, pre-construction activities (e.g., project formulation, feasibility studies, estimate, and basic design), and support activities may be carried out away from project locations. The second type of activities may take place either at the headquarters in the home country or foreign subsidiaries. It depends on how the E&C firm decentralizes these activities. It is notable that the activities necessarily performed at project locations tend to promote a dispersed configuration of production activities of the E&C firm.

However, factors influencing the location of activities are by no means simple. It is very likely that multiple factors determine the configuration of activities of the E&C firms. Furthermore, factors common to firms in many industries apply to E&C firms in varying degrees.

Factors generally favoring concentration of activities at one or a few locations include the following. (Factors encouraging dispersion of activities are just the opposite):

- (1) Economies of scale;
- (2) Proprietary learning;
- (3) Comparative advantage of one or a few locations for performing the activity;
- (4) Advantage of co-locating linked activities such as R&D and production;
- (5) Homogeneous preference to and need for products;
- (6) Mass transportation and reduction in transportation costs;
- (7) Fewer government impediments, such as tariffs; and
- (8) Formation of regional economic pacts, e.g., the European Community.

Factors from (1) to (5) and (7) are especially relevant to the E&C firm. Engineering and design activities may be located at the headquarters and/or regional headquarters to reap the economies of scale in specialized human resources as well as the benefits of vertical integration of closely linked pre-construction activities, such as project development, estimating, basic design, and financial packaging.<sup>5</sup> Research and development, if pursued by the E&C firm, may also take place at one or a few locations to effectively disseminate and protect proprietary knowledge, and refine it through practice and experience. Support activities also can be placed at one or few locations if economies of scale can generate net benefits to the E&C firm.

Furthermore, activities may be concentrated at a few locations if the comparative advantages of these locations are significant: for example, abundant

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<sup>5</sup>. It is also possible to have detailed design activities executed at the project offices.

human resources, major technological refinements (often at the E&C firm's major market), timely and comprehensive information on major multinational clients or suppliers, a developed financial market or financial institutions, and so on.

Factor (5) seems to be crucial in determining the configuration of E&C activities. The "one-off" characteristic, or customization, of construction output and local preferences generally drive the E&C firms to place their marketing activities in foreign countries. However, if these factors do not apply, it is very likely that activities will be concentrated at a few locations. Firms in the segments requiring specialized engineering expertise may concentrate their activities since the specialization promises homogeneous demand.

Factor (7) shapes a firm's configuration. Chapter 2 identified many barriers to trade in the E&C industry cited in the existing literature. Differences in safety and building regulations and technical standards, and requirements of professional registration (e.g., for architects and engineers),<sup>6</sup> established without any overt protectionist intent, may affect the export of E&C services and force firms to cope with them by setting up internal activities in the foreign market. However, a more influential factor in the dispersion of activities may be related to market access. Regulation may require local contracts to be awarded to local firms or in joint venture with a local firms owned by the firm.<sup>7</sup> More specifically, under such a system, most prominently in public works, a local commercial presence of some kind is required and E&C activities may be done only through a local subsidiary of the E&C firm. In this regard, nationalistic purchasing practices not only forces the firm to establish a local subsidiary but also influences the flow of goods associated with procurement for the project.

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<sup>6</sup>. Professional registration for architects and engineers is a standard practice in Europe, North America, Asia including Japan, and the Middle East. (Mayes 1987)

<sup>7</sup>. Ibid.

Factors (6) and (8), like nationalistic purchasing practice, may affect the flow of goods by affecting the location of procurement activity. Procurement activity in project offices or subsidiaries in the foreign country will diminish as needs and standards for materials and equipment become more homogeneous, transport becomes cheaper and is done in mass volume, local governments lower import tariffs and abandon nationalistic purchasing regulations, and regional trading blocs allow freer flows of goods. Under such circumstances, procurement activity can be performed at the headquarters or regional headquarters. Factors (6) and (8) seem to be associated with the degree of development of the world market of goods, or globalization of suppliers of each material and equipment. The same rule applies to subcontractors and labor.

Another factor which favors concentration of an activity is degree of risk which the activity bears. For example, foreign exchange management influences the performance of the international E&C firm in accounting and economic terms.<sup>8</sup> Foreign exchange becomes increasingly significant to the E&C firm operating globally given the volatile foreign exchange rates following the termination of Bretton Woods Agreement.<sup>9</sup> Risks associated with unpredictable fluctuation in foreign exchange can perhaps best be managed centrally so that all activities dealing with foreign exchange are located at the headquarters rather than dispersed at foreign subsidiaries.<sup>10</sup>

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<sup>8</sup> Accounting exposure refers to risks associated with the change in the value of a firm's foreign currency-denominated accounts due to a change in nominal (or market) exchange rates while economic exposure refers to risks associated with the change in the value of the firm due to a change in real exchange rates. For a complete discussion accounting and economic exposure, see for example, Shapiro (1986), pp.151-199 and Lessard (1986), pp.148-184.

<sup>9</sup> Lessard (1986), p.166.

<sup>10</sup> For a complete analysis and discussion of foreign exchange risk management of E&C firms, see Demacopoulos (1989).

Another possible factor favoring concentration of an activity is the degree of foreign involvement. Minor commitment to international markets leads to simple and centralized activities at headquarters.<sup>11</sup> In such a case, while certain E&C activities, e.g., construction management, are necessarily performed in foreign countries regardless of the degree of foreign commitment, all others may take place at the home country of the E&C firm.

### 3.3.2.2 Coordination of Internal Activities

One of the most crucial tasks in constructing a globalization model for the E&C firm is to examine what coordination means and how coordination may be systematically categorized in order for the model to be operative. More specifically, it is essential to analyze where incentives for coordination come from and how a competitive edge is shaped. The literature review has identified at least four distinctive kinds of coordination although they are not mutually exclusive. Coordinations is associated with: 1) duplication of activities; 2) dispersion of vertically integrated activities; 3) firm-specific knowledge; and 4) product (or segment) diversification.

#### 1) Duplication of Activities

The E&C firm's geographic expansion naturally results in service production at multiple locations as physical construction is carried out. Very often, the E&C firm's geographic expansion also results in establishing foreign branches and subsidiaries as local regulations require a commercial presence and the "experience goods" nature of the business forces the firm to establish local reputation and credit. Also, geographic distance between project offices and

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<sup>11</sup>.Stopford and Wells (1972).



headquarters complicates intra-firm trade in various internal services. As a result, comparable groups of activities are placed not only at project offices but also at subsidiaries in multiple countries. Under multi-domestic strategies, comprehensive E&C activities are performed in each foreign country; there are few exchanges between headquarters and local offices. The headquarters of the E&C firm treats its operations in each country as if they were separate holdings and simply collects the profits generated. Geographic diversification (or geographic globalization) *per se*, regardless of the level of internal coordination, protects the E&C firm from fluctuations in the volume of E&C activities arising from national and international macroeconomic factors, fluctuations in the business cycles in each market segment, and political events in a certain location.

In contrast, under global strategies the E&C firm can create net competitive advantages by sharing and integrating activities in primary and support activities over geographic distances. Examples of coordination activities over geographic distances for pre-construction, procurement, E&C, and support activities are discussed below.

#### Coordination in Pre-construction Activities

An E&C firm can share its corporate name worldwide and reinforce its reputation and credibility on the basis of the quality of its services and ability to cope with the "experience goods" nature of E&C services in different countries. It could be beneficial for firms to share project development in several countries to explore each other's multinational clients. Each would gain more opportunities and lower the cost of finding new clients. It is possible to achieve this coordination by sharing project development personnel in several regions by frequent travel of the personnel and intensively communicating through the

shared communication networks. Furthermore, sharing the knowledge on financing sources in each country and exploring bilateral and multilateral commercial and political agreements between and among countries could lead to be an excellent financial packaging as well as establishing sourcing channels for goods and services.

#### Coordination of Procurement Activities

Procurement activities in different countries could be integrated into fewer (or even one, at headquarters) locations or connected through communication network. Possible advantages could be significant if targets of procurement are expanded not only to suppliers but also to subcontractors, specialized consultants and engineering firms, and financial institutions. Such coordination could enable firms to lower procurement costs by providing economies of scale for procurement personnel and systems, take advantage of discounts for volume purchase, and improve the quality and availability of sourced goods, services, and capital. Moreover, E&C firm might not only reduce risks but even generate competitive advantages by coordinating sourcing channels for goods, services, and capital in ways designed to protect themselves from stoppages of supplies; deterioration of cost competitiveness as the comparative advantages of sourcing countries change, and by fluctuations in exchange rates.

#### Coordination of E&C Production Activities

Engineers and project managers can be shared by several organizational units for effective use of human resources and for alleviating fluctuations in work loads in different geographic markets. Sharing computer facilities (and construction equipment when the firm is engaged in physical construction)

could not only generate similar benefits but also develop more standardization in design, estimate, scheduling, budgeting, and so on. Sharing computer network provides a significant flexibility in the locations of various engineering activities because the most advanced computer network allows to transmit data, drawings, and other information.

#### Coordination of Support Activities

Net benefits of coordinating support activities may be greatest in financial activities. In addition to sharing financial institutions, as addressed earlier, activities dealing with surplus funds or profits for internal utilization and investment outside the firm; foreign exchange associated with payments to suppliers, subcontractors, and other firms for their inputs and payments from clients denominated by multiple currencies; and tax payments over a number of different tax regimes could be coordinated by integrating them at one or fewer locations.

Other possible support activities from which a net advantage can be generated through coordination include networking of accounting activities over multiple countries and centralizing data processing for accounting to facilitate accurate and quick strategic decision making.

#### 2) Geographic Dispersion of Vertically Integrated Production

The value-chain of the E&C firm has shown the linkages over vertically integrated activities of the E&C firm. E&C services take place effectively only when these vertically integrated activities are carried out in a coordinated way. In contrast to the case that vertically integrated production takes place at one location, dispersion of vertically integrated production is well known in manufacturing industries, most notably in the case of off-shore plants. For

dispersion of vertically integrated production to be successfully carried out, significant coordination of the flows of goods over geographic distances must be achieved. In the international E&C production, too, the vertical chain of activities can be dispersed into several locations.

It may be helpful to show an example of the dispersion of vertically disintegrated production in manufacturing in order to demonstrate the similarities and differences between goods production and the E&C services production.

Suppose that all production activities are performed at one location and export is the way foreign markets are served.<sup>12</sup> Then, the firm starts to produce its goods offshore for certain reasons.<sup>13</sup> There are at least three ways to do this: First, the firm may place a whole production system abroad; second, it may place abroad only down-stream production activities which must be done close to the foreign market; and third, the firm may separate a whole production system into several sets and place them at multiple locations.

In the first case, there may be comparatively little coordination associated with the physical production process because it is complete at the local level, at least in the physical sequence of the operation.<sup>14</sup> (Refer to Exhibit 3.3.2.)

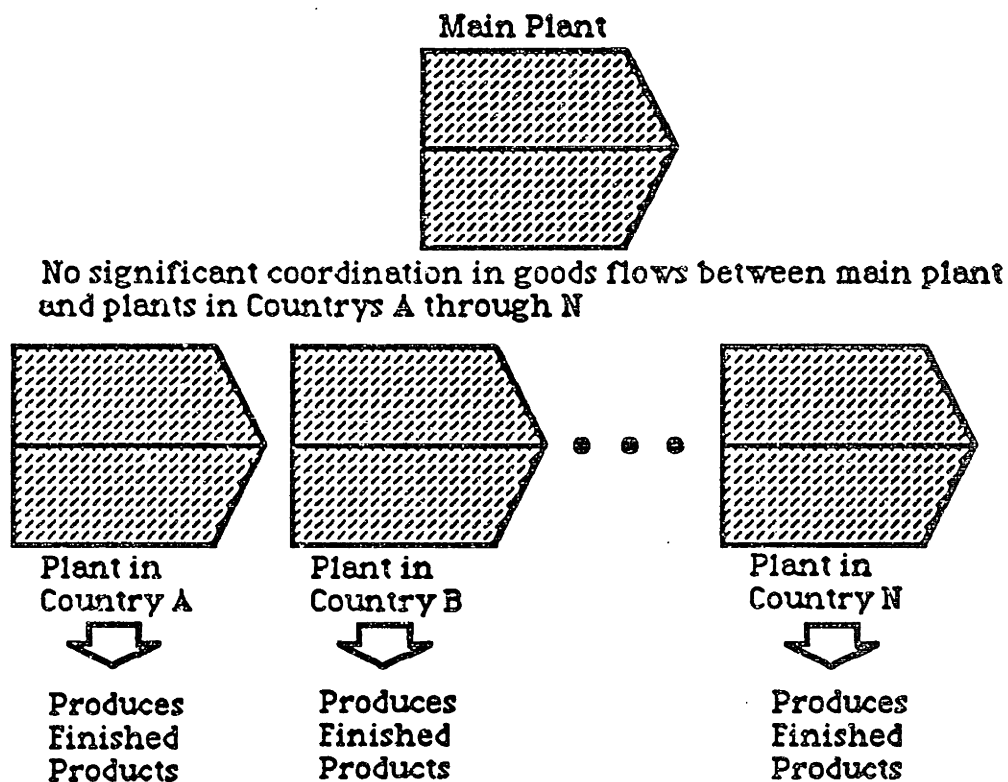
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<sup>12</sup>The concentrating of all activities at one location, the ease of coordinating production activities, economies of scale of production, and possibly quality control may be achieved more easily in the vertically integrated form of production.

<sup>13</sup>As we have seen in the MNE theory, reasons for making FDI are very diverse, e.g., factor endowments, often cheap labor, in foreign locations, transportation costs, trade barriers, protectionist measures by local governments, oligopolistic motivations, etc.

<sup>14</sup>Even, in this case coordination is required with respect to proprietary knowledge specific to the firm, e.g., production engineering, production management know-how, marketing linkages, various improvements arising from actual production or management, etc. In other words, intra-firm trade in the form of services occurs. We examine this kind of coordination in the next item.

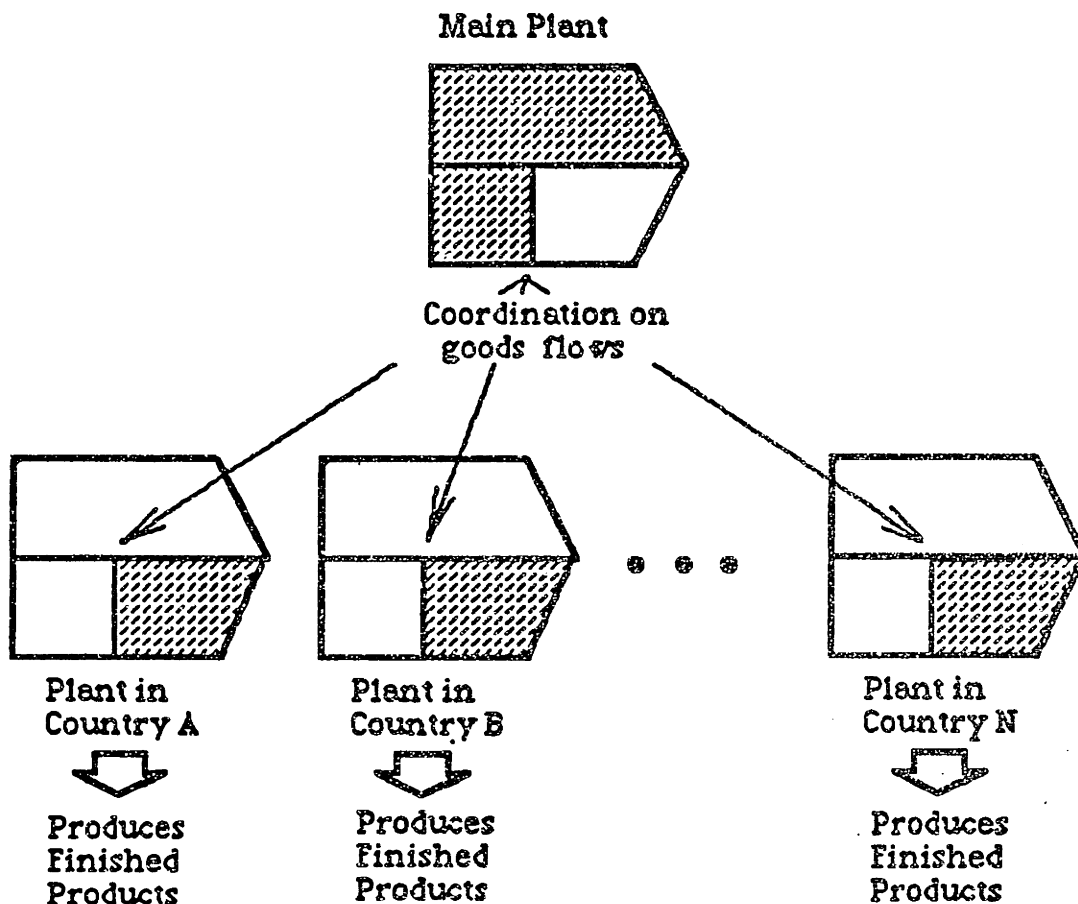
Exhibit 3.3.2 Illustration of a Manufacturing Firm Placing the Whole Production System Abroad



Note: Shaded areas indicate activities performed in each plant.

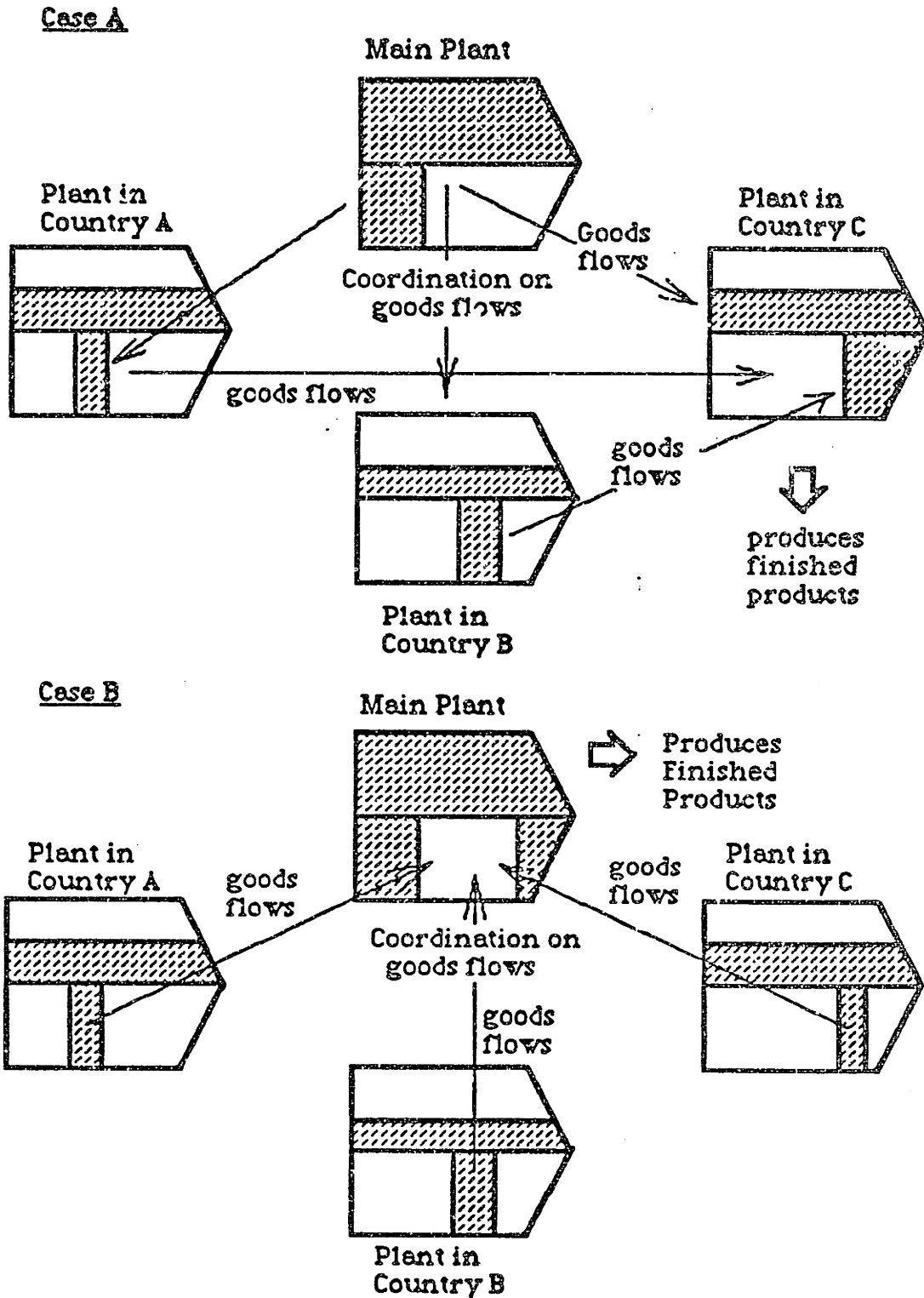
In contrast, in the second and third instances, there is significant coordination associated with physical production. In the second case, a major part of production is achieved in the main plant and then, semi-finished products are shipped to a foreign plant for the final assembly. The finished products may be locally marketed and sold in the host country or in regions close to the country. Coordination is primarily associated with intra-firm trade of goods. Exhibit 3.3.3 illustrates the point. The right-hand part of the primary activities (not shadowed) at the main plant is transferred to several countries, and goods flow between the main plant and plants achieving the shadowed activities. Quantity, quality, design and technological changes as well as timing of shippings must be coordinated.

**Exhibit 3.3.3** Illustration of a Manufacturing Firm Placing Down-Stream Activities Abroad



In the third instance, primary activities are separated into several sets of activities in order to take advantage of scale economies, comparative advantages, and other location-specific factors in different countries. Different parts of production are carried out in different countries. Finished products may be completed either in a foreign country (Case A Exhibit 3.3.4) or shipped back to the home country for final assembly (Case B in Exhibit 3.3.4).

Exhibit 3.3.4 Illustration of a Manufacturing Firm Separating its Production Systems into Several Sets and Placing Them at Multiple Locations



Note: Shaded areas indicate activities performed in each plant.

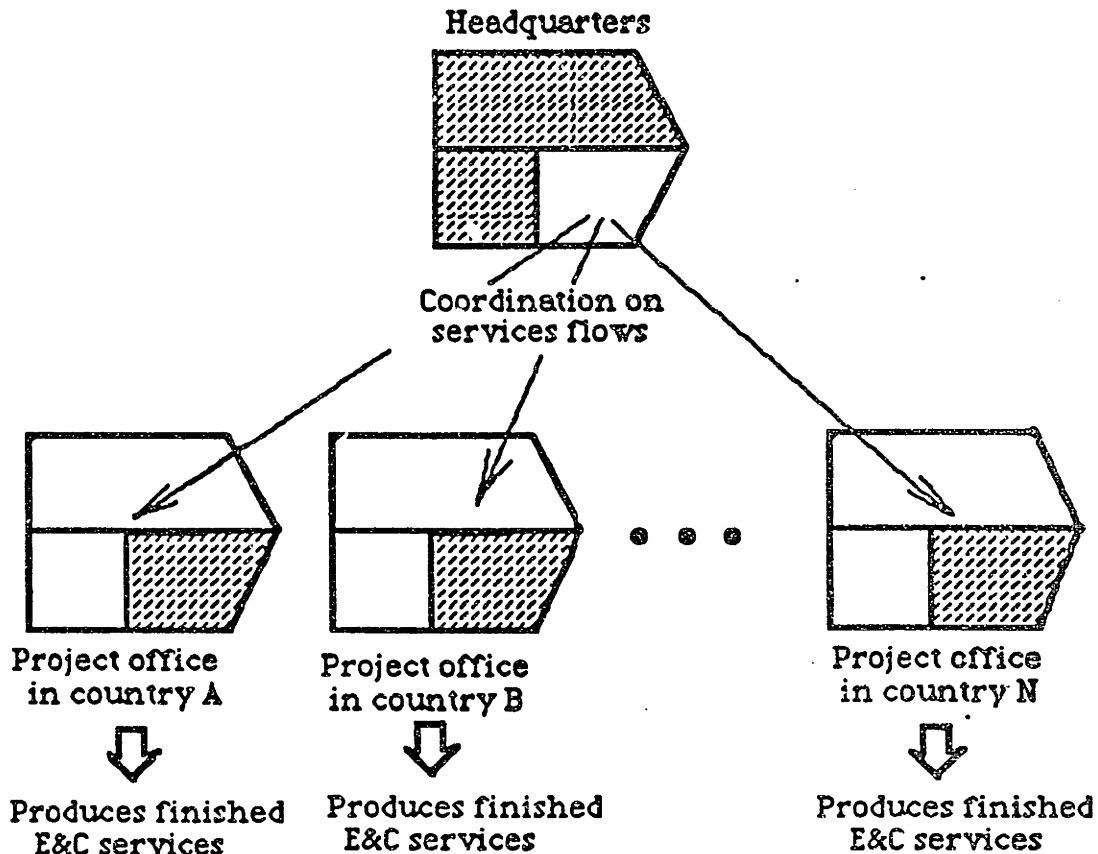
The point is that when a single set of production activities is divided into subsets and distributed in different locations, the firm needs to coordinate activities to complete the production. In manufacturing, coordination is primarily associated with physical flow of goods. Moreover, for the most efficient flows of goods, the flow of scientific, engineering, managerial knowledge, and top management's strategic decision making (i.e., intra-firm trade in services) must accompany the flows of goods (i.e., intra-firm trade of goods). As the markets served by the firm expand geographically, the importance of the coordination of physical flows of goods increases dramatically.

Similar dispersion of vertically integrated production happens in the E&C industry in a quite similar way and for comparable reasons. In the E&C industry, to serve foreign markets a firm can concentrate production of E&C services in the home country and export those services in the form of drawings, calculation sheets, data communications, licenses, and so on. (This is often the case when a firm specializes in engineering only.) However, when a firm is engaged in managing the physical erection of facilities, it must more or less produce the relevant services at the foreign project locations. Exhibit 3.3.5 illustrates the point. Headquarters may perform pre-construction and all support activities but project offices in foreign countries must assume the down-stream activities, that is, most of the activities related to project management, including supervising all physical work; coordinating materials and equipment inflows to the site; and controlling schedule, budget, safety, and quality. Coordination is required between activities done at the different locations, e.g., between an estimate made at headquarters and project management done at project offices or between basic design (often done at headquarters) and detailed design (done at a project office). Also, technical assistance may occasionally be provided from the headquarters.



Coordination is primarily achieved in the way they exchange information and knowledge (intra-firm services trade). This is similar to the second case in the manufacturing example.

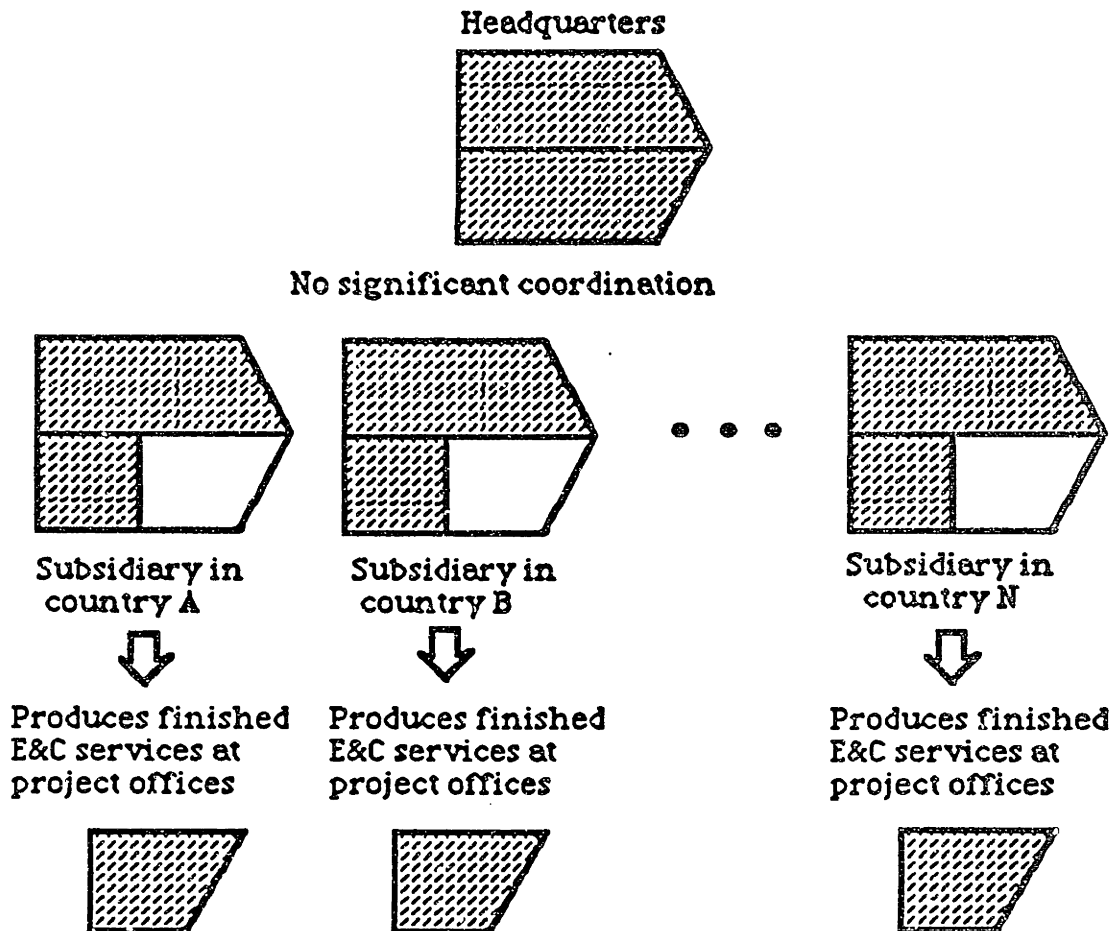
**Exhibit 3.3.5** Illustration of an E&C Firm Placing the Whole Activities Associated with Physical Erection of a Facility to Project Offices



However, as the E&C firm's international activities grow, the firm may establish foreign subsidiaries. If the firm decentralizes activities and those which used to be performed at headquarters are transferred to the local offices, coordination associated with linking vertically integrated activities diminishes markedly except for bidding decisions or occasional technical assistance from the headquarters before and during the execution of the project. This is close to the

first case in the manufacturing example. Exhibit 3.3.6 shows the growth of local activities.

Exhibit 3.3.6 Illustration of an E&C Firm Placing the Whole Activities on its Subsidiaries



The third case in the manufacturing example appears in the E&C firm as presented in Exhibit 3.3.7. For example, headquarters may specialize in certain activities, such as a part of pre-construction activities, a part of project management (e.g., computerized scheduling), and a good part of design and procurement<sup>15</sup> in addition to most of the support activities. It is also likely that a

<sup>15</sup>If sourcing goods and services -- or sourcing suppliers, manufacturers, labor, and subcontractors -- is restricted to the local markets due to import quota and

certain subsidiary in one foreign country will specialize in particular parts of design;<sup>16</sup> project offices manage physical installation of facilities with the help of headquarters and the specialized subsidiary and headquarters may coordinate overall flows of services worldwide. The development of communication technology may help E&C firms to achieve this kind of dispersed but integrated production of services. The flow of internal services as well as flows of goods procured at headquarters must be coordinated.

As we have seen, like manufacturing activities, E&C services may be vertically integrated. When this occurs, a firm must coordinate goods and services (or knowledge) to complete the sequence of services production.

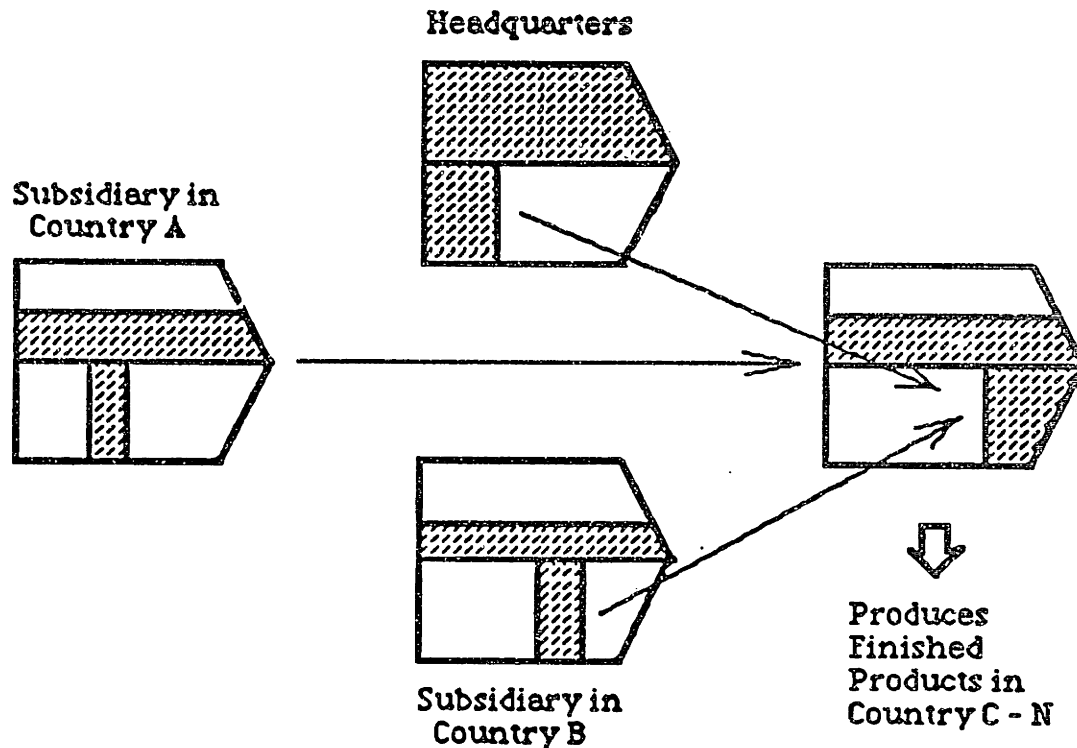
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other nationalistic measures or because of limitations in the development of the worldwide markets for these goods and services, the E&C firm may have no other choice but to source them locally. However, as the markets for goods and services develop worldwide, as transportation costs decrease, and as barriers of trade for these goods and services are lowered, the E&C firm may gain an advantage by concentrating the activity at one or few locations. Also when procurement activity is integrated at headquarters, there ought to be significant coordination for the flows of inputs procured by headquarters for its worldwide projects. This point is elaborated in the configuration and coordination of external inputs in the later section.

<sup>16</sup>.This may happen partly because foreign engineering personnel may be hired at lower wages, but more the outright purchase of a foreign firm specialized in the activity is involved.

Exhibit 3.3.7

Illustration of an E&C Firm Separating a Whole Activities into Several Sets and Placing them at Multiple Locations



Note: Shaded areas indicate activities performed in each organizational unit.

### 3) Knowledge Specific to the Firm

The third need for coordination may arise when the E&C firm wishes to appropriate firm-specific knowledge existing within its organization. Earlier, the transaction cost approach suggested that the "public good" nature of knowledge, which refers to the fact that there is little marginal cost for the use of knowledge, drives a firm possessing such knowledge to its maximum use for profits (or survival). This incentive may drive an E&C firm with the firm-specific knowledge to explore horizontal expansion of the firm. In practice, the fixed cost of maintaining the firm-specific knowledge accumulated in a firm's human

resource (and various kinds of corporate systems) can be amortized by maximizing use of the personnel to reach the break-even point and gain profits.

A high degree of coordination is required if the firm-specific knowledge is to be used by the firm in the most effective way at every opportunity. Furthermore, as it is used in a maximum number of circumstances, firm-specific knowledge is reshaped and improved; and the effect is to keep the E&C firm competitive. Thus, there must also be coordinated feedback of knowledge. The two-way coordination occurs in conjunction with the internal flow (or trade) of knowledge.

Firm-specific knowledge includes pure scientific and engineering knowledge, project management expertise, ways to achieve the excellent quality of services essential to the firm's reputation, and all sorts of knowledge which effectively differentiate the firm from another. The ability of top management to run an international E&C business in a profitable way falls into the category of firm-specific knowledge also.

Such knowledge may be coordinated in many ways. If it is embodied only in human resources, it is necessary to coordinate the physical placement of the personnel in order for the firm to appropriate the benefits of the firm-specific knowledge. If it is embodied in physical or verbal forms, coordination of knowledge may be accomplished through electronic or other long-distance communication. The means of communication are diverse, including letters, drawings, phones, telex, facsimile, computer networks, and other forms of telecommunication. As these channels are standardized and systematized, the corporate system of the E&C firm mustering them will achieve the best coordination of the knowledge, firm-specific and common, available to it.

Coordination of firm-specific knowledge takes place among multiple activities over geographical distances associated with vertical and horizontal

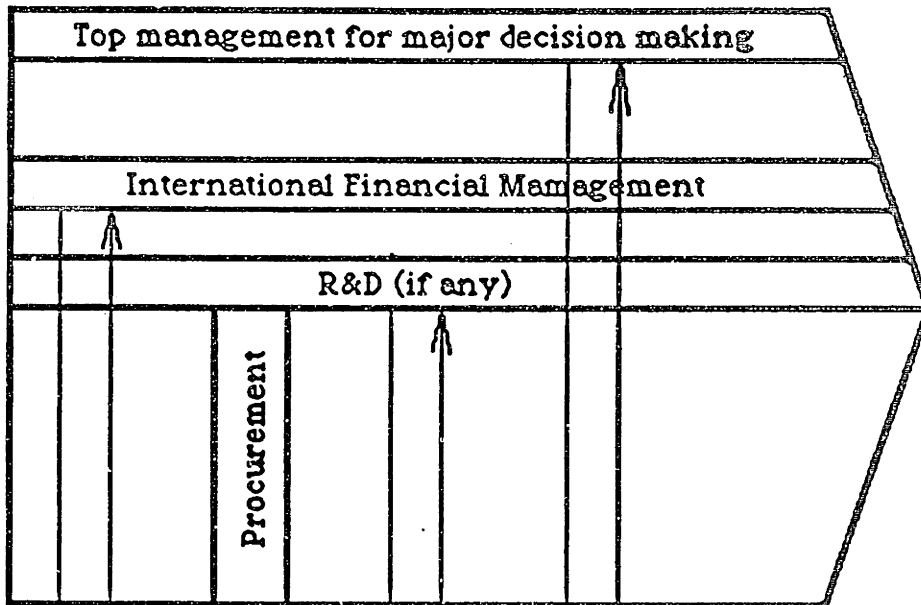
flows of services and goods within the E&C firm; the flows result from dispersion and separation of steps of E&C production. The point is effectively demonstrated by the value chain framework in Exhibit 3.3.8.

When knowledge is coordinated between the headquarters and a foreign subsidiary of the E&C firm, such horizontal coordination of firm-specific knowledge involves the transfer of strategic thought and decision making of the top management to the management of the subsidiary. Coordination of firm-specific knowledge can take place in many activities, such as marketing (e.g., bidding strategy of special kinds and treatment of particular multinational clients) and international finance associated with financial packaging unique to the firm. Similar horizontal coordination of knowledge takes place in the primary activities of the value chain insofar as the activities require knowledge.

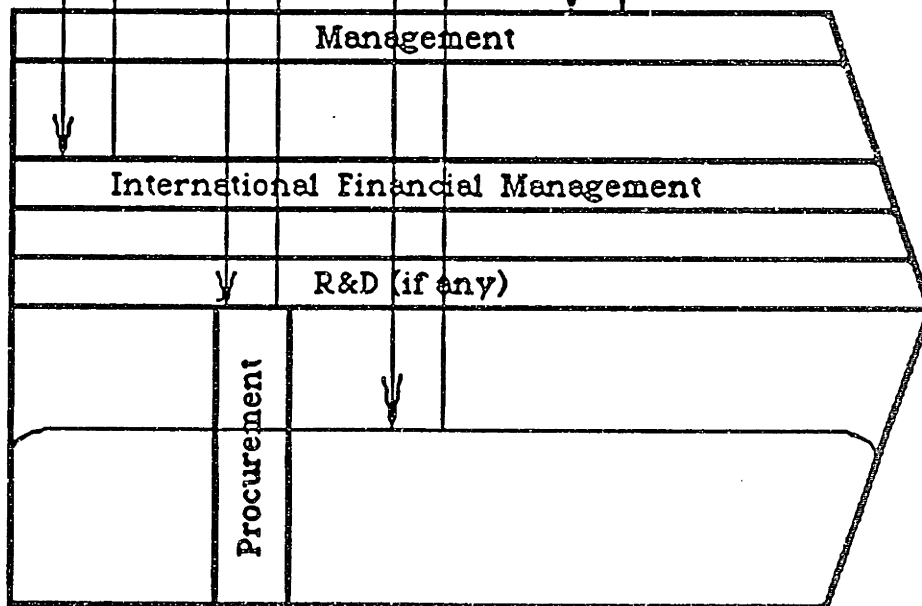
A good example of vertical coordination of knowledge is R&D activity performed centrally in the E&C firm. Any improvement developed at headquarters, in fact, must be exploited through horizontal transfer to the engineering personnel at the foreign subsidiaries as well as vertically to suitable primary activities, such as project management, taking place at the project sites. Top management decision making also applies both horizontally and vertically.

Exhibit 3.3.8 Coordination of Firm-Specific Knowledge

Headquarters



Foreign Subsidiary



4) Product Diversification

As pointed out earlier in this chapter, diversification is a distinctive characteristic of the E&C industry. When a firm diversifies into multiple product

segments (e.g., marine, petrochemical, general building, and heavy facilities), the firm faces three strategically important issues. First, each segment may require different engineering and project management expertise. Second, as the market for each segment differs geographically so does the geographic configuration of the E&C firm's internal activities. And, third, the configuration of inputs (suppliers and subcontractors) to the projects may differ as well. (This last point will be elaborated next in the external globalization.)

A diversified E&C firm faces two basic strategic options. It may operate each segment independently or coordinate activities over multiple segments. However, the coordination becomes complicated when the firm must cope not only with different activities but with differences in geographic locations of activities as well. In the most extreme case, different segments may be controlled by different product-based headquarters in different locations -- e.g., marine at London, general building and heavy at San Francisco, and petrochemical at Dallas. This happens when major markets for each segment differ geographically and/or the E&C firm purchases a foreign firm specialized in a particular segment.

Incentives for coordination over different segments in the E&C industry may follow the general trends in many other industries addressed by Porter<sup>17</sup>; i.e., 1) Management shifted from growth to performance in the 1970s and 1980s (as conglomerate-type E&C firms with independent business units for pursuing growth moved toward a bottom-line orientation exploiting interrelationships between related businesses.<sup>18</sup> 2) Technological change broke the barriers between different industries and segments as they came to depend on similar

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<sup>17</sup>.Porter (1985), pp.317-415.

<sup>18</sup>."Big firms reorganizing for profit," Engineering New Record, January 2, 1986, pp.10-11. Also, "C.T.Main back on track." Ibid., p.11-12.



technology (e.g., computers and communications now share many attributes.<sup>19</sup> 3) The costs and difficulties of coordinating multiple products segments for certain activities were reduced (e.g., engineering and procurement for multiple segments could be performed by a single control center). 4) Competitors operating in multiple segments emerged. Incentives to coordinate over multiple segments may be particularly keen when a project is so complex that it requires multiple disciplines.

Coordination over multiple segments is comparable in many ways to coordination over geographically dispersed locations. Therefore, the argument made for the coordination required by geographic diversification (associated with primary and support activities as well as with knowledge) applies equally to the coordination required by product diversification. For example, shared marketing (or project development) may lower the costs of surveillance of projects, increase business opportunities, increase differentiation as the firm's ability to deal with complex projects, higher entry barriers. Also, shared engineering know-how may create lower R&D costs; lower design costs including reduced time for engineering design; increase differentiation of its ability to deploy complex engineering knowledge; and thus allow the firm to create and take "early-mover-advantage".

However, the firm must now deal not only with difference in geographic locations of markets and internal activities but all kinds of differences among its segments, including expertise, personnel, goods and services procured, clients,

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19. McFarlean F. Warren, and James J. McKenney, "The Information Archipelago-Maps and Bridges," Harvard Business Review, September-October, 1982, McFarlean F. Warren, "Information Technology Changes the Way You Compete," Harvard Business Review, May-June 1984, pp.98-103, and Barfield, Claude E., and Robert Bento, "International Communications and Information Systems: The Impact on Trade," in American Enterprise Institute, 1984, pp.11-20.

and so on.<sup>20</sup> Implementing such coordination seems to require the highest degree of managerial and organizational sophistication.

### 3.3.3 External Globalization

The configuration and coordination of inputs to be sourced externally by the E&C firm can constitute an independent dimension of globalization. The separate consideration of this dimension is justified by the fact that sourcing inputs is theoretically a substitute for making them oneself.<sup>21</sup> Furthermore, the discussion earlier in this chapter has pointed out the importance of inputs for competitiveness of the firm in terms of cost and differentiation.

The importance of sourcing external inputs becomes greater as procurement is defined broadly to include sourcing all goods and services incorporated in final output of construction, that is, not only labor, materials, and equipment but services by subcontractors and knowledge from more specialized consultants, capital from financial institutions, and even JV partners.

#### 3.3.3.1 Definition of External Globalization

External globalization is defined by how a firm configures the locations of inputs geographically and how it coordinates the flow of inputs to projects in multiple locations. While the degree of external globalization is determined by the

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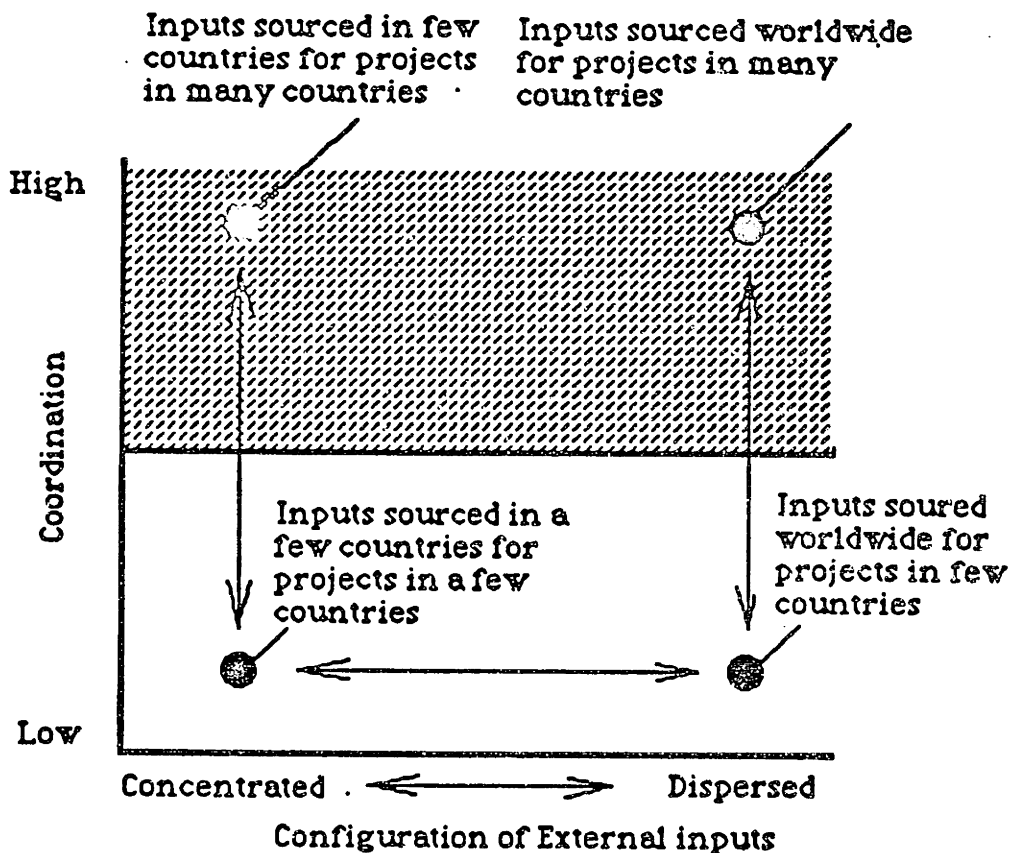
<sup>20</sup>For a complete discussion for coordination over segments, see Porter (1985), pp.323-363. Porter divides ways of achieving such coordination into three categories, tangible, intangible, and competitor interrelationships. However, tangibles and intangibles are difficult to separate since tangibles often already embody intangibles. "Competitor interrelationships," denoting that counterparts competing in multiple segments compel a firm to match an interrelationships. However, it seems to be a result of the other two reasons rather than a new reason.

<sup>21</sup>. Recall the discussion comparing GM and E&C firm earlier.

degree of coordination, various combinations of configuration and coordination provide variations in external globalization.

Exhibit 3.3.9 demonstrates how configuration and coordination interact around inputs. Configuration of the locations of inputs for each project varies from concentrated, namely one location (e.g., home country) to dispersed, at maximum worldwide on the horizontal axis. The exhibit shows that when inputs to the E&C firm are dispersed (sourced from diverse countries), the firm is positioned towards the right on the horizontal axis. Then, as the inputs flow to more number of countries, at maximum worldwide, the degree of coordination made by the firm rises regardless of the configuration.

Exhibit 3.3.9 Relationships between Configuration and Coordination of External Inputs



When the configuration of inputs of the E&C firm is concentrated, the firm is positioned towards the left on the horizontal axis. (In an extreme case, inputs are sourced in one country, possibly in the home or host country.) Then, if the sourced inputs are to be used for the firm's worldwide projects, coordination associated with the flows of the inputs is high so that the firm is located at the upper-left corner of the diagram. If the sourced inputs in the home country are for national use only, the firm cannot be regarded even as an international E&C firm. Thus, such a firm is eliminated.

As a number of locations of inputs increases, a position of a firm moves towards right. At the upper right corner of the diagram, a firm sources inputs worldwide and allocates them to projects located worldwide. In such a case, there must be significant coordination for the flows of the inputs. As the locations to which inputs are allocated diminish, degree of coordination then diminishes and the firm's position goes down to the lower-right corner. When inputs are sourced in host countries of projects for local use, coordination is considered low so that the firm is located at the lower-right corner of the diagram.

Therefore, the position of the E&C firm could be diverse in the plane except for the area close to the most lower-left corner. The upper-half area (the shaded area) includes the positions of global firms associated with configuration and coordination of inputs while the area in the lower half of the diagram is where multi-domestic firms stay. As in the diagram of configuration and coordination of internal activities, the strategic positions of global firms are numerous in the shaded area. As the firm becomes more global in term of inputs, its position goes upwards regardless of the configuration.

### 3.3.3.2 Factors Influencing External Globalization

Similar to the other two elements of globalization, external globalization is the outcome of the interaction between external and internal factors. Moreover, such factors influence how E&C firms configure inputs -- not the sourcing activities -- and how they coordinate flows of inputs into project locations. Where the E&C firm sources inputs and how the flows of the sourced inputs into projects is coordinated determine the competitiveness of the E&C firm.

Such factors driving external globalization and influencing the configuration and coordination of inputs are listed below.

#### 1) Geographic Globalization of Firms Providing Inputs

Geographic market expansion of firms providing inputs, e.g., suppliers and subcontractors, influences the degree of globalization of E&C firms. Unless suppliers, subcontractors, financial institutions, and consultants are geographically globalized, E&C firms must rely exclusively on local firms or firms operating in their home or a limited number of countries for the supply of goods, services and capital, and thus configuration of inputs are concentrated. When they are available in a limited number of countries, E&C firms must purchase them in such countries and transfer them through E&C firms' own internal channels. However, as the markets for goods and services develop, configuration of goods and services may become diverse.

#### 2) Trade Patterns and Factors Influencing Trade Patterns

Patterns of intra-industry trade based on comparative advantages and intra-industry trade based on the factors reviewed in Chapter 2 influence geographic globalization of E&C firms. Certain goods and services may be

produced in a limited number of countries while other goods and services are produced anywhere.

### 3) Government and Regulatory Factors

Trade barriers imposed by a host country affect configuration of inputs. A good example may be import restrictions or nationalistic purchasing practices of the host country. This may necessitate concentration of inputs to the host country considerably. Also, bilateral relationship between countries eliminates certain locations of inputs. For example, trade barriers imposed by exporting country, such as the ban of exporting high-tech materials and equipment from the U.S. to the eastern bloc countries, restricts configuration of inputs to other locations than the U.S. In contrast, a good relationship between countries, such as between Brazil and Iraq or the U.K. and India, may determine the flows of inputs. Such bilateral relationship may influence E&C firms' use of export credits provided by various countries, and thereby determine the configuration of inputs.

### 4) Home Government's Subsidies

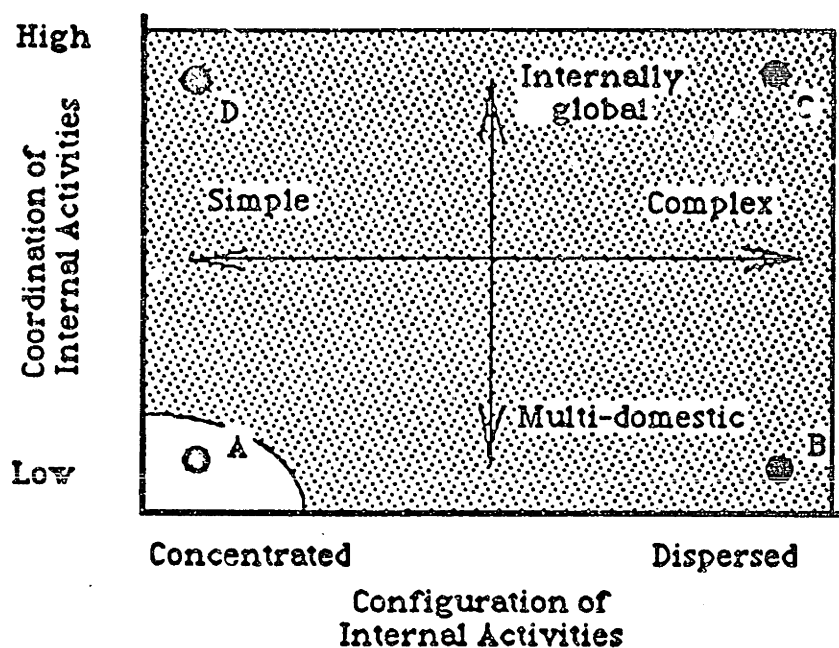
Home governments' subsidies, most notably export credits and tied-loans, may force E&C firms to concentrate their configuration of inputs to the countries providing subsidies. Often, such countries may be home countries of E&C firms. Then, concentrated configuration raises the degree of coordination for the flow of inputs from home country to the rest of the world as discussed earlier in this section.

### 3.4 A New Framework of Global Strategies for E&C Firms

Globalization of an E&C firm is defined by three elements, geographic, internal, and external globalization. Geographic globalization is concerned exclusively with markets: that is, where an E&C firm competes. The major advantage gained from geographic globalization is risk reduction. In contrast, the other two elements of globalization are concerned with how an E&C firm competes based on configuration and coordination of internal activities and external inputs in the market captured by the geographic globalization of the firm. It is possible that a firm may internally globalize but not externally, and vice versa. The other side of the coin is that there are numerous kinds of global strategies as well as many degrees of globalization, from highly global to virtually multi-domestic.

Strategic positions of E&C firms are illustrated in two diagrams. Regarding internal globalization, the extreme strategic positions E&C firms may take are presented as points A through D in Exhibit 3.4.1. Locations other than these extremes may be considered hybrids of the extremes with different configurations of internal activities as well as different degree of coordination. The upper half part of the diagram represents strategic positions of internally global E&C firms, in terms of duplication of activities, geographic dispersion of vertically integrated activities, firm-specific knowledge, and product (or segment) diversification. As the position of the E&C firm goes up vertically in this area, the degree of globalization of the firm increases. The lower half of the diagram represents the strategic positions of multi-domestic firms. As the position of the E&C firm descends vertically within this area, the firm increases the multi-domestic nature of its strategy. The white part of the cube represents strategic positions that are unrealistic theoretically and practically.

Exhibit 3.4.1 Strategic Positions of E&amp;C Firms for Internal Globalization



The "simplest global strategy" is positioned at D in the diagram. At D, configurations of internal activities are concentrated in home country. In other words, the E&C firm at D generates its competitive advantages by performing most of its services in its home country, possibly at its headquarters. Its competitive advantage arises from 1) economies of scale and scope in utilizing resources (e.g., human resources with different expertise and capital, most notably computer-based facilities) located at its headquarters; 2) comparative advantages (e.g., possession of high-quality human resources and information on projects, procurement, and so on); 3) potential clients (e.g., multinational clients incorporated in the home country); 4) a focus on pure services in the forms of scientific, engineering, and managerial expertise and the elimination of factors requiring local activities (i.e., exporting the knowledge only by sending small number of supervisory personnel to project offices; often licensing firm-specific



knowledge as much as possible; and placing only minimal marketing or project surveillance at subsidiaries in the major markets); and 5) concentrating on specialized demand for its output worldwide (or focusing on truly proprietary engineering requiring only limited modification).

"The most complex global strategy" is positioned at C, where the E&C firm gains a competitive advantages by 1) competing in the market segment which requires local differences in demand, preference, and standard; 2) placing at foreign subsidiaries most of other pre-construction activities, such as intensive surveillance of projects through established relationships with local clients; 3) having headquarters coordinate only key activities or objects, e.g., high-level decisions, dissemination and refinements of proprietary knowledge to be used locally, and managing capital including foreign exchange; and 4) possibly making use of communication technology to develop an information network for exchanging knowledge, data, drawing, and other information.

The most significant multi-domestic position is represented at the position B. The E&C firm at B places all activities either at a project office or foreign subsidiary. The local office has complete independence for decision making and does everything for itself. All activities are completed within the country where the project office or subsidiary is located. The subsidiary behaves as a national firm does. The headquarters of the E&C firm regards each operation in a foreign country as an independent investment, treats it as a portfolio item, and simply collects profits from each project. Firms at the position A is eliminated because such firms are considered national firms.

Regarding external globalization, the extreme strategic positions E&C firms may take are presented as points E through H in Exhibit 3.4.2. Locations other than these extremes may be considered hybrids of the extremes with different

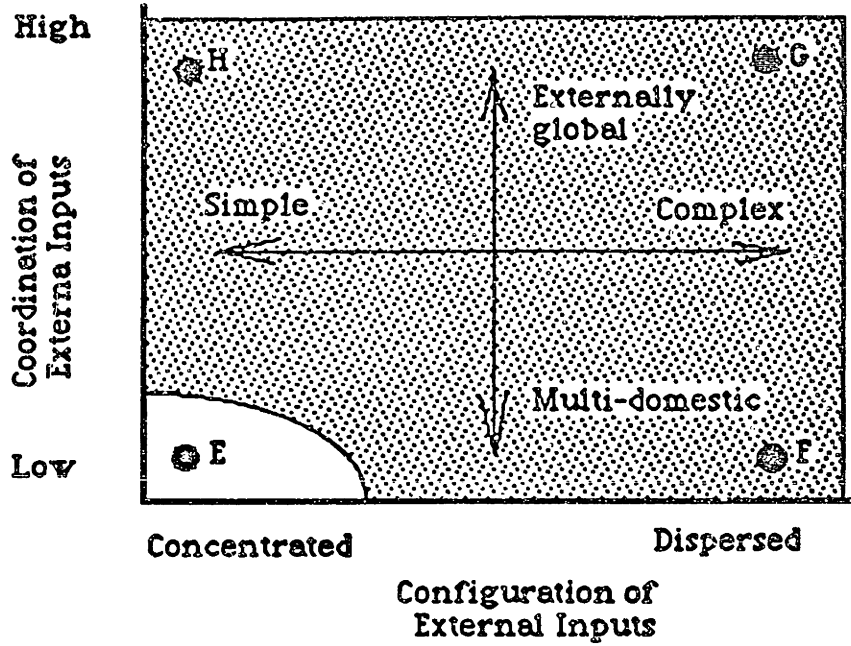
configurations of external inputs as well as different degree of coordination. The upper half part of the diagram represents strategic positions of externally global E&C firms, in terms of geographic dispersion of vertically integrated inputs. The lower half of the diagram represents the strategic positions of multi-domestic firms. As the position of the E&C firm descends vertically within this area, the firm increases the multi-domestic nature of its strategy. The white part of the diagram represents strategic positions that are unrealistic theoretically and practically.

The "simplest externally global strategy" is positioned at H in the diagram. At H, configurations of external inputs are concentrated in home countries. In other words, the E&C firm at H generates its competitive advantages by sourcing most of inputs in its home country and tightly coordinating the flow of inputs from its home country to rest of the world, possibly taking advantage of superiority of home country inputs in cost, quality, or differentiation or taking advantage of export credits available at home or home government's tied-loans.

"The most complex externally global strategy" is positioned at G, where the E&C firm gains competitive advantages by sourcing inputs worldwide and flexibly coordinating flows of goods, services, labor, and capital to locations at worldwide project locations in accordance with requirement, changing environmental conditions, and the firm's strategic motivation to perform a project in a particular way. Then, "the most multi-domestic strategy" is positioned at the point F. The E&C firm at F sources all inputs in the host country for local use so that degree of coordination of flows of goods and services is very low. The positions close to E are not realistic as explained earlier.

Exhibit 3.4.2

Strategic Positions of E&C Firms for External Globalization



### 3.5 Organizations and Management Styles of E&C Firms under Global Strategies

Under a multi-domestic strategy, E&C firms have fairly independent national or regional subsidiaries which perform complete activities within their parochial boundaries, including the control of project offices. Inputs to projects are primarily sourced from host countries so that project offices may perform sourcing activities. Headquarters may manage such subsidiaries as a portfolio, monitoring and controlling the results of its subsidiaries' operations.

In contrast, under global strategies each organizational unit of an E&C firm is viewed by what activities the unit performs under the firm's global goals, rather than the roles stipulated by the rigid organizational structure. For example, under a simple global strategy, headquarters of an E&C firm may play heavy roles through significant integration and concentration of activities at headquarters. Moreover, inputs are sourced worldwide by headquarters and are reallocated to its worldwide project locations at the right time and right location with the most favorable terms. Subsidiaries and project offices are more like mere satellites of the "hub".

Also, under a complex global strategy, a great deal of activities and responsibility are decentralized to national or regional units. However, different from multi-domestic strategy, several units may be specialized in a certain activity or a market segment, and responsible for strategy making and worldwide operations for such an activity or segment while other units may be responsible for marketing in their geographic realms. Project offices are managed and assisted by such operating centers. Primary roles of headquarters may be coordination of certain key activities (e.g., strategic decision making) at operating centers. Inputs are sourced flexibly, not only by several specialized units at the key locations suitable for the task but also by any units which have

advantages to source certain inputs. Thus, national units are no longer viewed as the ends of channels of the flows of firm-specific knowledge accumulated at headquarters or inputs but as terminals of pumping many inputs to other units of the firm, e.g., goods, services, capital, specific knowledge, and information specific to the unit or the location of the unit. In other words, each unit is specialized and interdependent, and then the firm is more flexible to changes in the environment of the firm.

Given the expansion of market of E&C firms, they are more vulnerable to differences in demand, competitive climate, and business infrastructure between developing and developed countries as well as between developed countries. Such E&C firms are exposed to more rapid fluctuations specific to certain geographic and product segments, a complex mixture of the liberalization of trade barriers and protectionism which vary from country to country, and volatile foreign exchange rates and other macro economic factors. Then, it is considered that a multi-domestic approach is too simplistic and may not be sufficient any more to remain competitive under these circumstances. Even, a simple global strategy may gradually become insufficient because the advantage of concentrating activities and inputs at the home country may start to less significant as the various factors addressed above become more influential. Consequently, it may be plausible to think that successful E&C firms in and after 1990s will be a complex global firms or hybrids between simple and complex global firms.

### 3.6 Computer and Communication Technology for Global Firms

So far, this chapter has demonstrated various factors which influence configuration and coordination of internal activities and external inputs. These factors include those external or internal to E&C firms, and economic, managerial, or organizational. However, it must be emphasized that another factor which is underpinning the working of many of such factors may be computer and communication technology.

The advanced computer systems, hardware, and software has enabled E&C firms to realize economies of scale production in many activities, such as design, estimate, scheduling, documentation control, internal human resource management, procurement, and construction management (for schedule, budget, and quality control). For example, it is now possible to control the entire range of procurement activities in a single computer system, such as handling orders (i.e., selection of suppliers and subcontractors, creation of order forms, and dispatching them), managing the schedule of orders and monitoring ordered items, and directing shipping procedures from packing to accepting items at project sites.

As a result of this, the advanced computer systems not only have reduced cost and time to perform them but also have enhanced quality of activities by preventing failures in design through standardization and modularization. Consequently, E&C firms have become able to perform these activities more effectively at much fewer locations.

Moreover, by linking computer hardware and software, it has become possible to link the activities in the value-chain vertically and to manage whole vertically integrated activities in an integrated way. This has further enhanced

E&C firms' capability to manage the whole process of E&C activities in a coordinated way over a large number of projects.

Then, as the internal communication networks were expanded internationally by linking computer networks and other communication networks (such as a satellite communication), E&C firms have obtained the potential to transmit data, drawing, and information to multiple locations in a second. Of course, improvement and development of other communication methods, such as phone, telex, and facsimile, surely contributed to the more effective communication of E&C firms. This provides a significant flexibility to the location of activities. It may not be exaggerated to say that any location can be the location of input of an activity and can be the location of getting output of other activity.

As a result, it is expected that E&C firms' ability to coordinate activities vertically and horizontally may have been enhanced markedly. It is also expected that their configuration of activities may also have changed significantly.

### 3.7 Propositions and Theoretical Predictions

The globalization model proposed in this study has predicted the way how and the reasons why E&C firms become geographically, internally, and externally globalized. The model has also predicted the diversity of globalization in terms of kinds and degree, and diversity of competitiveness generated by global strategies. Then, two propositions arise from the globalization model.

**Proposition 1:** International E&C firms and industry have been increasingly global: geographically and internally or externally, or both.

**Proposition 2:** International E&C firms gain significant competitive advantages by adopting global strategies.

For the first proposition to be supported, first a large number of E&C firms must be geographically global and the predicted factors which drive firms' geographic globalization must be supported by data.

More precisely, for geographic globalization to be supported, E&C firms must be executing projects in a number of countries and major geographic markets. Also, their geographically globalization must be explained by the factors such as macroeconomic, market imperfection in knowledge and/or financial markets, behavioral, and strategic factors.

For internal and external globalization to be supported, a large number of firms must have high degree of coordination in their internal activities or external inputs, or both although their configuration of internal activities and external inputs may vary from firm to firm; four kinds of coordination associated with duplication of activities: dispersion of vertically integrated activities, firm-specific knowledge, and product diversification must be confirmed by data; and



the factors which determine configuration of internal activities and external inputs must be justified by data.

To examine the second proposition, it must be shown that E&C firms value these strategies highly relative to other sources of competitiveness (e.g., engineering or project management expertise, financial packaging capability, etc.)

If the two propositions are proven by data, the model proposed in this study will have been accepted. Then, the picture depicted by data will become the *status quo* of globalization of E&C firms and industry, and the theoretical framework can be applied to various academic and practical issues pertaining to globalization of E&C firms.

### 3.8 Empirical Analysis Setting

The empirical analysis of the globalization model was performed in two ways. First, a questionnaire designed specifically for the purpose of this study was distributed to the top international E&C firms listed by the annual survey by ENR (7/7/1988). Second, among the firms which responded to the questionnaire, intensive interviews were performed to executives and managers of the firms which agreed to the interviews.

Chapter 4 analyzes the data obtained from the questionnaire and examines a large part of the theoretical prediction of the model. Chapter 5 completes the remaining part of the empirical analysis by case studies which are based on the interviews.

## CHAPTER 4

### EMPIRICAL ANALYSIS OF GLOBALIZATION FRAMEWORK

This chapter empirically explores the utility and applicability of the proposed theoretical framework of globalization for the E&C firms and industry. The framework is composed of three elements of globalization, geographic, internal, and external. This chapter, first presents the methodology of the empirical analysis. Second, it examines the driving forces of geographic globalization and the extent of geographic globalization for E&C firms. Third, the chapter investigates internal activities, that is, configuration and coordination of sourcing activities, and financial activities. Fourth, this chapter examines configuration and coordination of external inputs. Fifth, it examines configuration and coordination through communication patterns of E&C firms. Finally, this chapter examines the effectiveness of global strategies for international competitiveness among E&C firms.

#### 4.1 Methodology of the Empirical Analysis

This section details the methodology of the empirical analysis. The details of population and sample firms of the analysis, design of the questionnaire, and method of data analysis are presented.

##### 4.1.1 Population and Sample of the Data

The target firms of this study are 250 international E&C firms identified by Engineering News Record (ENR). The 250 firms include very large firms having with several billion dollars of annual foreign turnover and small firms having as

little as 10 million dollars. These comprise the population of international E&C firms on which this study focuses.

For this study, out of the 250 firms, locations and key persons were identified for 174 firms. The questionnaire was then sent to the firms. The responses were collected from 62 firms. Out of the 62 responses, 52 were usable, representing 21.2% of the population. The 52 firms are the samples on which this empirical analysis is based. The percentage clearly qualifies as an effective statistical sample.

As will be addressed, out of the 52 firms, 11 firms agreed to further interviews. The results of the interviews are used in the case studies in Chapter 5.

#### 4.1.1.1 Nationality of the Sample Firms

The surveyed E&C firms fall into four major national or regional groups: 1) the U.S., 2) Europe, 3) Japan, and 4) South East Asia.

U.S.:	9 firms
Europe:	28 firms
Japan:	11 firms
South East Asia:	3 firms

During the empirical analysis, nationality of firms are indicated by the following abbreviations: the United States = US, the U.K.=UK, France = FR, West Germany = WG, Italy = IT, Netherlands = NE, Switzerland = SW, Sweden = SD, Spain = SP, Turkey = TK, Japan = JP, South Korea = KR, and Hong Kong = HK.

#### 4.1.1.2 Grouping of the Sample Firms by Vertical Integration and Types of Firms

Activities which the E&C firm performs on a commercial basis are roughly categorized into 1) pre-construction, 2) design (engineering and architectural), 3) project management (and physical construction), and 4) post construction activities. Activities in which the E&C firms are engaged are summarized in Exhibit 4.1.1. More than half of the sample firms engage in the four kinds of activities, and firms which engage in three or more than three kinds of activities account for nearly 80 percent of the sample. Only six percent of the sample firms specialize in just project management (and physical construction).

Exhibit 4.1.1 Degree of Vertical Integration of Sample E&C Firms

Types of Activities				Numbers of Firms
1	2	3	4	
x	x	x	x	27
x	x	x		10
	x	x	x	2
x		x		5
	x	x		4
		x	x	1
		x		3
Total				52

Source: Questionnaire

As we see in the list, it is hard to classify the E&C firms neatly by the degree of vertical integration because the degree of vertical integration in activities in the firms is very significant. However, based on their annual reports in addition to the list above, the E&C firms may be classified roughly into 1) contractors and 2) engineering contractors. (Pure engineering firms which are engaged in only engineering design but not any project management activities are not considered in this study.) Contractors are firms engaged in managing subcontractors,

suppliers, and labor for the physical erection of facilities. Engineering contractors are engineering firms performing not only engineering but also management of physical installation of facilities (or in certain cases physical installation itself).

The 52 E&C firms surveyed are grouped into these categories based on the questionnaire regarding expertise and publicly available data.

- .1) Contractors: 31 firms
- 2) Engineering contractors: 21 firms

During the empirical test, each type of firm is represented by the following abbreviations: Contractor = C and Engineering contractor = E.

#### 4.1.1.3 Diversification of the Sample Firms

Specialties of the surveyed E&C firms are listed in Exhibit 4.1.2. Many of them appear to be very widely diversified over different construction products while only a few firms are specialized into a small number of segments.

## Exhibit 4.1.2 Diversification by Construction Products of the Sample E&amp;C Firms

Bldg	Hwy	Water	Rail	Mfg	Power	Marine	Airport	Number of firms
x	x	x	x	x	x	x	x	28
x	x	x	x		x	x	x	3
x	x	x	x	x	x	x		1
x	x	x	x	x	x		x	3
	x	x	x	x	x	x	x	1
x	x	x	x		x	x		1
x	x	x	x			x	x	2
x		x	x	x	x		x	1
		x	x	x	x		x	1
x	x		x	x			x	1
x	x	x			x	x		1
x		x		x	x			1
x		x		x			x	1
		x		x		x	x	1
x	x		x					1
x	x							1
				x		x		1
					x			1
				x				2
Total								52

Note: "x" indicates the firm is engaged in the expertise.  
Source: ENR (7/7/88)

## 4.1.2 Structure of the Questionnaire

A questionnaire was designed to analyze the theoretical framework of globalization of the E&C firm. It was comprised of about 120 questions covering: 1) general geographic configuration of activities, 2) procurement, 3) communication, 4) international financial management, 5) technology and know-how, 6) international competitiveness, and 7) various figures (e.g., amount of foreign sales) and functions achieved by E&C firms. (A sample of the questionnaire is appended to this dissertation.)

### 4.1.3 Rating System in the Questionnaire

In the questionnaire, respondents were asked to rate the items in each question on a scale from 1 to 5.<sup>1</sup> The results obtained were standardized to eliminate peculiar patterns of rating by respondents. The rating of each item was summed to get an average score. Using this rating method, the following analyses were made possible:

- 1) Average scores are compared to identify the relative order of items as a construct<sup>2</sup> by intensity of agreement and significance, and level of importance within the same question;
- 2) Firms or groups of firms, categorized by nationality, are compared to obtain the characteristics of their rating relative to others. It is also possible to group firms with similar characteristics, and correlate these with the firms indicated by their responses in other part of the questionnaire. For example, of particular interest is the comparison of behaviors between firms adopting a global strategy and firms adopting a multi-domestic strategy.

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<sup>1</sup>The measuring method of rating in the questionnaire is an application of the so-called, "semantic differential", developed by Osgood, Suci, and Tannenbaum (1957). The method is usually applied to the measurement of any concept, political, social, and behavioral. Originally, the subject's responses to the individual bipolar scale, originally 0 to 7, can be summed to give scores that indicate his or her position on the three underlying dimensions of attitude toward the object being rated, that is, (1) fair-unfair, clean-dirty, good-bad, valuable-worthless; (2) large-small, strong-weak; (3) active-passive, fast-slow, hot-cold. The method, however, can be applied to measure the similarity or difference between an individual's concepts of different objects.(Kidder, Louise H., and Judd, Charles, M., 1986.)

<sup>2</sup>. A hypothesis argues that one phenomenon or behavior - the subject - causes or is associated with another phenomenon or behavior - the object. Then, the phenomenon, both subject and object, is called a construct. (Kidder, L.H. and Judd, C.M. 1986)



#### 4.1.4 Data Treatment - Standardization

Scores obtained from the responses have been standardized to eliminate firms falling into a peculiar pattern. For example, some firms may tend to give higher or lower scores to all questions than may others. In such a case, a 5-rate given to a question by a firm whose average score over 120 questions is 3.9 might not be identical to a 5-rate reported by a firm whose average score is 2.9.

The procedures of standardization are: Denoting a score to question  $i$  by a firm  $j$  being  $r(ij)$ , its standardized score being  $sr(ij)$ , the average, or mean, score of the firm  $j$  over all questions as  $\mu(j)$ , and the standard deviation of the all scores by the firm  $j$  as  $\sigma(j)$ , then,

$$sr(ij) = \frac{r(ij) - \mu(j)}{\sigma(j)}$$

The standardized scores have now the characteristic of  $n(0,1)$ , namely, they have a mean value of zero and a standard deviation of one.

It is important to standardize scores for several reasons. First, it will eliminate any peculiar patterns of ratings (such as providing much higher or lower scores throughout the questionnaire than other firms) stemming from personal (responder's own), firm-specific, or cultural disposition. Second, standardization allows a quick, rough judgement by positive and negative signs of scores as well as scores over 1 as strong positive intensity and -1 as strong minus intensity.

There are, however, some pitfalls in standardization. A responder's abrupt too high or too low score to a few questions could create a statistical outlier. In other words, standardization is effective if a responder's average ratings are

consistently high or low whether the standard deviation is large or small. Since such outliers distort means as well as correlation, they must be carefully eliminated by visual observations.

## 4.2 Empirical Analysis of Geographic Globalization of E&C Firms

This section first examines the degree of geographic globalization of firms. Second, it investigates the significance of the factors driving and inhibiting global competition. Third, it examines the significance of the influence of barriers to trade on geographic globalization

### 4.2.1 Empirical Analysis of Degree of Geographic Globalization of E&C Firms

The geographic globalization of E&C firms is explored in terms of two variables, the number of countries and the number of major geographic markets (i.e., the U.S., Canada, Latin America, Europe, Africa, Middle East, and Asia) in which an E&C firm undertakes projects. (See Exhibit 4.2.1.) In the diagram, firms vary from those whose projects concentrating on a small number of countries and in few major markets to those undertaking projects in a substantially large number of countries and in all the major markets. It is observable that as the number of countries in which an E&C firm undertakes projects increases, the more likely the firm is to cover major world markets.

The border line separating firms that have geographically globalized and not globalized is arbitrarily drawn. Firms plotted to the upper-right of the line are considered to be geographically global. Thus, 40 firms out of the 52 samples (- 40 firms account for 77 percent of the samples -) are global geographically. From this result, we can conclude that nearly 80 percent of the E&C firms are global geographically.

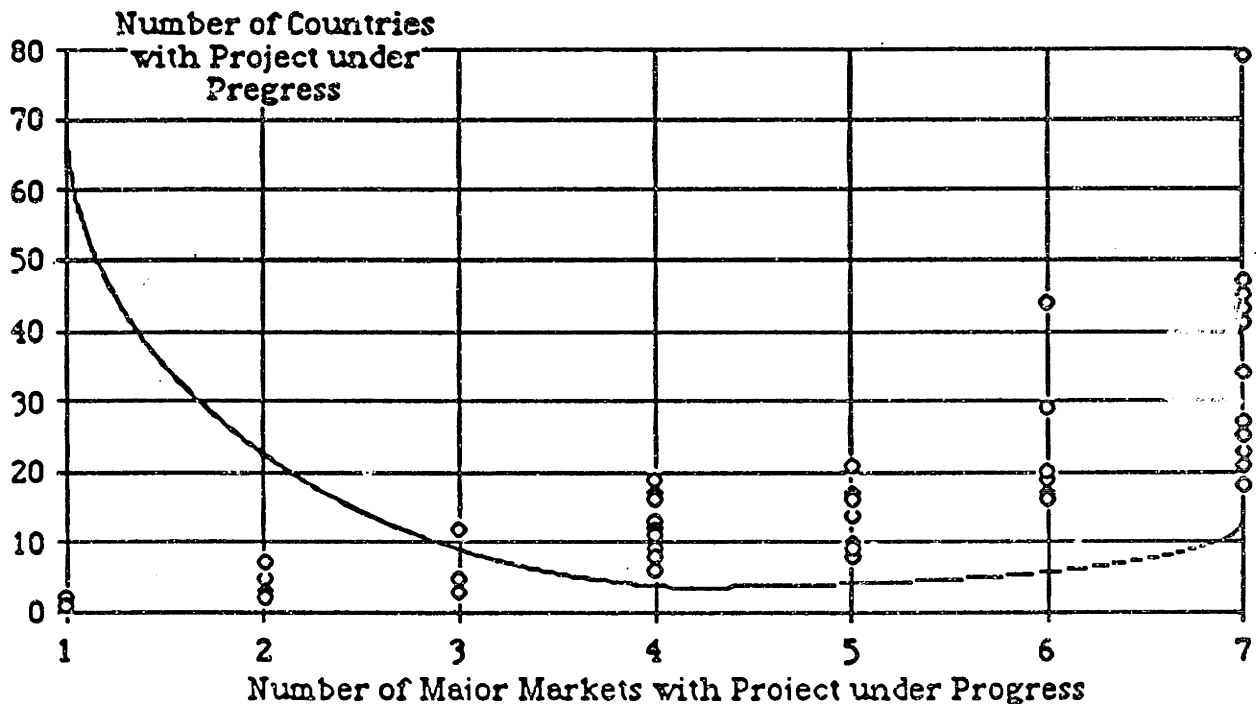
The 12 firms, plotted to the left of the line are following:

(IT,C), (IT,C), (IT,.), (IT,C), (TK,C), (IT,E), (SD,C), (WG,C), (FR,E), (HK,C),  
(US,C), (US, C), (KR,C)

The first abbreviation indicates nationality of a firm and the second, types of the firm, i.e., C - contractors and E - engineering contractors.

They have the following characteristics: 1) ten out of the 12 firms are contractors; and 2) 11 out of the 12 firms have small international revenues (i.e., less than \$200 million). From this result, we can conclude that firms with small absolute international revenues tend not to be geographically global, and that such firms tend to be contractors. It is important to note that firms with large entire revenues but small international revenues, such as many Japanese contractors whose ratios of international to revenues are less than 10 percent of their entire revenues, were not eliminated. Thus, they seem to be global, at least geographically.

Exhibit 4.2.1 Degree of Geographic Globalization of E&C Firms



Source: Questionnaire

#### **4.2.2 Empirical Analysis for the Mechanism for Geographic Globalization**

The theoretical framework in Chapter 3 identified several factors possibly explaining globalization: 1) accumulated experience and knowledge, typically represented by advantages in technological and/or management capabilities; 2) profits arising from a firm's absolute advantages or monopolistic competition; 3) the firm's reputation which reflects the "experience-good" nature of the firm's E&C outputs and production; 4) low E&C production costs; 5) financial packaging capability giving the firm cost and differentiation advantages, a well-known competitive edge for E&C firms; 6) raising the total volume of production to feed the firm's internal resources or to grow through the economies of scale use of the internal resources; 7) growth of foreign markets for which the firm's internal resources are utilized (i.e., a corollary to the sixth above); 8) small or stagnant domestic market which prevent the E&C firms to survive or grow in the market (i.e., another corollary to point six); 9) home country multinational clients which expand internationally (i.e., a behavioral motivation); 10) competitors in the home market who have expanded their markets abroad, another behavioral motivation known as "follow-the-leader"; 11) geographic diversification providing risk hedging for fluctuations of demand in geographic markets, a well-known advantage of global strategy; and 12) worldwide coordination of E&C activities, a general advantage of globalization.

Exhibit 4.2.2 below illustrates the responses of the 52 firms as to why they have expanded horizontally. The highest rated factor was "size or growth of foreign markets", and the second highest, though not much different from the highest, was the need "to raise total volume of E&C activities". This result supports the idea that horizontal expansion of firms competing on the basis of intangibles (or knowledge) may expand their activities horizontally and become geographically

global either aggressively in order to capture opportunities for the maximum use of their internal resources by taking advantage of the (growing) size of the foreign markets, or defensively in order to maintain their internal resources and survive as ongoing concerns by obtaining at least the minimum amount of work. However, small or inactive home markets do not seem to be a major factor, as "small or stagnant home market" received a very low score. Potentially global E&C firms look to the international markets as their natural battle ground or as markets at least as familiar as their home markets and consider how to grow, maintain, or survive in the foreign markets captured by them.

Exhibit 4.2.2 Reasons for Geographic Market Expansion of E&C Firms

Item	Score
1. Growth of foreign markets	0.38
2. Raising total volume of E&C	0.37
3. Reputation of the firm	0.33
4. Technological and managerial experience and knowledge	0.11
5. Benefits of worldwide coordination of E&C activities	-0.22
6. More profitability abroad	-0.26
7. Risk hedging by geographic diversification	-0.32
8. Financial packaging capability	-0.35
9. Increasing home country multinational clients	-0.42
10. Small or stagnant domestic market	-0.69
11. Low E&C production cost	-0.97
12. Competitors in the home market who expanded market abroad	-1.01

Note: Items are sorted in a descending order of the scores, not the order in the questionnaire.

The double line separates items with positive and negative scores.

Source: Questionnaire

"Reputation" and "technological and project management expertise", both well-known firm-specific advantages as well as intangibles, also obtained positive scores. However, in conjunction with the first and second highest motivations above, it seems to be more appropriate to think that firms must maintain these firm-specific advantages to grow or survive successfully in the foreign markets. In this respect, it is interesting that "low cost" gained the second lowest score

among items. This seems to support the argument made in Chapter 3 that competition in the E&C industry is based on absolute advantages, and that competition is price-sensitive only among firms which have met a prequalification for bidding by possessing similar absolute advantages.

Of more importance is the fact that typical advantages obtained through global strategies in manufacturing companies, e.g., "risk hedge through geographic diversification" and "benefits obtained through worldwide coordination of activities", were given relatively low scores. The result seems to suggest that E&C firms do not become geographically global to acquire the benefits of global strategies, rather, that the benefits are realized after the firms expands geographically. Therefore, it is essential to distinguish between motivation of globalization and benefits of globalization.

Of interest is the low score for which "more profits in the foreign markets". Despite profits for foreign work higher than for work performed in domestic markets, as reported by ENR,<sup>3</sup> profits are by no means a strong motivation for the E&C firms to expand horizontally.

Oligopolistic behaviors, such as "home-country multinational clients expanded their activities abroad" and "competitors in the home market expanded markets abroad", are, in general, not strong motivations.

### National Differences

Comparison of the results by nation provides a further insight into the geographic globalization of the E&C firms. (See Exhibit 4.2.3 below.) U.S. firms seem to behave differently from their European and Japanese counterparts. For example, U.S. firms are not as sensitive to "raising total volume of E&C", to which

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<sup>3</sup>. Profits in foreign and domestic works are 5.9% and 4.0% in 1986, 6.2% and 3.8% in 1987, and 5.1% and 4.1% in 1988. (ENR 7/16/87, 7/7/88, and 7/13/89)

the most sensitive were European E&C firms, or to "reputation". They are also less sensitive to "size and growth of foreign markets" and "technological and managerial expertise".

Exhibit 4.2.3 National Comparison of Reasons for Geographic Market Expansion of E&C Firms

Item	Scores		
	U.S.	Europe	Japan
1. Growth of foreign markets	0.27	0.46	0.16
2. Raising total volume of E&C	-0.08	0.50	0.31
3. Reputation of the firm	-0.26	0.40	0.48
4. Technological and managerial experience and knowledge	0.10	0.25	-0.16
5. Benefits of worldwide coordination of E&C activities	-0.18	-0.03	-0.65
6. More profitability abroad	0.18	-0.04	-0.87
7. Risk hedging by geographic diversification	-0.08	-0.11	-1.05
8. Financial packaging capability	-0.36	-0.44	-0.06
9. Increasing home country multinational clients	0.12	-0.52	-0.16
10. Small or stagnant domestic market	-0.97	-0.62	-0.32
11. Low E&C production cost	-0.78	-0.89	-1.21
12. Competitors in the home market who expanded market abroad	-0.90	-0.84	-1.42

Note: Items are sorted according to the overall rank order. The double line separates items with positive and negative scores in the overall rank.

Source: Questionnaire

Japanese firms differ significantly from their U.S. and European counterparts on a couple of points. First, they gave extremely low scores to "higher profits abroad", reflecting that their operations in the international markets were not necessarily successful in generating profits. With regard to the recognition of the benefits of global strategies, Japanese firms are the least sensitive to the issue of the benefits of global strategies, as indicated by the very low scores they gave to "risk hedging by geographic diversification" and "Worldwide coordination". As we will see later in this chapter, Japanese firms



most strongly emphasize local activities, manage their international operations least systematically, and tend to adopt a multi-domestic strategy more than the other nationalities.

It is important to note that only U.S. firms cited "home-country multinational clients become active abroad" as a factor driving E&C firms' horizontal expansion. In other words, U.S. firms seem to have relied highly on FDI made by U.S. multinational enterprises in the industry segments. This point is complemented by the response to other questions concerned with past experiences in obtaining contracts from multinational clients, private and public, and home or foreign for each. Exhibit 4.2.4 demonstrates the result. As we see, nearly 80 percent of the surveyed U.S. E&C firms obtained contracts from the same multinational clients in the private sector over the markets in several countries; surprisingly, the same nearly 80 percent of the U.S. firms obtained contracts from home multinationals as well. A similar story happens with respect to the public multinational clients (e.g., US Army Corps of Engineers). The U.S. firms which obtained contracts from private multinational clients also obtained contracts abroad from public clients. Nearly 70 percent of the U.S. firms obtained contracts from home-country public multinational clients over a multiple foreign countries.

However, Japanese firms seem to have derived fuel for their horizontal expansion from multinational clients (both home and foreign), in the private sectors especially. This result coincides with the historical fact that Japanese firms gained inroads into the U.S., European, and Australian E&C markets in the 1980s.

Multinationals seem to allow horizontal expansion of European firms as well although the impact is limited to much a smaller percentage of firms. The result, overall, supports the important role of multinational clients, especially

home-country multinational clients in the geographic globalization of the E&C firms.

Exhibit 4.2.4 National Comparison of Percentage of E&C Firms Which Acquired Foreign Contracts from the Same Multinational Clients

Types of Multinational Clients	Percentage		
	U.S.	Europe	Japan
Private (General)	77.8	44.8	63.6
Private (Home Country)	77.8	34.5	63.6
Public (General)	77.8	31.0	27.3
Public (Home Country)	66.7	20.7	18.2

Source: Questionnaire

#### 4.2.3 Barriers to Trade as Impediments to Geographic Globalization

The theory predicts that tariff and non-tariff barriers are major impediments to the geographic expansion of E&C firms. However, the survey result gives a twist to the argument. Overall, barriers to trade seem not to trouble E&C firms too seriously. Out of the 13 major barriers to trade, only two really appear to hamper international operations of the surveyed E&C firms as presented in Exhibit 4.2.5.

A possible reason seems to be that the surveyed E&C firms have already been prepared to deal with these barriers to trades. As Appendix A of this dissertation will show, the surveyed firms have established considerable numbers of foreign subsidiaries. Since the trade barrier problem arises in the course of foreign trade, firms having numerous national firms as their subsidiaries may have overcome these barriers in the way these firms' geographic globalization occurs.

The barrier which has received highest score is "nationalistic awarding of contracts." This corresponds to the claims by the existing literature emphasizing

local presence, particularly for public projects.<sup>4</sup> Another barrier to trade which has received a positive score is "restrictions on repatriation of profits." In contrast, "reciprocity of professionals' qualification" and "differences in standard and specifications" obtained the first and the second lowest scores.

Although barriers to trade have obtained low scores overall, a closer look at individual firms' responses reveals some interesting findings. For example, for "nationalistic awarding of contacts," thirty-three firms (63 percent of the surveyed firms) gave positive scores to this item, and 19 firms (37 percent of the firms) gave very high scores. Sixteen out of the 19 firms are contractors. From this result, it may be considered that contractors, which compete less on the basis of technology than engineering contractors, compete with local firms. In other words, engineering contractors compete based on the absolute advantages so that they may compete with other international engineering contractors but not local firms, which are considered to be scarce or none. Therefore, the overall low scores in the exhibit seem to have been diluted by many low scores given by engineering contractors.

In summary, barriers to trade are, in general, not very significant for E&C firms to acquire contracts probably because many of them have established local subsidiaries which may provide access to national markets. However, equally likely reason may be dilution of the overall scores by very low scores provided by engineering contractors whose proprietary technology allows to circumvent such trade barriers.

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<sup>4</sup> For example, a survey by Arkell, J., and Harrison, I., (1987) argues that 29 out of 44 non-OECD countries had a requirement for local contracts to be placed with local practices or by joint venture with majority local holding. Mayes (1987) also argues that "some form of local commercial presence is required, and the general consensus was that almost all work, both in consulting and contracting, would be done through a local subsidiary."

**Exhibit 4.2.5      Significance of Barriers to Trade by Percentage of Firms**

Items	Scores
1. Nationalistic awarding of contracts	0.13
2. Restrictions on repatriation of profits	0.09
3. Requirement to hire local subcontractors, to form joint venture, or to employ nationals	-0.07
4. Duties on imported materials and equipment	-0.09
5. Restrictions of use of imported materials and equipment	-0.10
6. Governments' subsidies	-0.22
7. Difficulties of temporary movement of personnel	-0.35
8. Forced unfair pricing or dumping	-0.39
9. Unequal taxation of foreign firms	-0.46
10. Tied-aid agreement by governments	-0.51
11. Differences in bidding procedures, registration of firms, authorization to work	-0.53
12. Differences in standard and specifications	-0.88
13. Reciprocity of professionals' qualification	-1.04

Note: Items are sorted in a descending order of scores, not in the order in the questionnaire.

The double line separates items with positive and negative scores.

Source: Questionnaire

### **4.3 Empirical Analysis of Configuration and Coordination of E&C Firms**

This section first examines configuration and coordination of internal activities, particularly sourcing and financial activities. Second, configuration and coordination of external inputs are examined. It is important to distinguish between the locus of responsibility for sourcing, which is part of internal globalization, and the actual dispersion of inputs, which is part of external globalization.

#### **4.3.1 Configuration of Sourcing Activity**

Configurations of the locus of sourcing activity of the surveyed firms are examined here. There are two reasons why sourcing activity is an important element of the configuration of E&C firms. First, configurations of sourcing activity are less well understood than other activities, such as managing physical construction (e.g., managing labor and subcontractors) which are necessarily performed at project locations.

Second, how an E&C firm performs sourcing activity determines the effectiveness of the entire project management performed by an E&C firm. Sourcing embraces not only purchasing goods and services but also numerous other related activities. It includes checking drawings, examinations of standards, capacity, and prices; soliciting bids, negotiations and contacts to outside firms; coordinating purchases with insurance contracts; and scheduling and monitoring of shipping, acceptance, and quality, payment and so on. Moreover, sourcing goods and services requires a good understanding of engineering for the selection of materials and equipment. Furthermore, sourcing often requires high-level political considerations when a project is financed by a government-

ted loan or a bilateral government agreement for the use of a barter trade, or when it is bound by local-content provisions.

Third, sourcing activity determines how competitive an E&C firm will be on the bases of cost (particularly in a lump-sum type contract) and differentiation for all kinds of related expertise stated in the second reason.

The locations of two types of sourcing by the surveyed firms are examined: first, sourcing services, i.e., unskilled labor and subcontractors for general civil (e.g., footing, excavation, concrete, steel structure, and so on), mechanical, and electrical works, and second, sourcing goods, i.e., bulk and manufactured materials, and electrical, electronic, and heavy equipment.

#### 4.3.1.1 General Configuration of Sourcing Activity

The upper half of Exhibit 4.3.1 summarizes the locations of an activity sourcing labor and subcontractors by the surveyed firms. The result is very striking. Contrary to the conventional belief that most activities related to project management are performed at the project office, the locus of responsibility for sourcing subcontractors varies considerably. Headquarters plays a significant role in many firms. Headquarters source subcontractors for mechanical and electrical works in about half of the firms; Headquarters also source subcontractors for civil works in 30 percent of the firms and even unskilled labor in 10 percent of them.

In contrast, project offices play a much smaller role in sourcing services. Their role is significant only in sourcing unskilled labor in about 60 percent of the firms and subcontractors for civil works in about 30 percent of them. Project offices are much less important in sourcing subcontractors in mechanical and

electrical works. Also, note that subsidiaries source each of the four kinds of services in 20 to 25 percent of the firms.

Similar to sourcing subcontractors, the locations of activities sourcing goods are diverse among the firms. (Refer to the lower half of Exhibit 4.3.1.) However, in general the role of headquarters is important in more firms for sourcing goods than for sourcing services. Headquarters source heavy, electronic, and electric equipment in 55 to more than 60 percent of the firms (65, 61, and 55 percent of the firms respectively), and source manufactured materials in about 40 percent of firms and even bulk materials, which is not suitable to be transported long distances, in about 20 percent of the firms.

Exhibit 4.3.1 Configuration of Sourcing Activities - Organizational Units Sourcing Goods and Services by Percentage of Firms

	(Percentage)							
	P.O.	SUB	HQs	P.O. + SUB	P.O. + HQs	SUB + HQs	P.O. + SUB + HQs	Total
Unskilled labor	62.0	22.0	10.0	4.0	0.0	2.0	0.0	100.0
General civil works	31.3	27.5	29.4	5.9	0.0	5.9	0.0	100.0
Mechanical works	11.8	25.5	52.9	3.9	0.0	5.9	0.0	100.0
Electrical works	15.8	23.5	52.9	3.9	0.0	3.9	0.0	100.0
Bulk materials	51.0	17.6	19.6	3.9	0.0	5.9	2.0	100.0
Mfd. materials	15.7	27.5	39.2	3.9	2.0	9.8	2.0	100.0
Electrical equipment	7.8	23.5	54.9	3.9	0.0	9.8	0.0	100.0
Electronic equipment	7.8	21.5	60.8	3.9	0.0	5.9	0.0	100.0
Heavv equipment	7.8	17.6	64.7	3.9	0.0	5.9	0.0	100.0

Note: Abbreviations in the exhibit mean sourcing organizational units, such as: P.O. = Project Office, SUB = Subsidiary, HQs = Headquarters, and P.O. + SUB = both Project office and subsidiary, Mfd. = Manufactured.

Source: Questionnaire

The role of project offices seems to be limited to sourcing only bulk materials. This is true for half of the firms. And again, subsidiaries source these materials and equipment in 17 to 28 percent of the firms.

The data on the locations of sourcing activities reveals a considerable diversity. However, the data also prove that there is a significant dispersion of vertically integrated activities around sourcing activities in many E&C firms. Approximately half of the surveyed firms integrate the sourcing activities for their worldwide E&C operations at their headquarters, away from the locations where actual installations of goods and services take place. In these firms, worldwide coordination of goods and services by headquarters must be high as sourcing activities are separately performed at their headquarters. The coordination seems to play a crucial role for effective project management for these firms.

For the firms in which subsidiaries play a crucial role in sourcing activities, there seems to be dispersion of vertical integrated activities if the subsidiaries are regional headquarters serving a large number of countries in the region or if the subsidiaries serve as product-segment-based headquarters for the worldwide operation in the segments. The level of coordination in the latter case is as significant as that of the coordination by headquarters.

#### 4.3.1.2 Types of Configurations of Sourcing Activity

The E&C firms may now be categorized by the organizations which play a major role in sourcing.

##### Firms Whose Headquarters Perform a Sourcing Activity

Exhibit 4.3.2 lists 26 E&C firms whose headquarters source goods and services for their international E&C operations. The exhibit uncovers several interesting facts. First, 13 firms, exactly half of the listed firms, are engineering contractors. Second, 11 out of the remaining 13 firms, which are contractors, have limited international involvement and geographical coverage. For instance,



although 4 out of the 13 firms are large firms, their international revenues were less than \$200 million in 1987,<sup>5</sup> accounting for less than 13 percent of their total revenues; and their international operations are limited in small numbers of countries. The other seven firms are all small firms with entire revenues mostly less than \$100 million; and two firms serve only two and three countries. It seems that the E&C firms with small scales of international activities may place their major activities including the sourcing activity at their headquarters because coordination of activities over geographical distances is not difficult and the risk of foreign commitment is minimal.

Third, interesting enough, headquarters play a crucial role in all 12 Italian firms surveyed, accounting for 46 percent of the listed 26 firms. Exhibit 4.3.3 below demonstrates the importance of their headquarters in sourcing. Headquarters source mechanical and electrical work subcontractors in over 80 percent of the Italian firms, civil work subcontractors in a half of them, unskilled labor in a quarter of them. Moreover, headquarters source electronic and heavy equipment in all the Italian firms, manufactured materials and electrical equipment in 90 percent of the firms, and even bulk materials in 50 percent of them. Then, project offices and subsidiaries perform minimal sourcing functions in the Italian firms.

Two firms are quite exceptional. One performs sourcing activity at its headquarters largely because the sourcing activity of the firm is incorporated into the headquarter-coordinated sourcing of its parent company, a large electrical multinational conglomerate which is based in Switzerland and operates on a worldwide basis.

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<sup>5</sup>. They are at the erected values of facilities given by ENR (7/7/89).

**Exhibit 4.3.2 E&C Firms Whose Headquarters Primarily Source Goods and Services**

USL	CW	MW	EW	BM	MM	EIE	EOE	HE
1	1	3	3	123	123	3	3	3
1	23	3	3	23	3	3	3	3
2	2	3	3	1	3	3	3	3
12	1	12	3	3	1	3	3	3
1	2	3	3	3	3	3	3	3
1	3	3	3	3	3	3	3	3
3	1	1	1	1	3	3	3	3
1	3	3	3	3	3	3	3	3
1	1	3	3	1	1	3	3	3
2	23	23	23	23	23	23	23	23
3	3	3	3	3	3	3	3	3
1	3	3	3	3	3	3	3	3
2	3	3	3	3	3	3	3	3
1	1	3	3	3	3	3	3	3
23	3	3	3	3	3	3	3	3
2	2	2	3	1	3	3	3	3
3	1	3	3	1	3	3	3	3
1	23	23	1	23	3	23	3	3
3	3	3	3	3	3	3	3	3
1	2	3	3	1	3	3	3	3
1	1	3	3	1	1	3	3	3
3	3	3	3	1	23	23	23	23
1	3	3	3	1	3	3	3	3
1	3	3	3	1	1	3	3	3
2	3	3	3	1	3	3	3	3
2	2	2	2	3	3	3	3	3

Note: (1) Firms are listed at random.

(2) "1" indicates that a project office sources; "2" subsidiary, "3" headquarters, and "23" both subsidiary and headquarters source.

(3) "USL" means unskilled labor, "CW" general civil works, "MW" mechanical works, "EW" electrical works, "BM" bulk materials, "MM" manufactured materials, "EIE" electrical equipment, "EOE" electronic materials, and "HE" heavy equipment.

Source: Questionnaire

**Exhibit 4.3.3 Configuration of Sourcing Activities - Organizational Units Sourcing Goods and Services by Percentage of Italian Firms (Percentage)**

	P.O.	SUB	HQs	P.O. + SUB	P.O. + HQs	SUB + HQs	P.O. + SUB + HQs	Total
Unskilled labor	41.6	25.0	25.0	0.0	0.0	8.3	0.0	100.0
General civil works	16.7	25.0	50.0	0.0	0.0	8.3	0.0	100.0
Mechanical works	0.0	8.3	83.3	0.0	0.0	8.3	0.0	100.0
Electrical works	8.3	8.3	83.3	0.0	0.0	0.0	0.0	100.0
Bulk materials	33.3	8.3	50.0	0.0	0.0	8.9	0.0	100.0
Mfd. materials	8.3	0.0	91.7	0.0	0.0	0.0	0.0	100.0
Electrical equipment	0.0	0.0	91.7	0.0	0.0	8.9	0.0	100.0
Electronic equipment	0.0	0.0	100.0	0.0	0.0	0.0	0.0	100.0
Heavy equipment	0.0	0.0	100.0	0.0	0.0	0.0	0.0	100.0

Source: Questionnaire.

#### Firms Whose Subsidiaries Perform a Sourcing Activity

Exhibit 4.3.4 looks at seven E&C firms with subsidiaries playing a crucial role in sourcing. Four firms are engineering contractors while the remaining three firms are all Japanese contractors. The existence of the four engineering contractors suggests that E&C firms are of two principal types with regard to the sourcing activity, one in which headquarters performs the sourcing activity and the other in which subsidiaries perform it. In any surveyed engineering contractor, a project office is not the principal sourcing organization.

**Exhibit 4.3.4 E&C Firms Whose Subsidiaries Primarily Source Goods and Services**

Country	USL	CW	MW	EW	BM	MM	EIE	BOE	HE
US	2	2	2	2	2	2	2	2	2
JP	1	2	2	2	2	2	2	2	3
US	12	12	12	12	12	12	12	12	12
UK	1	2	2	2	1	2	2	2	2
JP	12	12	12	12	12	12	12	12	12
JP	2	2	2	2	2	2	2	2	2
SW	1	2	2	2	1	2	2	2	2

Note: (1) "1" indicates that a project office sources; "2" subsidiary, "3" headquarters, and "23" both subsidiary and headquarters source.

Source: Questionnaire

### Firms Whose Project Offices Perform the Sourcing Activities

Exhibit 4.3.5 enumerates three firms which perform the sourcing activity exclusively at project offices. Interesting enough, two of the three firms are Japanese contractors, which source all services and goods at project offices.

Exhibit 4.3.5            E&C Firms Whose Project Offices Primarily Source Goods and Services

Country	USL	CW	MW	EW	BM	MM	EIE	EOE	HE
JP	1	1	1	1	1	1	1	1	1
JP	1	1	1	1	1	1	1	1	1
US	1	1	1	1	1	1	1	1	1

Source: Questionnaire

It is quite difficult to generalize the characteristics of the sourcing units of Japanese firms. Some firms source primarily at their headquarters while others do it at subsidiaries and a couple at project offices. In general, however, Japanese project offices and subsidiaries, particularly project offices, play a much larger role in sourcing than the competitors in other countries. (See Exhibit 5.3.6 below.) Project offices source unskilled labor and 45 percent of firms source civil work subcontractors in 80 percent of Japanese firms while subsidiaries source electrical work and mechanical work subcontractors are sourced in 45 and 36 percent of them respectively. Headquarters source mechanical work subcontractors in 36 percent of Japanese firms but other kinds of subcontractors in less than 20 percent of them and no unskilled labor. Also, subsidiaries and project offices, particularly subsidiaries, play a major role in sourcing materials and equipment. Project offices source bulk materials in 70 percent of them and electric and electronic equipment in approximately half of them.

**Exhibit 4.3.6 Configuration of Sourcing Activities - Organizational Units Sourcing Goods and Services by Percentage of Japanese Firms**

(Percentage)

	P.O.	SUB	HQs	P.O. + SUB	P.O. + HQs	SUB + HQs	P.O. + SUB + HQs	Total
Unskilled labor	81.8	9.1	25.0	0.0	9.1	0.0	0.0	100.0
General civil works	45.5	27.3	9.1	18.2	0.0	0.0	0.0	100.0
Mechanical works	18.2	36.4	36.4	9.1	0.0	0.0	0.0	100.0
Electrical works	27.3	45.5	18.2	9.1	0.0	0.0	0.0	100.0
Bulk materials	72.7	18.2	0.0	9.1	0.0	0.0	0.0	100.0
Mfd. materials	27.3	45.5	9.1	9.1	9.1	0.0	0.0	100.0
Electrical equipment	18.2	54.5	18.2	9.1	0.0	0.0	0.0	100.0
Electronic equipment	18.2	54.5	18.2	9.1	0.0	0.0	0.0	100.0
Heavy equipment	18.2	27.3	45.5	9.1	0.0	0.0	0.0	100.0

Source: Questionnaire

### 4.3.2 Configuration of External Inputs

Configurations of two types of external inputs sourced by E&C firms are also examined, one for labor and subcontractors and the other for suppliers of materials and equipment. Geographic configuration is roughly divided into four major locations, the host country, the region around the host country, worldwide, and home country.

#### 4.3.2.1 General Configuration of External Inputs

Exhibit 4.3.7 below illustrates where the surveyed firms source labor, subcontractors for civil, mechanical and electrical works, and suppliers for bulk and general manufactured material, electrical, electronic, and heavy equipment.

A considerable diversity for the configuration of labor, subcontractors, and goods has been observed among the surveyed firms. Approximately 70 percent of the surveyed E&C firms source unskilled labor and civil works subcontractors locally, either in the host country or in the region around the host country. However, about 30 percent of the firms source mechanical and electrical works

subcontractors worldwide. Also, 30 percent of the firms source them at their home countries.

For suppliers, although about 60 percent of the firms source bulk materials locally, either in the host country or region around the host country, a very small fraction of the firms source other materials and equipment locally. Instead, 50 to 60 percent of the firms source other materials and equipment worldwide, and 25 to 30 percent in their home countries.

This result suggests that there are fairly efficient markets developed worldwide for most of the materials and equipment except for bulk materials, which are primarily local. Moreover, there is a fair number of mechanical and electrical subcontractors operating worldwide while many civil works subcontractors mostly operate only nationally or regionally. In contrast, it is important to note that a large number of E&C firms typically mobilize subcontractors and suppliers from their home countries.

Exhibit 4.3.7 Configuration of Inputs - Locations from Which Goods and Services Are Sourced

	(Percentage)					Total
	Host country	In the region around host country	World-wide	From home country	Mixture of the other four	
Unskilled labor	52.9	21.6	15.7	2.0	5.8	100.0
General civil works	54.9	15.7	17.6	7.8	3.9	100.0
Mechanical works	21.6	11.8	31.3	27.5	7.8	100.0
Electrical works	19.6	9.8	31.3	33.3	6.0	100.0
Bulk materials	50.0	11.5	23.0	7.7	7.7	100.0
Mfd. materials	9.6	7.7	57.7	11.5	13.5	100.0
Electrical equipment	5.8	3.8	46.2	32.7	11.6	100.0
Electronic equipment	3.8	3.8	57.7	26.9	7.8	100.0
Heavy equipment	1.9	1.9	59.6	25.0	11.6	100.0

Source: Questionnaire

#### 4.3.2.2 Types of Configuration of External Inputs

The E&C firms are categorized by types of configurations, worldwide, home-country concentration, complex, and local.

##### E&C firms with worldwide sourcing

Exhibit 4.3.8 presents the sourcing patterns of the 19 firms which primarily source goods and services worldwide. Seventy percent of the firms mobilize mechanical and electrical works worldwide, and half of them source civil works subcontractors worldwide. Thirty percent of them even source labor worldwide. However, worldwide sourcing is more prominent in sourcing materials and equipment. Ninety percent of the firms source electric, electronic, and heavy equipment worldwide; 80 percent source manufactured materials worldwide; 60 percent of them mobilize even bulk materials worldwide.

Exhibit 4.3.8 Configuration of Inputs - Locations from Which Goods and Services Are Sourced in Firms with Worldwide Sourcing

	(Percentage)					
	in the host country	In the region around the host country	World-wide	From home country	Mixture of the other four	Total
Unskilled labor	30.0	12.5	31.3	0.0	6.2	100.0
General civil works	37.5	6.2	50.0	6.2	0.0	100.0
Mechanical works	12.5	0.0	68.8	6.2	12.5	100.0
Electrical works	12.5	0.0	68.8	12.5	6.2	100.0
Bulk materials	31.2	12.5	56.3	0.0	0.0	100.0
Mfd. materials	12.5	0.0	81.3	0.0	6.2	100.0
Electrical equipment	0.0	0.0	93.8	0.0	6.2	100.0
Electronic equipment	0.0	0.0	93.8	0.0	6.2	100.0
Heavy equipment	0.0	0.0	93.8	0.0	6.2	100.0

Source: Questionnaire

Exhibit 4.3.9 lists the details of how the 19 firms source each kind of item. Several interesting facts may be derived from the table. First, the group was

dominated by engineering contractors, twelve out of the 19 firms. Moreover, five out of the six firms sourcing truly worldwide are engineering contractors. Another firm sourcing truly worldwide is an affiliate firm of the large electric conglomerate, and its sourcing activity is integrated into the parent's large worldwide sourcing system as pointed out earlier. Then, consequently only four firms are contractors which source goods and services worldwide.

Exhibit 4.3.9 E&C Firms Sourcing Goods and Services Worldwide

Country	USL	CW	MW	EW	BM	MM	EIE	EOE	HE
US	L	W	L	L	W	W	W	W	W
FR	L	L	L+H	H	W	W	W	W	W
US	W	W	W	W	W	W	W	W	W
US	L+W	W	W	W	R+W	W	W	W	W
FR	L	L	RWH	W+H	W	W	W	W	W
UK	L	W	W	W	L	W	W	W	W
IT	L	L	W	W	L	L	W	W	W
KR	W	L	I	L	L	W	W	W	W
WG	LRW	R	R	W	W	W+H	W+H	W+H	W+H
NE	W	W	W	W	W	W	W	W	W
SP	L	H	H	H	W	W	W	W	W
SW	R	W	W	W	W	W	W	W	W
US	W	W	W	W	W	W	W	W	W
IT	W	W	W	W	W	W+H	W+H	W+H	W+H
KR	L	L	W	W	L	W	W	W	W
US	R	W	W	W	L	W	W	W	W
SWD	L	L	W	W	L	W	W	W	W
WG	W	L	L	L	L	W	W	W	H
HK	R	R	W	W	R	L	W	W	W

Note: L = sourcing locally, in the host country, R = sourcing in the region around the host country, W = sourcing worldwide, and H = sourcing from home country.

Source: Questionnaire

Second, the 19 firms are nationally diverse, including firms from the U.S., France, U.K., Italy, Korea, Hong Kong, and Sweden, of which the U.S. firms form a largest group. Note that no Japanese firms are included in this group. (As we see next, Japanese firms show a unique pattern in their sourcing practices.)



Third, the home countries of these 19 firms are not the prime markets for sourcing goods and services. They seem to be the firms pursuing competitiveness through the most efficient and flexible sourcing.

#### E&C firms with home country sourcing

Twenty-three firms, which account for nearly a half of the 52 surveyed, intensively source services and goods from their home countries. Exhibit 4.3.10 demonstrates an aggregated picture of the sourcing patterns of these 23 firms. A little over 60 percent source electric work subcontractors and 50 percent source mechanical work subcontractors from their home countries. Also, more than 70 percent source electrical equipment and about 50 percent heavy equipment from home. However, these firms mix home-country-sourcing with local and worldwide sourcing. More than half of them source unskilled labor, civil works subcontractors, and bulk materials locally, and 30 to 70 percent of them source materials and goods worldwide.

Exhibit 4.3.10 Configuration of Inputs - Locations from Which Goods and Services Are Sourced in Firms with Home Country Sourcing

	(Percentage)					Total
	In the host country	In the region around the host country	World-wide	From home country	Mixture of the other four	
Unskilled labor	61.0	17.4	13.0	4.3	4.3	100.0
General civil works	52.3	17.4	13.0	13.0	4.3	100.0
Mechanical works	17.4	8.7	21.7	52.2	0.0	100.0
Electrical works	13.0	8.7	17.3	61.0	0.0	100.0
Bulk materials	60.9	8.7	17.4	13.0	0.0	100.0
Mfd. materials	8.7	4.3	52.2	26.1	8.7	100.0
Electrical equipment	4.3	0.0	17.4	74.0	4.3	100.0
Electronic equipment	0.0	4.3	34.7	56.5	4.3	100.0
Heavv equipment	0.0	0.0	47.8	47.8	4.4	100.0

Source: Questionnaire

Exhibit 4.3.11 lists the 23 firms and demonstrates the detailed patterns of their sourcing. Several interesting characteristics of these firms are identified.

Exhibit 4.3.11 E&C Firms Sourcing from Home Country

Country	USL	CW	MW	EW	BM	MM	EIE	EOE	HE
IT	LRWH	L	H	H	L	H	W	W	W
JP	R	R	W	H	R	W	H	W	H
JP	L	L	H	R	L	H	H	W	H
IT	L	L	R	R	H	R	H	W	W
JP	W	L	L	W	W	W	H	H	H
FR	R	L	W	H	L	W	H	H	W
IT	L	L	H	H	L	W	H	H	W
UK	L	L	R	H	L	W	H	H	W
IT	L	W	W	W	H	H	H	W	H
IT	L	W	W	W	H	W	H	H	H
IT	R	L	H	H	L	H	H	H	H
IT	W	W	W	W	W	WH	WH	WH	WH
WG	R	R	H	H	L	W	H	H	W
IT	W	R	H	H	L	L	H	H	L
IT	L	LH	H	H	L	W	W	W	W
FR	H	H	H	H	L	W	W	W	W
IT	L	R	H	H	L	LH	H	H	H
FR	L	H	H	H	H	H	H	H	H
JP	L	L	H	H	L	LH	H	H	H
JP	L	L	L	L	L	W	H	H	H
US	L	L	L	L	L	H	H	H	H
IT	R	L	L	L	R	W	H	H	H
JP	L	L	H	H	L	L	L	R	H

Source: Questionnaire

First, there are eight engineering contractors and 15 contractors. This distribution suggests that the choice of home country sourcing is not determined by types of firms.

Second, the 23 firms are grouped into three categories, firms with complex sourcing (i.e., mixing home country sourcing with local and worldwide sourcing), firms combining home country sourcing with worldwide sourcing, and firms combining home country sourcing with local sourcing as listed in Exhibit 4.3.12.

Although nationalities and types vary in each category, small firms tend to have home-country and local sourcing.

Third, there is a certain relationship between nationalities and the home-country-sourcing patterns. The 23 firms include 11 Italian and six Japanese firms. Altogether they account for 75 percent of the firms sourcing intensively from their home countries. These Italian firms account for 92 percent of the surveyed Italian firms while the Japanese firms 55 percent of the surveyed Japanese firms.

Exhibit 4.3.12 E&C Firms Combining Home Country Sourcing and Ways of Sourcing

Complex Sourcing	Home + Worldwide Sourcing	Home + Local Sourcing
(IT,E), (IT,C), (IT,C),(IT,E) (JP,C), (JP,C) (JP,C), (FR,E) (UK,C), (WG,E)	(IT, E), (IT, E) (IT, E), (TR,C)	(IT, C), (IT, E) (IT, C), (IT, C) (FR,E), (JP, E) (JP, C), (JP, C) (US,C)

Note: The first abbreviation in a parenthesis indicates nationality of a firm and the second indicates a type of the firm.

Source: Questionnaire

#### E&C firms with complex sourcing

There are seven firms, all contractors, which show a complex pattern of home-country (but not intensive), local, and worldwide sourcing. (Exhibit 4.3.13)

Exhibit 4.3.13 E&C Firms with Complex Sourcing

Country	USL	CW	M'W	EW	BM	MM	EIE	EOE	HE
US	L	L	W	W	L	W	W	H	H
JP	L	L	LR	LR	LR	LRW	LRW	LRWH	LRW
US	R	L	L	L	LW	LW	LW	W	W
UK	R	L	L	L	R	RW	LW	W	LW
WG	L	R	R	R	L	R	R	W	W
JP	L	L	R	R	L	W	W	W	W
JP	L	L	H	H	L	W	W	W	W

Source: Questionnaire

### Firms with Local Sourcing

Three firms source all goods and services locally. One is a large U.S. engineering contractor, and other two firms are large Japanese contractors. (Refer to Exhibit 4.3.14 below.) Several reasons for their local sourcing practice are considered. First, they are all active primarily in developed countries, such as Canada, western Europe, and Australia. In these countries, most of materials and equipment are available locally; importing labor to these countries are often prohibited legally; and in the case of Australia, it is too far from any other continent to import goods. Second, in the international market, one of the two Japanese contractors concentrates on constructing heavy facilities (e.g., tunnels, highways, bridges, or dams); primary inputs to these facilities are bulk materials (e.g., concrete and sand) and heavy manufactured materials (e.g., H-steel) often sourced locally, possibly to reduce transportation costs, as we have seen earlier.

Exhibit 4.3.14 E&C Firms with Local Sourcing

Country	USL	CW	MW	EW	BM	MM	EIE	EOE	HE
US	R	R	R	R	R	R	R	R	R
JP	L	L	L	L	L	L	L	L	L
JP	L	L	L	L	L	L	L	L	L

Source: Questionnaire

### Italian and Japanese Firms

As pointed out above, Italian and Japanese firms are idiosyncratic in terms of the configuration of their external inputs. The characteristics are demonstrated in Exhibit 4.3.15 and 4.3.16. Although both Italian and Japanese firms source heavily from their home countries, the intensity is much higher in Italian firms. Italian firms intensively source from their home country mechanical and electrical work subcontractors, and electric and electrical equipments. Also, their home sourcing is fairly strong for bulk and manufactured

materials, and heavy equipment. Japanese firms' home sourcing is the strongest for heavy equipment followed by electrical equipment. Mechanical and electrical work, and electronic equipment are fairly extensively sourced in Japan.

Exhibit 4.3.15 Configuration of Inputs - Locations from Which Goods and Services Are Sourced in Italian E&C Firms

(Percentage)

	In the host country	In the region around the host country	World-wide	From home country	Mixture of the other four	Total
Unskilled labor	58.3	16.7	16.7	0.0	8.3	100.0
General civil works	50.0	16.7	25.0	6.2	0.0	100.0
Mechanical works	8.3	8.3	33.3	50.0	0.0	100.0
Electrical works	8.3	8.3	33.3	50.0	0.0	100.0
Bulk materials	58.3	8.3	8.3	25.0	0.0	100.0
Mfd. materials	16.7	8.3	41.7	25.0	0.0	100.0
Electrical equipment	0.0	0.0	33.3	58.3	8.3	100.0
Electronic equipment	0.0	0.0	50.0	41.7	8.3	100.0
Heavy equipment	0.0	0.0	66.7	25.0	8.3	100.0

Source: Questionnaire

Exhibit 4.3.16 Configuration of Inputs - Locations from Which Goods and Services Are Sourced in Japanese Firms

(Percentage)

	In the host country	In the region around the host country	World-wide	From home country	Mixture of the other four	Total
Unskilled labor	72.7	9.1	0.0	0.0	9.1	100.0
General civil works	81.8	9.1	0.0	0.0	9.1	100.0
Mechanical works	27.3	9.1	9.1	36.4	9.1	100.0
Electrical works	18.2	18.2	9.1	36.4	9.1	100.0
Bulk materials	63.6	9.1	9.1	0.0	18.2	100.0
Mfd. materials	18.2	0.0	45.5	9.1	18.2	100.0
Electrical equipment	18.2	0.0	18.2	45.4	18.2	100.0
Electronic equipment	9.1	9.1	36.4	27.2	18.2	100.0
Heavy equipment	9.1	0.0	18.2	54.5	18.2	100.0

Source: Questionnaire

Also, Italian firms combine home country sourcing with worldwide and local sourcing while Japanese firms combine home country sourcing more with local sourcing than with worldwide sourcing. The largest reason for home country sourcing for these two nationalities seems to be their frequent use of tied loans and export credits, both of which result in exports of goods and services from their home countries. Also, part of the reasons may be superior quality of certain products shipped from their home countries.<sup>6</sup>

Part of the reason for Japanese contractors' local sourcing practice may be, as mentioned above, their recent emphasis on E&C in developed countries and on heavy civil E&C in developing countries. However, their lack of sourcing capability, particularly worldwide sourcing capability as will be revealed in Chapter 5, may also have forced them to rely on local and home country sourcing.

#### **4.3.3 Configuration and Coordination of Internal Sourcing Activity and External Inputs**

Based on the data obtained so far, Exhibit 4.3.17 provides the grouping of the surveyed firms by organizational units performing sourcing activities, or configuration of sourcing activities, and configuration of inputs.

The exhibit suggests several interesting facts. First, regarding configuration of sourcing activities, headquarters play a crucial role in sourcing in half of the surveyed E&C firms, whereas project offices play the role in only less than 6 percent of the firm. Also, subsidiaries primarily perform sourcing activities in 15 percent of firms while in 29 percent of the firms, headquarters, subsidiaries, and project offices source goods and services jointly. Roughly, the

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<sup>6</sup>. Norsa, Aldo (1988), p.99.

firms whose headquarters play such a role are either large engineering contractors or medium to small contractors.

Exhibit 4.3.17 Configuration of Sourcing Activities and Inputs of E&C Firms

Configuration of inputs	Sourcing Organizational Units			
	HQs (26 firms)	Mixed (15 firms)	Subsidiaries (8 firms)	Project Offices (3 firms)
Worldwide Sourcing  (19 firms)	(E, US, 34) (C, US, 12) (E, FR, 43) (E, FR, 79) (C, IT, 21) (E, KR, 19) (E, NE, 17) (C, KR, 2) (C, SD, 3) (C, HK, 2)	(E, US, 43) (E, WG, 4) (C, SP, 14) (C, IT, 43) (C, WG, 2)	(E, US, 45) (E, UK, 9) (E, SW, 47)	(E, US, 29)
Home Country Sourcing  (23 firms)	(E, IT, 44) (E, IT, 23) (C, IT, 8) (C, IT, 6) (E, IT, 5) (C, IT, 16) (E, IT, 43) (C, IT, 2) (C, IT, 20) (C, IT, 12) (C, IT, 3) (C, TK, 5) (C, FR, 1) (C, JP, 17) (E, JP, 18) (C, US, 1)	(E, FR, 47) (C, UK, 27) (C, WG, 1) (C, JP, 9) (C, JP, 7) (C, JP, 17)	(C, JP, 13)	
Complex Sourcing  (7 firms)		(C, US, 2) (C, US, 19) (C, UK, 8) (C, JP, 16)	(C, JP, 25) (C, WG, 1)	(C, JP, 11)
Local Sourcing (3 firms)			(E, US, 21) (C, JP, 25)	(C, JP, 17)

Note: The first abbreviation in parentheses indicates a type of a firm, the second indicates nationality of the firm, and a number represents a number of countries in which projects are undertaken by the firm.

Source: Questionnaire

Second, regarding configuration of inputs, the largest group is comprised of firms sourcing goods and services from their home countries. Such firms account for 44 percent of the surveyed firms. The second largest group is formed by firms sourcing goods and services worldwide for each project. They account for 37 percent. In other words, more than 80 percent of the surveyed E&C firms source goods and services either worldwide or from their home countries. Only six percent of firms source goods and services locally, whereas 13 percent of firms combine worldwide, home country, and local sourcing in a complex way.

Third, combining the two kinds of configurations, the largest group is comprised of firms whose headquarters sourcing from home countries. Thus, they seem to take the internally and externally "simplest global strategies" characterized by a concentration of internal activities and external inputs. They account for 31 percent of the surveyed firms. More importantly, nearly 60 percent of these firms are Italian firms. Furthermore, except for the two firms who source worldwide, all Italian firms are in this group. From this result, we may be able to conclude that most Italian firms compete on the basis of home country sourcing by their headquarters. As addressed earlier, their home country is considered to be related to their frequent use of export credits, targeting projects financed by Italian tied loans, and to a certain extent differentiation of themselves by the use of superior Italian products. A reason why headquarters of Italian firms source appears to be almost self-evident. Physical proximity between Italian E&C firms and Italian suppliers or subcontractors justifies headquarters sourcing them. Also, because many Italian firms (particularly contractors) have medium to small international operations, coordination of activities and inputs from headquarters may not be truly difficult.

Fourth, the second largest group in considering the two kinds of configuration is formed by firms whose headquarters source worldwide. They



account for about 19 percent of the surveyed firms. These firms seem to achieve cost effective and flexible sourcing on a worldwide scale. Also, in six percent of the firms, subsidiaries source goods and services worldwide, whereas in about 10 percent of the firms, headquarters, subsidiaries, and project offices jointly perform worldwide sourcing.

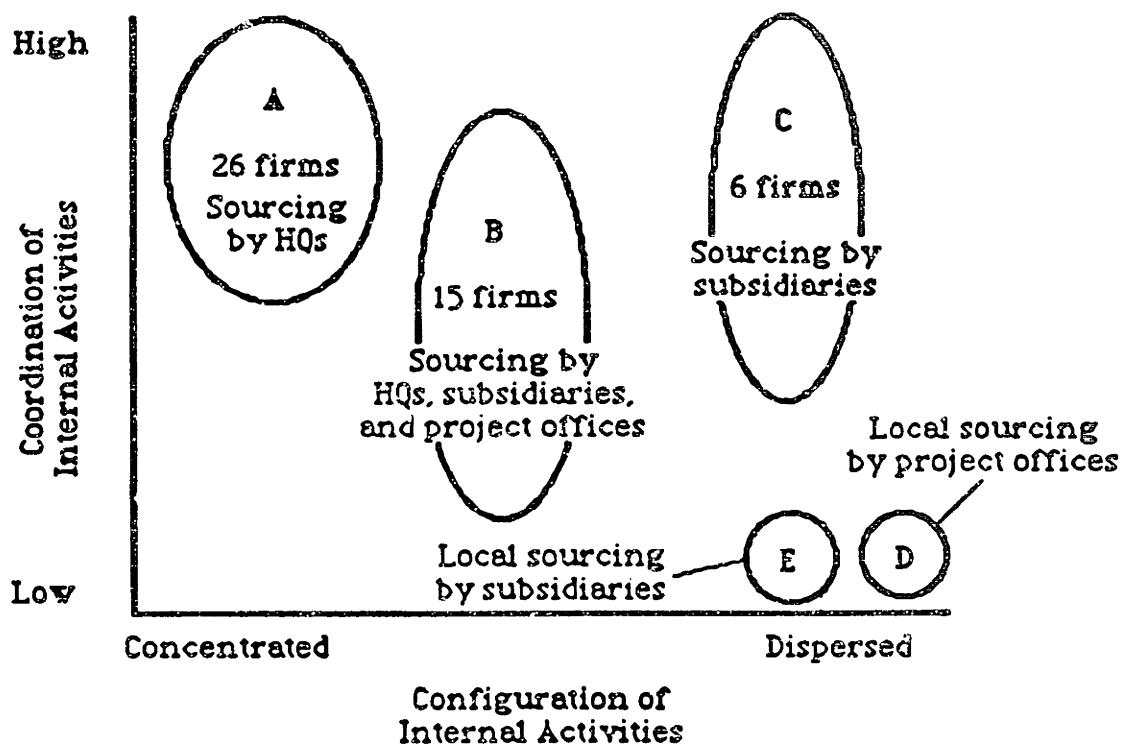
Fifth, firms whose subsidiaries, project offices, or mixture of headquarters, subsidiaries, and project offices source worldwide account for 17 percent. Also, firms whose subsidiaries or mixture of headquarters, subsidiaries, and project offices source from their home countries account for 13 percent. Japanese firms represent more than half of the latter kind of firms.

Sixth, there are a number of hybrid firms of the firms addressed above. They account for 13 percent. Finally, there are three firms (two Japanese and one American), whose subsidiaries or project offices source locally. As addressed earlier, they mostly operate in developed countries.

Now, the firms are schematically positioned for internal and external globalization in Exhibits 4.3.18 (1) and (2). It is important to note that measuring coordination is more difficult than identifying configuration. In the two exhibits, vertical positions of firms (that is, extent of coordination) are determined by qualitatively measuring the extent of coordination associated with dispersion or separation of sourcing activities.

First, firms are positioned in Exhibit 4.3.18 (1) for its internal globalization measured by the configuration and coordination of sourcing activities. The horizontal axis represents the configuration of the internal sourcing activity while the vertical axis represents extent of coordination of the sourcing activity. The surveyed firms are plotted in the two-dimension diagram. There are five distinctive groups of firms.

Exhibit 4.3.18 (1) Internal Globalization of E&C Firms Measured by Configuration and Coordination of Sourcing Activities



Note: Ovals indicate groups of firms with different combinations of configuration and coordination of internal activities.

Twenty-six firms with concentrated sourcing are represented by group A at the upper-left corner of the diagram. Group A is formed by firms whose headquarters source goods and services either worldwide or from home countries. Group A is the largest group, accounting for half of the surveyed firms. (It is worth to remember that approximately half of the firms in this group are Italian firms, and the Italian firms in this group account for nearly 85 percent of all Italian firms.) Because of the geographic separation of the sourcing activity from project locations, both groups must have very high coordination. Given the concentrated configuration of sourcing activity and high degree of coordination

of sourcing activity, these firms, thus, seem to adopt a "simple global" strategy for internal globalization.

Firms in Group B are those in which headquarters, subsidiaries, and project offices jointly perform sourcing activities. The firms in this group, 15 in all, account for about 29 percent of the surveyed firms. Levels of coordination of these firms associated with separation of the sourcing activity could be diverse, from medium-high to moderate depending on the mixture of sourcing organizations. In other words, the more activities project offices or national subsidiaries execute, the less degree of coordination they have internally.

In the six firms in Group C subsidiaries source goods and services. Degree of internal coordination in these four groups are considered diverse, from high to low, depending on the role of the subsidiaries. If their subsidiaries are operating centers, each of which serves worldwide in a different market segment, degree of internal coordination may be high, and their strategies may to be "complex global". However, if they are just national subsidiaries and serve for projects in the countries where subsidiaries are located, degree of internal coordination may be low, and their strategies may be close to "multi-domestic". If the both types of subsidiaries exist within one firm, degree of coordination may be moderate.

Three firms whose project offices source goods and services are represented in Group D. Their levels of internal coordination are low because project offices perform sourcing activities independently. Therefore, their strategies seem to be quite multi-domestic.

Two firms in Group E executes sourcing at their subsidiaries. Because their subsidiaries source only locally, they are considered national (or regional) subsidiaries serving project offices within the countries (or regions) in which the subsidiaries are located. Thus, the degree of internal coordination is considered to be low.

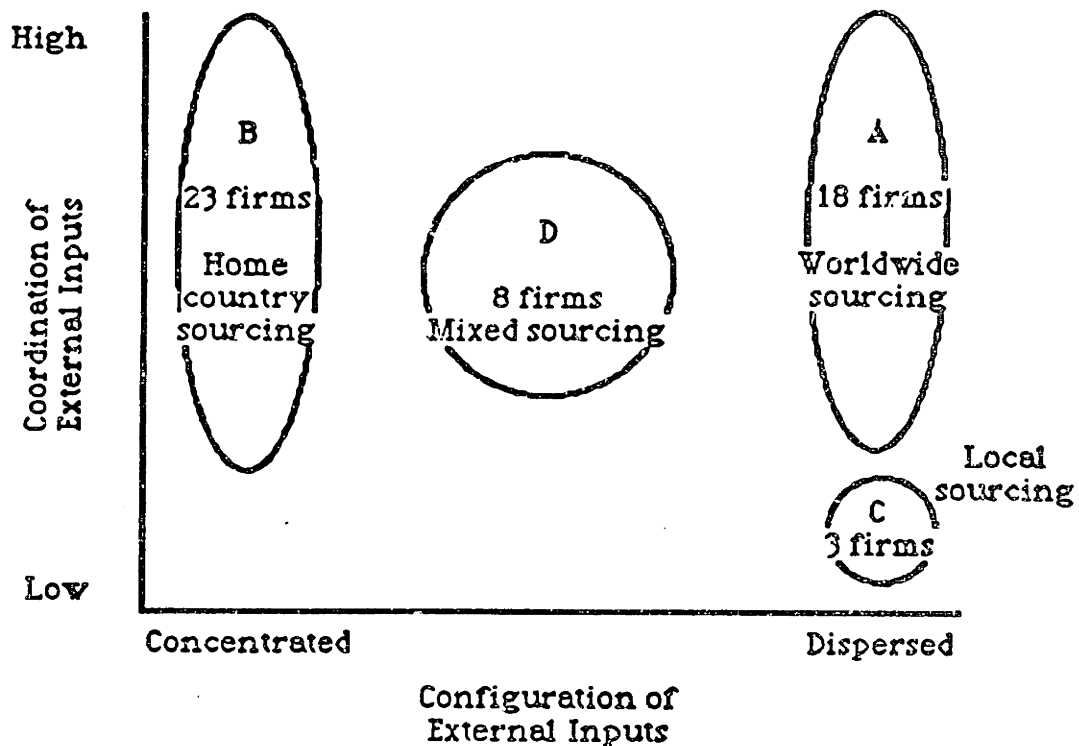
Exhibit 4.3.18 (2) shows strategic positions of firms in configuration and coordination of external inputs. Firms with worldwide sourcing, 18 firms in all, are represented in Group A at the right end of the diagram. Group A is comprised of firms undertaking projects in varying numbers of countries so that their levels of coordination of external inputs are diverse. The degree of external coordination decreases as numbers of countries in which they undertake projects decrease. Engineer contractors tend to undertake projects in a larger number of countries than contractors so that engineering contractors are likely to stay above contractors in the diagram. The firms (which are all contractors) undertaking in a few countries may be positioned at the bottom of the oval representing Group A.

Group B, 23 firms in all, sources inputs from home countries, and thus the group is positioned close to the vertical axis. As the numbers of countries in which projects are undertaken decrease, levels of coordination go down, from the top to the bottom of the oval. Again, it is worth pointing out that approximately 85 percent of them are Italian firms.

Three firms in Group C source inputs in local countries. Their configuration of external inputs is considered to be dispersed because the location of inputs are as many as the the countries in which they undertake projects. However, regardless of the numbers of countries they serve, their levels of coordination of inputs are low because their inputs are limited to local use.

Then, firms in Group D, eight firms in all, are considered to have hybrid configuration and coordination. Their horizontal and vertical positions vary depending on the combination of worldwide, home country, and local sourcing.

Exhibit 4.3.18 (2) External Globalization of E&C Firms Measured by Configuration and Coordination of External Inputs



Note: Ovals indicate groups of firms with different combinations of configuration and coordination of external inputs.

#### 4.3.4 Configuration of Financial Activities

This section examines the configuration of financial activities and coordination of the financial activities and flows of capital within the organization of the E&C firms.

##### 4.3.4.1 Configuration of Sourcing, Payment, and Decision Making

Exhibit 4.3.19 illustrates which organizational units of the E&C firms source, pay, and make decisions for various financial transactions. Similar to the transactions for goods and services incorporated into designed facilities, a

significant part of decision making and real financial transactions are, in general, made at headquarters of E&C firms. Headquarters are heavily engaged in the financial transactions that take place in the pre-construction period, such as those for bonding, obtaining insurances, and equity participations. Fund-sourcing for the three transactions are performed at headquarters at 75 to over 80 percent of the surveyed E&C firms; paying activities at 50 to 70 percent of the firms; and decision making for the three kinds of financial transactions at 75 percent to 100 percent of them.

Exhibit 4.3.19 Configuration of Financial Activities - Organizational Units Performing Financial Activities by Percentage of Firms (Percentage)

Items	Activities	P.O.	SUB	HQs	Total
Bonds	Sourcing funds	4.7	14.0	81.3	100.0
	Payments	25.0	22.5	52.5	100.0
	Decision making	0.0	15.6	84.4	100.0
Insurances	Sourcing funds	6.8	18.2	75.0	100.0
	Payments	28.6	21.4	50.0	100.0
	Decision making	8.5	17.0	74.5	100.0
Equity participation	Sourcing funds	5.0	12.5	87.5	100.0
	Payments	8.1	18.9	73.0	100.0
	Decision making	0.0	0.0	100.0	100.0
Payment to subcontractors	Sourcing funds	44.4	26.7	28.9	100.0
	Payments	60.4	33.3	6.3	100.0
	Decision making	31.1	35.6	33.3	100.0
Payment to suppliers	Sourcing funds	38.6	29.5	31.9	100.0
	Payments	46.8	34.0	19.2	100.0
	Decision making	30.4	28.3	41.3	100.0
Day-to-day payment	Sourcing funds	60.5	18.6	20.9	100.0
	Payments	74.5	23.4	2.1	100.0
	Decision making	63.0	15.2	21.7	100.0
Local borrowing	Decision making	6.3	20.8	72.9	100.0
Internal use of fund	Decision making	8.5	10.6	80.9	100.0
Foreign exchange	Decision making	4.4	6.7	88.9	100.0

Note: P.O. = Project Office, SUB = Subsidiary, and HQs = Headquarters  
Source: Questionnaire

For activities performed after construction starts, such as payment to subcontractors and suppliers, day-to-day payment to local staff and labor hired on a daily basis, the role of project offices rise significantly. The role of subsidiaries also increases at 20 to 30 percent of the E&C firms. However, headquarters still performs the role at 20 to 40 percent of the firms except for the actual paying activity.

Headquarters are also the primary decision makers for financial transactions critical to the performance of entire firms, such as local borrowings, internal use of funds, and foreign exchange. Seventy to nearly 90 percent of firms make these decisions at their headquarters.

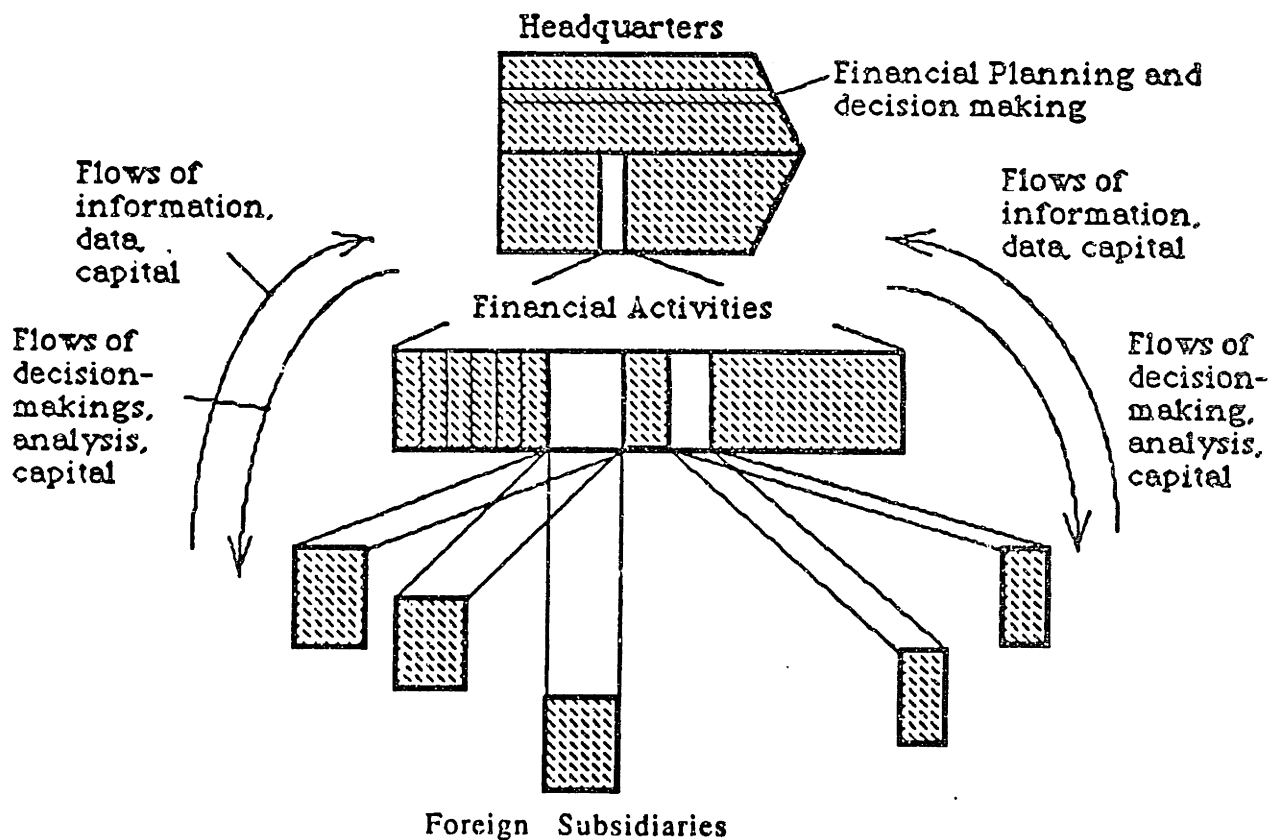
Several conclusions may be derived from these results. First, numerous financial activities, particularly those in the pre-construction period and crucial financial decisions, are performed by headquarters in many E&C firms. There are firms in which headquarters perform financial activities even after construction starts. In contrast, financial activities performed by project offices are minimal, limited to those taking place after construction starts. This finding suggests that in many firms there is a substantial dispersion of vertically integrated financial activities and that coordination to offset the dispersion is very high.

Second, the concentration of substantial amounts of financial activities at headquarters also indicates that in many E&C firms financial activities are highly coordinated over geographic distances by headquarters. Coordination includes planning, actual sourcing and allocation of funds, matching the amount and timing of funds' needs on favorable terms, selection of currencies, and assessment of contract terms for many projects in several countries. For firms to coordinate financial activities after construction begins, headquarters must monitor actual progress, change orders, and changes in contracts made at project sites for many projects. Furthermore, all these transactions affect the activities

managing foreign currencies, performed at the headquarters of many E&C firms. Thus, the coordination by headquarters of these firms must be quite complex.

Third, along with the flows of various payments and profits between headquarters and foreign units, internal services in the form of information, analytical data, and managerial directions also flow between different units over geographic distances. Exhibit 4.3.20 below demonstrates geographic dispersion of vertically integrated financial activities and a concentration of many financial activities in the headquarters of E&C firms. The figure also demonstrates flows of capital and internal services which coordinate the flows of capital and various financial activities performed locally. Thus, in general E&C firms are quite global in terms of the degree of coordination of financial activities.

Exhibit 4.3.20 Configuration of Financial Activities and Flows of Capital and Related Internal Services





#### 4.3.4.2 Types of Configuration of Financial Activities by Firms

Exhibit 4.3.21 below categorizes configurations of financial activities of the surveyed E&C firms. Although the role of headquarters is generally significant in many firms, configuration of financial activities vary among the firms. Basically, there are four types of configurations of financial activities: (1) Very highly concentrated at their headquarters; (2) dispersed at both headquarters and subsidiaries; (3) dispersed over headquarters and project offices; and (4) dispersed over headquarters, subsidiaries, and project offices.

A comparison of firms in different categories provides interesting observations. First, nationality seems to influence the configuration of financial activities. Most of the UK, French, and Japanese firms have dispersed configurations of financial activities. All Japanese firms except two in category (1) are considered to have a very dispersed and complex configuration of activities. Their headquarters, subsidiaries, and project offices seem to perform different financial activities.

Second, firms sourcing goods and services at headquarters and firms sourcing them in their home countries tend to have a high concentration of financial activities at their headquarters. When headquarters source goods and services, it is very likely that they pay for them. Also, when goods and services are sourced in their home countries, headquarters may be involved in sourcing and thus pay for them.

Third, Italian firms which source goods and services in Italy have a high concentration of financial activities at headquarters. Also, their frequent use of subsidized financial packages obtained from the Italian government seems to justify the location of financial activities in Italy.

Fourth, contractors seem to have more dispersed financial activities than engineering contractors. Contractors concentrate in the categories (3) and (4)

while many engineering contractors are found in (1) and (2). In line with the second finding above, it may be plausible to assume that contractors must pay for more inputs sourced locally than engineering contractors while many engineering contractors integrate sourcing and paying activities at a few locations and achieve them for their worldwide operation.

#### Exhibit 4.3.21 Categories of Configurations of Financial Activities

##### (1) Concentration at headquarters

Country	Type	P.O.	SB	HQ	Country	Type	P.O.	SB	HQ
US	E	L	M	VH	FR	E	L	0	VH
US	E	0	0	VH	WG	E	L	L	VH
US	C	L	0	VH	TK	C	L	0	VH
IT	E	L	0	VH	JP	E	L	0	VH
IT	E	L	0	VH	JP	C	L	0	VH
IT	C	L	0	VH	HK	C	L	0	VH

##### (2) Dispersion over headquarters and subsidiaries

Country	Type	P.O.	SB	HQ	Country	Type	P.O.	SB	HQ
US	E	L	M	H	UK	C	L	M	M
FR	E	L	M	H	UK	E	L	VH	M
FR	E	L	M	H	IT	C	0	M	M
FR	E	L	M	H	IT	C	0	M	H

##### (3) Dispersion over headquarters and project offices

Country	Type	P.O.	SB	HQ	Country	Type	P.O.	SB	HQ
US	C	M	0	M	WG	C	M	0	H
US	C	M	0	H	UK	E	M	0	H
IT	C	M	L	H	SD	E	M	0	M
IT	C	M	0	H	JP	C	H	0	M
IT	C	M	0	H	JP	C	H	0	M
SW	E	M	L	M					

## (4) Dispersion over headquarters, subsidiaries, and project offices

Country	Type	P.O.	SB	HQ	Country	Type	P.O.	SB	HQ
JP	C	L	M	M	UK	C	L	M	M
JP	C	L	M	M	US	C	M	L	L
JP	C	M	L	M	US	E	L	L	M
<u>JP</u>	C	L	L	M	<b>IT</b>	C	L	M	M
<u>JP</u>	C	M	L	M	WG	C	L	M	M
<u>JP</u>	C	M	M	L	KR	C	M	L	M
NE	E	M	M	M	KR	E	L	M	M

Note: 1) Abbreviations denote the following: VH: Very high; H: High; M: Moderate; L: Low; 0: Zero. VH, H, L, and 0 indicate the concentration of different financial activities at the indicated location at more than 80, 55 to 79, 20 to 54, and less than 20 percent respectively.

2) Seven firms not included in this table did not respond to the question pertaining to financial activities.

3) Firms with boldfaced nationalities have sourcing activities primarily at their headquarters.

4) Firms with underlined nationalities source goods and services primarily in their home countries.

Source: Questionnaire

#### 4.3.4.3 Headquarters' Control of Financial Activities

The previous argument has revealed the importance of headquarters' financial transactions for most of the E&C firms. The questionnaire responses about the importance of coordination at headquarters further reveal the nature of such coordination in the E&C firms. Reflecting the importance of headquarters' coordination of financial activities for almost all the surveyed E&C firms, the score for each of these items is quite high. (See Exhibit 4.3.22) It appears that E&C firms share, despite the temporary production of E&C services abroad, the same motivations for coordinating financial activities as manufacturing multinational enterprises.

The largest motivation for headquarters to coordinate financial activities seems to be the reduction of foreign exchange risks, followed by effective coordination of the internal surplus funds for investment and internal allocation

of funds.<sup>7</sup> Coordination of foreign exchange transactions is important to E&C firms. Not only the repatriation of profits to headquarters but also payment for goods and services sourced abroad are denominated in multiple currencies. Management of currency risks may become dramatically complex, and such risks may be managed most effectively by headquarters.

**Exhibit 4.3.22 Significance of Headquarters' Coordination of Financial Activities**

Items	Scores
1. Reduce foreign exchange risks	0.92
2. Increase overall returns on investment	0.75
3. More effective use of surplus funds within firm	0.69
4. Reduce overall corporate tax	0.48
5. Obtain funds with lower interest rate for local use	0.36

Note: Items are in a descending order, not the order in the questionnaire.  
Source: Questionnaire

**4.3.4.4 Effects of Globalization of Financial Markets to E&C firms**

The theory outlined in Chapter 3 predicted that one of the forces pushing E&C firms to operate worldwide in a coordinated way is the so-called "globalization of financial markets," or the integration of the major world financial markets. The figure below illustrates the influence of this factor on management of financial activities of the E&C firms.

It seems that the major influence has been on financial activities at headquarters rather than in subsidiaries or project offices. (Refer to Exhibit 4.3.23 below.) Expanded access to financial markets and control of multinational financial transactions at the headquarters of the E&C firms has been a major influence on them. The globalization of financial markets has provided

<sup>7</sup>. For a complete discussion for the importance of headquarters' coordination of financial transactions, see Demacopoulos (1989).

advantages for integrating financial activities at one location. The importance of the increased access for local offices to world financial markets and E&C firms' exposure to greater competition in the finance portion were supported by only a few firms. Also, the significance of the integration of major world markets was supported only moderately.

Exhibit 4.3.23 Significance of Effects of Globalization of Financial Markets on E&C Firms

Items	Scores
1. More headquarters' access to world financial market	0.50
2. More headquarters' control of worldwide financial transactions	0.24
3. Increased competitiveness of firms with well developed financial markets at home country over firms from countries with less developed financial market	0.02
4. More competition in the finance portion	-0.28
5. More local offices' access to world financial market	-0.48

Note: Items are in a descending order of scores, not the order in the questionnaire.

Source: Questionnaire

#### 4.3.5 Importance of Mergers, Acquisitions, and Cooperation<sup>8</sup>

In addition to setting up their own foreign branches or subsidiaries registered locally, firms may use mergers and acquisitions (M&A) and cooperation as means to establish local commercial presence in foreign countries. These options are usually quicker, and sometimes surer and less risky than establishing branches and subsidiaries although M&As have their own complexities, such as effectiveness of control and integration of the acquired or cooperating firms as well as accurate assessment of firms in terms of their value and expertise.

<sup>8</sup>.Cooperation refers to formal and informal, long-term alliances between firms that link aspects of their businesses but fall short of a merger of the firms.

Generally, the surveyed E&C firms seem to favor neither M&A nor cooperation as Exhibit 4.3.24 illustrates. M&A is less favored than cooperation which seems to support the theory developed here that as they globalize geographically, E&C firms will favor looser forms of cooperation over rigid forms (M&A). Also, foreign international E&C firms appear to be less favored as targets for M&A and cooperation than indigenous E&C firms.

The reasons why M&A and cooperation are not popular among E&C firms could be diverse. In addition to the general reasons addressed above, possible reasons could be that many of the E&C firms are relatively small and cannot afford to purchase foreign firms; that the competitiveness of an E&C firm lies in knowledge specific to the firm, knowledge embodied in human resources and various operational and administrative corporate systems that are difficult to transfer or integrate into others; that risks of market fluctuations prevent E&C firms from making a strong commitment to a particular market.

Exhibit 4.3.24      Importance of M&A (Mergers and Acquisitions) and Cooperations

Items	Scores
M&A of international E&C firms	-1.21
M&A of local E&C firms	-1.00
Cooperation with international E&C firms	-0.73
Cooperation with local E&C firms	-0.49

Source: Questionnaire

A close examination of individual firms' response reveals an interesting finding. Despite the low scores for the M&A option, some firms favor this option. (See Exhibit 4.3.25.)

Exhibit 4.3.25 List of E&amp;C Firms Which Favor M&amp;A or Cooperation or Both

Country	M&A of foreign E&C firms	M&A of local E&C firms	Cooperation with foreign E&C firms	Cooperation with local E&C firms
US	X		X	X
US			X	
FR	X		X	X
FR	X	X	X	X
IT	X			
IT		X		
IT			X	X
IT			X	
IT				X
IT		X	X	
IT			X	X
IT	X	X		
UK			X	
UK				X
UK		X		
UK	X	X		X
WG		X	X	X
JP				X
JP	X	X	X	X
JP			X	X
JP	X		X	X
JP				X
JP				X
HK			X	X

Source: Questionnaire

These firms are either European or Japanese; only one American firm is included. U.S. firms seem not to truly favor even long-term cooperation with foreign and local firms. This result suggests several types of global strategies. That is, when an international firm favors M&A, it may have a more fragmented and multi-domestic organization due to the difficulty of integration. In contrast, when a firm favors its own branches or subsidiaries, it may be easier to coordinate them. Thus, internal coordination may generally work well for these firms.

#### 4.4 Internal Communication

The theory proposed three basic forms of strategic positions E&C firms might adopt for their internal activities, multi-domestic, simple global, and complex global. The theory predicted that global E&C firms must have the second and third forms of organizations. This section examines degree of globalization of E&C firms from the viewpoint of communication, which sustains coordination of flow of goods, services, capital, and knowledge for the firms to be operated in a coordinated way.

##### 4.4.1 Aggregated Patterns of Communication by E&C Firms

First, communications are divided into two categories, "regular" and "as-needed". The frequencies of communication in each category are examined. The first kind of communication is associated with the formal coordinating system of a firm while the latter reflects the flexibility of the coordinating system within a firm.

Exhibit 4.4.1 illustrates the general characteristics of how E&C firms communicate internally. Although instances of communication within E&C firms on an as-needed basis appears to occur more often than regular communication, the frequency of communication is very diverse among firms on both regular and as-needed bases.

Although the densest communication appears to take place between subsidiaries and project offices in many firms, headquarters also communicate with subsidiaries in many firms. This indicates that headquarters strongly coordinated activities in subsidiaries. More importantly, headquarters directly communicate with project offices as well. This fact seems to indicate that there are



firms in which headquarters coordinate not only subsidiaries but also project offices worldwide.

Exhibit 4.4.1 Frequency of Communication by Percentage of Firms

		(Percentage)							
		none	once a year	a few times a year	once a month	once a week	twice a week	every -day	Total
Regu- lar	P.O. - HQs	3.8	1.9	5.8	46.2	17.3	15.4	9.6	100.0
	P.O. - SUB	0.0	2.0	2.0	23.5	19.5	27.5	25.5	100.0
	SUB - HQs	0.0	7.7	9.8	37.3	15.7	15.7	15.7	100.0
As- needed	P.O. - HQs	4.0	4.0	18.0	16.0	10.0	38.0	10.0	100.0
	P.O. - SUB	0.0	0.0	2.0	20.0	16.0	22.0	40.0	100.0
	SUB - HQs	0.0	2.0	16.0	18.0	18.0	28.0	18.0	100.0

Source: Questionnaire

#### National Differences

The theoretical framework suggested that degree of coordination is determined by several factors. Thus, communication may also vary by several factors. One of such factors may be nationality. For example, methods and frequency of communication may vary markedly within European, American, and Japanese firms. In Exhibit 4.4.2, the data generated here supports the difference among European, American, and Japanese for regular, but not for as-needed communications. American firms communicate on a regular basis more frequently than European and Japanese firms; the largest group of American firms communicate daily, and Europeans once a month. Japanese firms show very distinctive patterns; they communicate either once a month or twice a week. However, the overall level of regular communications within Japanese firms seems to be not frequent.

Exhibit 4.4.2 National Comparison of Frequency of Communication by Percentage of Firms

		(Percentage)							
U.S.		none	once a year	a few times a year	once a month	once a week	twice a week	every -day	Total
Regu- lar	P.O. - HQs	11.1	11.1	11.1	11.1	11.1	22.2	22.2	100.0
	P.O. - SUB	0.0	0.0	0.0	12.5	12.5	12.5	62.5	100.0
	SUB - HQs	0.0	0.0	12.5	25.0	12.5	12.5	37.5	100.0
As- needed	P.O. - HQs	11.1	11.1	11.1	11.1	22.2	22.2	11.1	100.0
	P.O. - SUB	0.0	0.0	0.0	12.5	25.0	12.5	50.0	100.0
	SUB - HQs	0.0	0.0	0.0	25.0	37.5	0.0	37.5	100.0
Europe									
Regu- lar	P.O. - HQs	3.4	0.0	3.4	44.8	20.7	17.2	10.3	100.0
	P.O. - SUB	0.0	3.4	0.0	24.1	31.0	13.8	27.6	100.0
	SUB - HQs	0.0	13.8	3.4	34.5	17.2	13.8	17.2	100.0
As- needed	P.O. - HQs	3.8	3.8	15.4	19.2	7.7	34.6	15.4	100.0
	P.O. - SUB	0.0	0.0	0.0	23.1	15.4	19.2	42.3	100.0
	SUB - HQs	0.0	3.8	15.4	15.4	23.1	26.9	15.4	100.0
Japan									
Regu- lar	P.O. - HQs	0.0	0.0	9.1	81.8	0.0	9.1	0.0	100.0
	P.O. - SUB	0.0	0.0	0.0	30.0	0.0	70.0	0.0	100.0
	SUB - HQs	0.0	0.0	10.0	60.0	10.0	20.0	0.0	100.0
As- needed	P.O. - HQs	0.0	0.0	27.3	18.2	9.1	45.5	0.0	100.0
	P.O. - SUB	0.0	0.0	0.0	10.0	20.0	40.0	30.0	100.0
	SUB - HQs	0.0	0.0	20.0	30.0	0.0	50.0	10.0	100.0

Source: Questionnaire

U.S. and European firms show a similar pattern of "as-needed" communications. Firms are quite diverse, ranging between loose communication (i.e., once a month) and dense communication (i.e., everyday). In other words, some firms communicate more frequently than others. As is the case for "regular" communications, Japanese firms again function differently, communicating twice a week or once a month.

#### 4.4.2 Types of Communications by Firms

Analysis of the frequencies and patterns of communications of individual E&C firms uncovers further interesting facts. Although patterns of communication vary from firm to firm, the surveyed E&C firms appear to be grouped into three distinctive categories as predicted by the theory.

##### (1) Hub and spoke communication

The firms in the first category seem to have "hub" and "spoke" type communication patterns. The first category may be grouped into two subcategories. In the first subcategory, headquarters communicate frequently with subsidiaries and subsidiaries communicate frequently with project offices. In the second subcategory, headquarters communicate with project offices but not with subsidiaries. Also, subsidiaries do not frequently communicate with project offices. These in the first category are listed below. (Note: Firms with extremely frequent communications among headquarters, subsidiaries, and project offices on both regular and as-needed bases are boldfaced.)

(1)-1 **Headquarters communicate with subsidiaries and subsidiaries communicate with project offices**

**9 firms**

- 2 U.S.(2 E); 2 Japanese (2 C); 1 French (1 E); 2 Italian (2 C); and 1 West German (1 C)

Note: "C" in the parentheses indicate a contractor, and "E" a engineering contractor.

(1)-2 Headquarters communicate with project offices directly but not with subsidiaries (also little communication between subsidiaries and project offices)

3 firms

- 2 Italian (1 E and 1 C); and 1 U.S. (1 C)

(2) Flexible organizations - Headquarters, subsidiaries, and project offices communicate frequently to each other

The firms in the second category appear to have flexible organizations in which headquarters, subsidiaries, and project offices all communicate with each other with equal frequency. The firms in this category are listed below.

18 firms

- 2 French (2 E), 6 Italian (1 E and 5 C); 2 U.S. (1 E and 1 C); 4 Japanese (4 C); 1 Korean (1 E); 1 West German (1 E); and 1 U.K.(1 C)

(3) Multi-domestic communication - Subsidiaries and project offices are separated from headquarters

The third kind of firms are those in which subsidiaries maintain significant autonomy; subsidiaries frequently communicate with project offices but not with headquarters, and headquarters do not frequently communicate with project offices.

3 firms

- 1 U.K. (1 E), 1 Swiss (1 E); and 1 Swedish (1 C)

The remaining firms are considered to be hybrids of the firms in the three types. Such firms are listed below.

19 firms

- 4 U.S. (2 E and 2 C); 2 Italian (2 E); 5 Japanese (1 E and 4 C); 1 French (1 E); 2 U.K. (1 E and 1 C); 1 Spanish (1 C); 2 West German (1 E and 1 C); 1 Turkish (1 C); and 1 Hong Kong (1 C)

As the theory indicated, E&C firms are categorized into three groups by patterns of communication in much the same manner as patterns of configuration and coordination of internal activities and external inputs are categorized. However, more important is that there are five firms communicating very heavily on both regular and as-needed bases and among headquarters, subsidiaries, and even project offices. Four of the five firms are categorized in "flexible communication" ((2) above) while the other one in "hub and spoke communication" ((1)-1 above) Note that all these firms are engineering contractors which are very active worldwide, executing projects in 36 countries (in 1987) and operating foreign subsidiaries in 21 countries on average. All have dispersed configuration as the large number of countries with projects and subsidiaries indicate while certain activities, such as sourcing, are integrated at headquarters in these firms. These firms, thus, seem to have very complex but flexible organizations.

It is also interesting that the firms with multi-domestic organizations (firms in (3) above) are also all engineer-contractors. Furthermore, these three firms have worldwide sourcing practices. This fact supports the argument made in the discussion of sourcing practices that engineering contractors may be divided into two rough categories, one which integrates activities at either

headquarters or subsidiaries (which probably serve as product-base headquarters) and the other having independent subsidiaries.

#### 4.4.3 Contents of Communication

Exhibit 4.4.3 demonstrates what the E&C firms communicate internally. Items 1 and 2 are concerned with pre-construction activities, Items 3 through 7 refer to activities after construction starts (Item 6 and 7 could take place in the pre-construction period as well), and Item 8 represents administrative activities which must occur regardless of the stage of a project.

Internal communication takes place in both the pre-construction and construction periods. The progress of projects and the financial positions of local firms are important topics of communication for the E&C firms, and of course, are communicated on a regular basis. However, there is also a relatively high rate of communication about procurement and technical matters; this communication supports the internal coordination of flows of goods and services as well as flows of knowledge. Also, marketing and project targeting appear to require significant horizontal coordination of proprietary knowledge. When financial packages designed at headquarters are included in the bidding process, the communication become more important.

**Exhibit 4.4.3          Contents of Communication of E&C Firms by Percentage of Firms**

Items	Scores
1. Work progress and scheduling	0.89
2. Financial positions of the site office and subsidiaries	0.65
3. Project targeting, and bidding strategy	0.53
4. Subcontracting and procurement	0.41
5. Technical matters	0.37
6. Market surveillance	0.22
7. Personnel management or recruiting	0.16
8. Foreign exchange transactions	0.11

**Note:**        Items are in a descending order of scores, not in the order in the questionnaire.

**Source:**     Questionnaire

**4.4.4            Effects of Information Technology Advances on E&C Firms**

Several sections of this chapter have examined some forces driving globalization of E&C firms. The last driving force in terms of internal coordination to be examined here is information technology. The survey clearly supports the argument that information technology enables E&C firms to exchange a large amount of information and data and eventually to integrate activities between their multinational organizational units. The largest and only positive score was given to "effective cooperation among headquarters, subsidiaries, and project offices". (See Exhibit 4.4.4.) More than 60 percent of the surveyed firms supported this item.

The second effect we may consider important (though not so significant as the first one), is local offices' access to centralized resources, e.g., engineering and design, data bases, and computer facilities centrally located at headquarters. Approximately 40 percent of the firms seem to have gained advantages from some kind of integration of knowledge and facilities.

**Exhibit 4.4.4      Effects of Communication Technology Advances by  
Percentage of Firms**

Items	Scores
1. More effective cooperation among headquarters, subsidiaries, and project offices	0.36
2. Headquarters' tighter control of local operation	0.01
3. Foreign offices' easier and more effective access to centralized resources, such as technical data	-0.07
4. Cost reduction by centrally processing all data collected from foreign offices	-0.43
5. Cost reduction by replacing intra-firm movement of human resources	-0.44

Note: Items are sorted in a descending order, not in the order of the questionnaire.

The double line separates items with positive and negative scores.

Source: Questionnaire

#### 4.5 Relationship between Internationalization and Globalization

The theory predicted that degree of internationalization may influence the need to take global strategies. More specifically, when degree of internationalization is represented by the combination of two variables, an absolute value of international revenue and a ratio of international revenue to the entire revenue of a firm, the need to take globalization may increase as the figures of the two variables increase. This section examines this theoretical prediction. Exhibit 4.5.1 plots the positions of the surveyed firms in terms of the two variables.<sup>9</sup>

<sup>9</sup>It is difficult to obtain consistent sales figures among firms because of the diversity in types of contracts and E&C firms' reporting methods for the different types of contracts. For example, a fee-based E&C contract, which is based on expected man-hours and an overhead cost plus a mark-up, such as a CM (construction management) contract, provides a much smaller sales figure than a lump-sum, unit-price, or cost-plus-fee contract. Moreover, when CM contracts include procurement, which is usually based on a cost-plus-fee basis, and contracts include the entire purchase value of procured materials and equipment, the contract value could become nearly equivalent to lump-sum contracts. Since the E&C firm usually has a portfolio of different types of contracts, the sales figure which appears in its annual report is not an accurate means of measuring how well the firm is faring in the world market. The data available in the annual



Although a significant diversity has been observed in the figure, there are, in general, three groups of firms; first, those with a medium percentage of foreign revenue but large amounts of foreign revenues (at the medium low to medium high) - Group A; second, those with a high percentage of foreign revenue but small to moderate amounts of foreign revenue (at lower right corner) - Group B; and third, those with a small amount of foreign revenues and small percentage of foreign revenues (lower left) - Group C.

Considering the characteristics of each firm we have examined so far, Group A, comprised of 10 firms, have the following characteristics: 1) They have a medium percentage of foreign revenue (- they are firms with the 10 largest international revenues of our sample -) but large amounts of foreign revenue; 2) they are engineering contractors (except for two Japanese firms)<sup>10</sup>; 3) they are geographically global, 7 firms are internally global, and 9 firms are externally global.

Group B, comprised of 10 firms, is classified by the following characteristics: 1) They have a high percentage of foreign revenue but small to moderate amounts of foreign revenue; 2) They are highly specialized, e.g., one firm in electrical work, six firms for infrastructure work, and three firms are

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survey of the international E&C firms by Engineering News Record (ENR) provides a fairly reasonable adjustment to the measurement problem although the conversion of the values in CM contracts to values of erected facilities leaves a question for equivalence of different types of contracts in terms of values vis-a-vis various risks and liabilities specific to each type of contract.

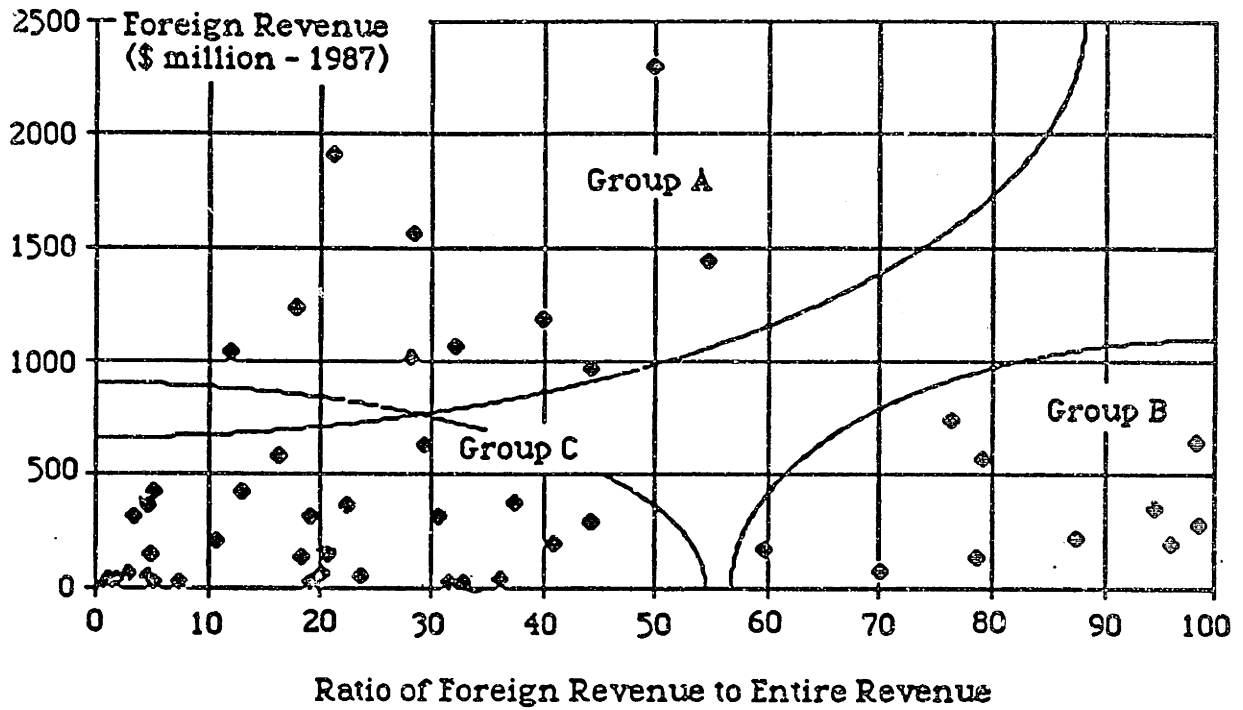
<sup>10</sup> The two Japanese firms are known for their heavy involvement in E&C projects related to real estate development. However, to what extent the values of their foreign contracts are comparable to those of other firms is subject to argument since these firms, in such a type of project, appear to assign a considerable part of management and engineering functions to either their joint venture partners or subcontractors, ... actually serves more like prime contractors.

highly specialized engineering firms; and 3) they are highly global, geographically, internally, and externally..

Group C is comprised of the remaining 32 firms. Their characteristics include: 1) Seventy-five percent of these firms are contractors; 2) they include nine out of the 11 Japanese firms. Compared to the other two groups, degree of internationalization of these firms, particularly the ratio of international revenue varies considerably. Firms positioned to the right on the map may have the characteristics more or less similar to firms in Group B while those at the upper part of the group (two firms, both engineering firms) may perhaps have the characteristics similar to firms in Group A. In contrast, the firms close to the origin are certainly not international. Generally, they have a limited degree of globalization in the three elements.

From this result, the theoretical prediction on the relationship between internationalization and globalization seems to be supported. In general, the more international firms are, the more global the firms are as well. Also, engineering contractors, especially those highly international in terms of their large international revenues, tend to be more global while highly international contractors in terms of ratio of foreign revenue are global, and they tend to be highly specialized. However, the diverse distribution, particularly in Group C, suggests that the relation is not quite clear as firms' internationalization is less significant.

Exhibit 4.5.1 Distribution of E&C Firms by Degree of Internationalization



Note: Numbers in the diagram indicates the identification numbers of the sample firms.

Source: Questionnaire

#### 4.6 Empirical Analysis of General Characteristic of Globalization of the International E&C Industry in Competitive Aspect

Porter argues that industry-specific factors are the major determinant factors of globalization of a firm. In other words, degree of globalization differs by industry. In contrast, the theory in Chapter 3 argued that factors determining globalization of firms are many and differ among the three elements of globalization; industry-specific factors are simply one kind of various factors; More importantly, because globalization of a firm is the result of an interaction between changes in the environment of a firm and its efforts to cope with the changes, the degree and ways of coping with such change vary from firm to firm. The empirical analysis so far has supported the argument of Chapter 3 that the degree and kinds of globalization vary considerably from firm to firm even in the same industry. This section examines the relationship between degree of (geographic) globalization and industry factors in order to finalize the argument above.

If E&C firms have become geographically global, they must compete face-to-face worldwide. In addition, if they compete that way, it is likely that E&C firms have an incentive to compete in a coordinated way over several geographic markets. Exhibit 4.6.1 below demonstrates the frequencies with which E&C firms encounter the same E&C firms.

A number of firms frequently encounter the same competitors. E&C firms which face the same competitors "often," "very often," or "always" account for almost 80 percent of the surveyed firms. Six percent of the firms always compete with the same other firms. This clearly indicates that many E&C firms have geographically globalized and that they compete on a worldwide basis. However,

the diversity in the distribution of the firm between "sometimes" and "always" suggests the degree of globalization varies by firm very significantly.

Exhibit 4.6.1 Percentage of E&C Firms by Frequency to Encounter the Same Competitors Over Multiple Geographic Markets

					(%)
not at all	sometimes	often	very often	always	Total
0.0	21.6	45.1	27.5	5.8	100.0

Source: Questionnaire

### Differences by Types of Firms

An examination of the data by types of the E&C firms provides a further thrust to the relationship between degree of globalization and industry-specific factors. As summarized in Exhibit 4.6.2, the frequency of encountering the same competitors varies considerably by types of firms, even within the same type of firms. Engineering contractors encounter the same competitors more frequently as more than half of their responses are either "always" or "very often". Contractors experience such competition with much less frequency, though the phenomenon is far from uncommon. Responses of nearly 80 percent of the contractors are either sometimes or often. We can conclude from this that engineering contractors have much greater incentive to adopt global strategies, while contractors have less incentive to take global strategies.

There are two possible reasons why the frequencies differ by type of firm. First is the difference in the expertise required by the segments in which each type of firm is engaged. Second is the ease with which firms may diversify between segments. For example, a heavy contractor able to manage the construction of bridges can also manage the construction of highways and dams because of the similar expertise required. However, it may not be quite as easy for an E&C firm specializing in natural gas processing plants to diversify into

polystyrene plants, because each type requires engineering knowledge and experience more specialized than build different facilities in the heavy construction segment. Also, the specialization required of engineer-contractors narrows their segment and diminishes the number of qualifying firms.

Furthermore, as we see in Appendix A, a contractors must establish a much stronger commercial presence in each foreign location than must engineering contractors; this reduces the amount of face-to-face competition under which contractors are likely to experience with the same competitors in multiple countries. Moreover, as the expertise of the E&C firms becomes more generalized and less proprietary, they tend to compete with local firms rather than with international E&C firms.

From this result, it is considered that an appropriate unit in considering globalization is not an industry but a segment, possibly by a type of final output. However, it is important to note that there is a considerable diversity in the frequency within each type of firm. This appears to indicate that firms have different levels of incentives to compete in a coordinated way even within the same segment and that degree of globalization may defer from firm to firm.

Exhibit 4.6.2: Percentage of E&C Firms by Types for Frequency to Encounter the Same Competitors

	not at all	some- times	often	very often	always	(%) Total (%)
Contractors	0.0	25.8	54.8	16.1	3.2	100.0
Engineering Contractors	0.0	15.0	30.0	45.0	10.0	100.0

Source: Questionnaire.

Differences by Nationality

An examination of the data from the viewpoint of national differences provides a further support to the argument of this study. The frequency to encounter the same competitors vary by nationality and even within the same nationality. (Refer to Exhibit 4.6.3)

While U.S. and European E&C firms encounter the same competitors with similar frequency, Japanese firms do so less frequently. Their responses to the question are concentrated in "sometimes" and "often", with "sometimes" more likely. This result seems to reflect the fact that the sample Japanese firms, which are contractors rather than engineering contractors, compete in the conventional heavy and general building segments but not in the industrial plants segment.<sup>11</sup> In the conventional heavy and general building segments, it may be more likely for the Japanese firms to compete with local firms than with international firms. Also, the result may reflect the more recent fact that they are currently active in development-related projects, often run with Japanese real investment firms, and projects from Japanese multinational manufacturing and service firms. In either case, the clients tend to nominate exclusively Japanese contractors. In this relationship, little competition, at least with foreign firms, is involved.

This result again appears to suggest that degree of globalization does not depend on industry characteristic alone.<sup>12</sup> As the Japanese example above suggests, nationality of firms seems to be also an important factor which affects degree of globalization of firms. Moreover, even within the same nationality, the degree seems to vary from firm to firm.

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11. In the case of plant construction, they often form consortia with engineering firms and general trading firms, and execute E&C activities requiring only conventional expertise, such as building the external structure and footing of a fertilizer plant.

12. Porter argues that industry globalizes due to industry characteristics. See the review of Porter's work in Chapter 2.

Considering varying degree of globalization by differences in segment and nationality and even within the same segment or nationality, we can conclude that degree of globalization differs by factors specific not only industry but segment, nationality, and each firm. It is because of the diversity in the factors affecting globalization of a firm as the theory in Chapter 3 suggested. This result also suggests that the approach of this study that appropriate unit in considering globalization is not an industry but a firm.

Exhibit 4.6.3: Percentage of E&C Firms by Nationality for Frequency to Encounter the Same Competitors

	(%)					Total (%)
	not at all	sometimes	often	very often	always	
U.S.	0.0	22.2	33.3	33.3	11.1	100.0
European	0.0	7.1	50.0	35.7	7.1	100.0
Japanese	0.0	54.5	45.5	0.0	0.0	100.0

Source: Ibid.



## 4.7 Effectiveness of Global Strategies in Promoting the International Competitiveness of E&C Firms

This research has examined a substantial part of the configuration of the internal activities and of the external inputs, and the coordination of the internal activities and external inputs of E&C firms. Varying patterns of configurations and varying degrees of coordinations among global firms, multi-domestic firms, and their hybrid firms have been uncovered. This section examines the extent to which global strategies are effective in shaping the competitiveness of E&C firms of various kinds.

### 4.7.1 Aggregated Results

As seen in the review of the existing literature on this issue, addressed, the sources of international competitiveness are typically identified as project management and engineering expertise, government subsidies, and financial packaging capability. How then might competitiveness be obtained by adopting global strategies, relative to the significance of the four previously identified sources of competitiveness?

The questionnaire asked the E&C firms to rate 31 possible sources of competitiveness for E&C firms. The 31 items are grouped roughly into three categories: Items 1 through 19 are sources of competitiveness in acquiring contracts; items 20 through 23 are concerned with execution of contracts; and items 24 through 31 involve the management of all international E&C activities. (Of course, item 20 through 31 also facilitate the acquisition of contracts.)

Exhibit 4.7.1 illustrates the aggregated result of the responses. As anticipated, project management expertise and reputation were the highest-rated items with only tiny difference between them, followed by financial packaging

capability. Project management capability is the fundamental requirement for E&C firms. The firm's reputation is also an important tool representing the entire capability of an E&C firm. The rating of reputation appears to support the argument that the "experience goods" and "one-off" characteristics of E&C services are fundamental aspects of these businesses.

It is important to note that items 24 through 28, which are concerned with the coordination of activities associated with procurement, technical matters, credit assurance, fund sourcing, and financial management by headquarters, received high scores, second only to the well-known top three items. Items 25 through 28 seem to be equally or more important than other well-known sources of competitiveness, such as general and specialized engineering capabilities (items 2 and 3); know-how of local subcontractors (item 21); and vertical integration from project management to design (item 18). Although headquarters' coordination is only one example of various types of coordination, this result indicates the importance of coordination of internal activities and outputs for the competitiveness of E&C firms.

This result has profound implications. For quite a while, it has been commonly believed that the competitiveness of an E&C firm has depended on the quality of the activities performed by its project engineers on project sites, such as project management expertise, engineering expertise, knowledge of subcontractors. However, as the E&C firm's operations begins to transcend national boundaries and as activities are allocated to foreign subsidiaries and project offices at distant and multiple locations, the nature and quality of the coordination of these dispersed activities seem to become crucial sources of competitiveness for an E&C firms. (The evidence clearly supports the earlier argument that the top management's capability to manage a wide range of

international activities is as important to the global success of an E&C firm as local project management and engineering know-how.)

Exhibit 4.7.1 Significance of Sources of International Competitiveness of E&C Firms

Items	Scores
1.Low costs	-0.98
2.Proprietary engineering knowledge	0.30
3.Generally engineering knowledge	0.22
4.Proprietary high-tech equipment	-0.19
5.Project management expertise	0.98
6.Reputation of the firm	0.98
7.Political links to market or project	0.10
8.JV with a firm having complementary expertise	0.15
9.Linkage with home design firm or consultant	-0.64
10.Linkage with home MNE clients	-0.24
11.Linkage with home financial institutions	0.00
12.Bonding capacity	0.06
13.Financial packaging capability	0.67
14.Equity participation	-0.42
15.Home government financial support	0.06
16.Exchange rate of home currency	-0.16
17.Use of home standard and code	-0.80
18.Vertical integration (design+management)	0.33
19.Vertical integration (management+operation)	0.02
20.Linkage with home subcontractors and suppliers	-0.33
21.Knowledge of local subcontractors and suppliers	0.39
22.Project office's procurement capability of local labor, materials, and equipment	0.20
23.Language and cultural similarity	-0.41
24.HQs' worldwide procurement capability	0.34
25.HQs' offering technical help	0.40
26.HQs' credit assurance in getting local funds	0.30
27.HQs' worldwide funds sourcing capability	0.46
28.HQs' worldwide financial transactions	0.20
29.HQs' centralized data processing	-0.24
30.HQs' worldwide management of information on subcontractors and suppliers	-0.15
31.M&A, and cooperation	-0.40

Source: Questionnaire.

From this perspective, the meaning of Exhibit 4.7.1, comprised of the scores given to various sources of competitiveness becomes different. For example, many

firms perform project management activities at several locations. The activities associated with only physical erection of a facility are performed at the project site (i.e., day-to-day management of labor, subcontractors, materials and equipment, technical matters, quality, and schedule). However, other activities (e.g., sourcing) are performed at headquarters. A large part of financial activities, which used to be a major activity at project offices, are also performed in headquarters. When this becomes true, a major part of project management is taken out of the hands of the project office.

Moreover, engineering, major strategic decision making, and a large part of pre-construction activities (estimates, financial packaging, production of bidding documents) may also be performed at headquarters. In the hybrid firms, these activities may be performed at regional headquarters or product-segment-based headquarters which might be located at several places on the globe. With this kind of vertically dispersed configuration of E&C activities, the coordination of the activities performed at different locations becomes an integral part of shaping each firm's competitiveness.

By the same token, reputation depends on factors other than the E&C firm's competence in project management at project sites when primary activities are disaggregated at different locations. Certain activities may be integrated at one or a few locations to serve the worldwide organization of the E&C firm. Flows of materials, equipment, subcontractors, specialized consultants, and financial capital sourced worldwide must be channelled to worldwide locations at the right moment. When this is the case, the efficiency of a firm's entire production system shapes its reputation.

Furthermore, excellence in pure engineering (items 2 and 3) may be a foundation for a firm's competitiveness, but engineering capability can only be expressed through coordination between the management of installation

activities at the project site and engineering performed at headquarters (at least, a major part of design works or basic design is done at headquarters or possibly at regional or product-base headquarters).

To recapitulate, as E&C firms become geographically global, coordination of internal activities and external inputs become more important. Moreover, such coordination becomes an integral part of the generally known sources of competitiveness. Overall, efficiency in the production system of E&C firms spanning a large geographic area shapes considerable part of their competitiveness.

#### 4.7.2 National Differences in the Sources of Competitiveness

Comparing national differences among surveyed firms of the US, Europe, and Japan provides another perspective on the international competitiveness of E&C firms. As Exhibit 4.7.2 indicates, dominant sources of competitiveness are project management capabilities and reputation of the firms regardless of national origin. High scores from firms of all nationalities for items 5 and 6 clearly demonstrate this fact. Coordinations from headquarters also seems to be important for competition for the U.S., European, and Japanese firms as the scores to item 24 through 28 indicate. This result supports the importance of coordination beyond nationality. However, worldwide procurement coordination at headquarters appears not to be important to Japanese firms (item 24). This is reflected in their general sourcing patterns, namely local sourcing by local units.

Second, U.S. firms are more management-oriented and less engineering-oriented than their European and Japanese counterparts. As the scores to items 2 through 5 indicate, U.S. firms discount both general and specialized engineering know-how as a competitive factor while European and Japanese firms seem to

perceive a competitive edge in technological excellence. Also, Europeans seem to appreciate proprietary high-tech equipment most (item 4).

Third, financial tools seem important to European and Japanese firms but not to U.S. firms (items 13 through 15). European and Japanese firms seem to gain substantial competitive edges through the creation of advantageous financial packages; European firms are most likely to enjoy subsidies from their home governments; and only Japanese firms feel that they gain competitiveness through equity participations.

Fourth, Japanese firms alone are very concerned with the competitiveness gained through favorable exchange rates, reflecting their extensive sourcing in both home and host countries and the minimum level of their worldwide sourcing inputs. This is supported by their answers to items 21 and 22 in which Japanese firms were revealed to be the most concerned with local subcontractors and suppliers. Items 9, 10, and 11 suggest that only Japanese firms seem to gain competitive advantages from linkages with home country design firms and financial institutions.

In contrast, advantages from political links to foreign countries and projects are realized most significantly by European firms as the answers to items 7 indicate. U.S. and Japanese firms perceive fewer significant competitive edges in this regard.

Exhibit 4.7.2 National Comparison of Sources of Competitiveness of E&C Firms

Items	U.S.	Europe	Japan
1.Low costs	-0.78	-0.79	-1.21
2.Proprietary engineering knowledge	-0.16	0.54	0.55
3.Generally engineering knowledge	-0.36	0.42	0.63
4.Proprietary high-tech equipment	-1.05	0.19	-0.07
5.Project management expertise	1.30	1.08	0.84
6.Reputation of the firm	1.06	1.17	0.97
7.Political links to market or project	0.23	0.50	-0.55
8.JV with a firm having complementary expertise	0.27	0.21	0.18
9.Linkage with home design firm or consultant	-0.97	-0.50	-0.35
10.Linkage with home MNE clients	0.02	-0.32	0.37
11.Linkage with home financial institutions	-0.24	0.09	0.39
12.Bonding capacity	0.22	0.21	-0.12
13.Financial packaging capability	0.19	0.87	0.84
14.Equity participation	-0.85	-0.53	0.44
15.Home government financial support	-0.57	0.48	-0.17
16.Exchange rate of home currency	-0.32	-0.27	0.48
17.Use of home standard and code	-0.74	-0.82	0.66
18.Vertical integration (design+management)	0.38	0.43	0.30
19.Vertical integration (management+operation)	-0.26	0.10	0.33
20.Linkage with home subcontractors and suppliers	-0.79	-0.04	-0.39
21.Knowledge of local subcontractors and suppliers	0.21	0.45	0.65
22.Project office's procurement capability of local labor, materials, and equipment	0.27	0.24	0.5
23.Language and cultural similarity	-0.54	-0.16	-0.68
24.HQs' worldwide procurement capability	0.42	0.45	0.10
25.HQs' offering technical help	0.70	0.46	0.45
26.HQs' credit assurance in getting local funds	0.52	0.27	0.46
27.HQs' worldwide funds sourcing capability	0.38	0.54	0.48
28.HQs' worldwide financial transactions	0.27	0.35	0.15
29.HQs' centralized data processing	0.04	-0.29	-0.22
30.HQs' worldwide management of information on subcontractors and suppliers	-0.33	-0.08	-0.06
31.M&A, and cooperation	-0.26	-0.38	-0.18

Source: Questionnaire.

### 4.7.3 Differences by Types of Firms in Sources of Competitiveness

Exhibit 4.7.3 compares sources of competitiveness by type of firm: contractors and engineering contractors. Project management expertise and reputation of the firms are again principal factors of competitiveness regardless of the type of firm. More importantly, coordinating functions appear to be important beyond type of firm as positive scores by the two types of firms for items 24 through 28 indicate, another support to the importance of coordination. However, contractors appear to perceive this factor as a competitive advantage more than engineering contractors, as the responses pertaining to coordination indicate. This result seems to reflect the facts that the headquarters of many contractors source goods and services from their home countries and that engineering contractors are quite diverse, a condition which will be analyzed at the end of this section.

In addition to the extent of coordination, there is a significant difference between the two types of firms. Contractors are also more concerned with local sourcing capability for their competitiveness than are engineering contractors (items 21 and 22). This underscores the argument in the appendix of this study that contractors require stronger local presence, which may provide firms with intensive local sourcing capability, than engineering contractors. Contractors are more anxious about financial packages and home country subsidies than engineering contractors (items 13 to 15). In contrast, contractors conceive that proprietary engineering capabilities give them less of a competitive advantage than do engineering contractors while contractors seem to consider that general engineering capability is more important (items 2 and 3).

Engineering contractors appear to consider more than contractors that vertical integration in design and project management is an important source of



competitiveness. It is probably because engineering contractors compete not only activities erecting facilities but also, and more often, in the pre-construction activities including design.

Exhibit 4.7.3 Comparison of Sources of Competitiveness of E&C Firms by Types of Firms

Items	C	E
1.Low costs	-0.97	-1.00
2.Proprietary engineering knowledge	0.18	0.48
3.Generally engineering knowledge	0.32	0.06
4.Proprietary high-tech equipment	-0.11	-0.32
5.Project management expertise	0.99	0.98
6.Reputation of the firm	0.97	1.01
7.Political links to market or project	0.02	0.20
8.J.V with a firm having complementary expertise	0.23	0.02
9.Linkage with home design firm or consultant	-0.49	-0.86
10.Linkage with home MNE clients	-0.28	-0.17
11.Linkage with home financial institutions	0.02	-0.03
12.Bonding capacity	0.16	-0.08
13.Financial packaging capability	0.71	0.62
14.Equity participation	-0.35	-0.54
15.Home government financial support	0.12	-0.03
16.Exchange rate of home currency	-0.11	-0.23
17.Use of home standard and code	-0.78	-0.83
18.Vertical integration (design+management)	0.17	0.57
19.Vertical integration (management+operation)	0.04	-0.01
20.Linkage with home subcontractors and suppliers	-0.25	-0.44
21.Knowledge of local subcontractors and suppliers	0.56	0.14
22.Project office's procurement capability of local labor, materials, and equipment	0.47	-0.20
23.Language and cultural similarity	-0.28	-0.62
24.HQs' worldwide procurement capability	0.38	0.29
25.HQs' offering technical help	0.41	0.38
26.HQs' credit assurance in getting local funds	0.50	0.00
27.HQs' worldwide funds sourcing capability	0.49	0.41
28.HQs' worldwide financial transactions	0.26	0.12
29.HQs' centralized data processing	-0.32	-0.12
30.HQs' worldwide management of information on subcontractors and suppliers	-0.12	-0.19
31.M&A, and cooperation	-0.42	-0.37

Note: "C" and "E" indicate contractors and engineering contractors respectively.

Source: Questionnaire.

#### 4.7.4 Diversity of Engineer-Contractors

Large U.S. and European engineering contractors have shown both similar and markedly different characteristics throughout this study. They are large in terms of organizational sizes and annual sales; they are quite widely diversified in geographic markets as well as in product-segments; some of their subsidiaries are engaged in different product-segments and each operates worldwide; these subsidiaries are often acquired firms. However, based on an analysis of publicly available data from these firms, U.S. companies tend to expand their internal organization abroad, or establish their own branches and subsidiaries. They also acquire firms with specific expertise, but not on the same scale as Europeans do, and they acquire U.S. firms more often. In contrast, European firms tend to acquire foreign firms with specific expertise, rather than to establish their own affiliates. Most importantly, US firms tend to be global while European are more likely to be multi-domestic in terms of the degree of coordination of internal activities.

Exhibit 4.7.4 provides a comparative view of sources of competitiveness as perceived by the top three American and European firms. The largest difference between the two groups is found in the significance attributed to coordination from headquarters and roles of local offices. (Refer to items 24 through 29 and item 21.) All three U.S. firms consider headquarters' coordination of various activities to be as important as project management expertise, reputation, and specialized engineering know-how while the European firms gave headquarters' coordination quite low scores. Instead, the European top three gave much higher scores to their local units' capability to source local subcontractors and suppliers than U.S. firms (item 21). Furthermore, the European firms appear to have gained a further competitive edge through ties with their home government in the form

of subsidies (item 15) and through political links to host countries (Item 7). Also, the European firms seem to enjoy greater advantages of vertical integration in design and project management than the U.S. firms.

Exhibit 4.7.4 Comparison of Sources of Competitiveness of Top U.S. and European Engineering Contractors

Items	Top U.S.	Top European
1. Low costs	-1.49	-1.24
2. Proprietary engineering knowledge	0.66	0.59
3. Generally engineering knowledge	-0.47	0.55
4. Proprietary high-tech equipment	-1.49	-0.94
5. Project management expertise	1.11	0.61
6. Reputation of the firm	1.11	0.82
7. Political links to market or project	0.55	0.89
8. JV with a firm having complementary expertise	0.09	0.15
9. Linkage with home design firm or consultant	-1.21	-0.65
10. Linkage with home MNE clients	-0.19	0.09
11. Linkage with home financial institutions	0.09	0.11
12. Bonding capacity	0.55	-0.16
13. Financial packaging capability	0.55	0.68
14. Equity participation	-0.65	-0.62
15. Home government financial support	-0.37	0.95
16. Exchange rate of home currency	0.09	0.11
17. Use of home standard and code	-1.49	-0.65
18. Vertical integration (design+management)	0.20	0.61
19. Vertical integration (management+operation)	-0.37	-0.67
20. Linkage with home subcontractors and suppliers	-0.65	-0.42
21. Knowledge of local subcontractors and suppliers	-0.08	0.65
22. Project office's procurement capability of local labor, materials, and equipment	-0.65	-0.08
23. Language and cultural similarity	-1.21	-0.42
24. HQs' worldwide procurement capability	1.11	-0.12
25. HQs' offering technical help	1.11	-0.12
26. HQs' credit assurance in getting local funds	1.11	0.11
27. HQs' worldwide funds sourcing capability	1.11	-0.12
28. HQs' worldwide financial transactions	1.11	-0.12
29. HQs' centralized data processing	1.11	-0.42
30. HQs' worldwide management of information on subcontractors and suppliers	0.20	-0.65
31. M&A, and cooperation	0.27	0.05

Source: Questionnaire.

Overall, U.S. engineering contractors seem to achieve efficient worldwide operations through rationalization of their E&C operations by integrating several key activities at headquarters (or product-based headquarters); headquarters seem to perform a large portion of project management and engineering for local units and to coordinate various activities at project offices and subsidiaries dispersed the world; Efficiency of the whole system significantly contributes to their competitiveness. In contrast, the European firms give their foreign subsidiaries substantial independence; project offices and subsidiaries compete on the bases of management and engineering expertise and familiarity with local factors, all embodied in human resources working at each location. Headquarters seem to coordinate a small number of activities when there is a locational advantage, such as subsidies from home-country government and political links to foreign countries.

#### 4.8 Summary of the Empirical Analysis by Questionnaire

Analysis of the questionnaire results have supported a large part of the globalization theory proposed in the previous chapter. However, the results have also suggested several practical implications for implementing global strategies. The results are summarized below.

##### Degree and Mechanism of Geographical Globalization of E&C Firms

The questionnaire results have shown that at least 80 percent of the surveyed firms are geographically global. The firms which are considered not quite geographically global are contractors and have small international revenues (i.e., less than \$200 million a year). Also, a linear relation was found between the number of countries and the number of major markets in which firms undertake projects. Thus, the firms concentrating in small numbers of countries, a few major markets, or having small international revenues may not likely to be truly geographically global.

From the result, it is generally said that the more geographically a firm globalizes, the more dispersed configuration of internal activities the firm has. It is because whenever an E&C firm engages in a project, it must perform certain activities, such as project management, at each project location. However, degree of dispersion depends on what activities a firm executes at a project location.

Information from the surveyed firms demonstrated the accuracy of the theory in predicting the mechanisms for becoming geographically globalized. E&C firms must develop and maintain geographical markets for growth, profitability, or survival by appropriating their proprietary E&C knowledge (or more practically, by maximizing the use of their internal human resources, capital assets, and corporate systems) just as manufacturing firms must keep

selling their products in a wide geographic area. The size of the international market an E&C firm must develop or maintain depends on the balance between the size of its internal resources and the size of demand in the firm's chosen market segment. In other words, when demand in the market in which a firm is operating is insufficient for the firm to grow (aggressive geographic globalization) or survive (defensive geographic globalization), it must expand its foreign market.

Other factors driving E&C firms to foreign expansion, such as linkages with multinational clients, movement of domestic competitors abroad, and worldwide linkage of financial markets are supported only moderately by the data. However, these factors vary widely among firms, particularly they are strong factors for Japanese and several American firms. Also, certain advantages which might be obtained from global strategies, such as risk diversification and benefits of coordination, were not seen to be important by the surveyed firms. In other words, firms do not expand geographically in order to gain the benefits of global strategies; these benefits are realized after firms expand their markets fully.

#### Relationship between Internationalization and Globalization

Highly international engineering contractors in terms of a large international revenue and specialized firms in terms of high ratios of international revenue tend to be more global. Thus, the results have confirmed that the more international firms are, the more global they are. However, when the degree of internationalization is small, degree of globalization is more likely to vary from firm to firm. Less international firms seem to realize the benefits of global strategies to a more limited extent.

### General Characteristic of Globalization of E&C Firm

Contrary to the conventional view of construction that management, operation, and competition in the E&C industry are based on local or multi-domestic factors, quite a few of the internationally active E&C firms seem to operate and compete through coordinating internal activities and external inputs. The study has shown that three out of the four kinds of coordination of internal activities (e.g., coordinations associated with horizontal diversification, dispersion of vertically integrated activities, and proprietary knowledge) proposed in the theoretical framework seem to be performed by the surveyed E&C firms. Thus, they are internally global. Also, quite a few firms seem to coordinate inputs. More precisely, they coordinate goods, services, capital, and information worldwide within their organizations. They coordinate inputs sourced at wide-spread locations in the external markets and coordinate flows of these inputs into E&C services on a worldwide scale. In so doing, many international E&C firms have become externally global.

Moreover, the study has identified varying levels of globalization and types of global firms, as well as various multi-domestic firms as the theory predicted. The analysis has also shown the various factors which determine the practical ways in which E&C firms operate in the spectrum between global and multi-domestic strategic positions.

### Configuration and Coordination of Internal Activities

The data have generally confirmed that there are many E&C firms in which the sourcing function, one of the most important and integral functions of the E&C firm, has been detached from project offices and placed at headquarters or foreign subsidiaries. In general, the role of headquarters in sourcing is more significant than the role of the project office. In half of the surveyed firms,

headquarters play a major role in sourcing. Headquarters of some firms even source bulk materials and unskilled labor which are usually sourced locally; subsidiaries primarily perform sourcing activities in eight firms; in only three firms do project offices primarily perform sourcing activities; and in 15 firms, there is a very complex mix of various organizations performing sourcing activities. It may be assumed that many of the surveyed firms require significant coordination due to the dispersion of vertically integrated structure of value-chains of firms, at least when sourcing is headquarters-driven and when a sourcing pattern is very complex. It is important to note that no pattern of configuration of sourcing activities is exclusive to any nationality and types of firms, though headquarters tends to play the most significant role in sourcing in Italian firms.

#### Configuration and Coordination of External Inputs

Two dominant configurations of inputs for E&C firms reflect sourcing either worldwide or from home countries. The firms having either of these two patterns of configuration account for 80 percent of the surveyed firms. Most of the large engineering contractors source worldwide. (Sixty percent of all surveyed engineering contractors source worldwide). Home country sourcing is found most notably in Italian and Japanese firms. All Italian firms surveyed have this sourcing pattern. Also, only three firms source only locally.

Because both worldwide sourcing and home country sourcing require a high level of coordination for the flows of goods and services, it may be assumed that the level of coordination of external inputs is very high in at least 80 percent of the surveyed E&C firms. However, firms with highest degree of coordination of external inputs are all engineering firms.



### Configuration and Coordination of Financial Activities

The role of headquarters in financial activities is even more significant than sourcing goods and services in many E&C firms. Again, the role of project offices is small, limited to the day-to-day financial transactions associated with locally sourced inputs. Headquarters perform most of the pre-construction financial activities (e.g., financial packaging), sourcing funds, managing foreign exchange, making almost all the major decisions, and even overseeing financial activities taking place after construction starts. Coordination associated with financial activities is clearly very significant in many E&C firms.

### Communication

Communication patterns are essential to how configured activities are coordinated. The patterns are diverse ranging from very heavy to very light communications on both regular and as-needed bases. On a regular basis, American firms communicate more frequently than European and Japanese firms. However, Americans and Europeans do not differ greatly in frequency of as-needed communications, though both share a range of frequency, from heavy to light communications. Japanese firms seem to produce fewer have less communications than do their American and European counterparts.

Patterns of communication imply three patterns of organization: the hub and spoke (headquarter-centered), flexible (complex and multi-direction), and multi-domestic (autonomous around a subsidiary). Many E&C firms fall into either the hub or flexible type of organization. This is another indirect proof that many E&C firms become global through internal coordination. The five firms having very heavy communications were large engineering contractors. These firms appear to perform significant coordination in multiple directions.

### Globalization of E&C Industry in Competitive Aspects

Many E&C firms responding to the questionnaire encounter the same competitors quite often but a varying frequency. Degree of (geographic) globalization measured by the frequency seems to be determined by various factors, such as nationality or characteristics of the segment in which a firm compete. Industry characteristics may not be an appropriate unit in considering globalization.

### Sources of International Competitiveness of the Global Firm

The analysis of sources of competitiveness has provided another proof that many E&C firms are global. Headquarters' coordination seem to be a significant source of competitiveness for many E&C firms. For them, coordination from headquarters is as important as the well known traditional sources of competitiveness for E&C firms, e.g., the project management expertise embodied in human resources and executed at each project location. However, in the modern E&C firms, project management expertise is disaggregated into several activities. Then, a global firm's worldwide E&C activities form a single system. For a global firm, therefore, how the system works effectively to serve its worldwide operations is a very important source of competitiveness. In contrast, the competitiveness of multi-domestic firms is determined by the expertise embodied in human resources at each location of project or subsidiary.

Many U.S. and European firms may be considered to be global in the respects addressed above. Also, the largest U.S. engineering contractors appear to be typical global firms while the largest European engineering contractors are typically multi-domestic firms in terms of coordination of internal activities. However, both are externally global. In contrast, Japanese firms are global externally but not internally and externally.

#### 4.9 Issues to Be Examined in the Case Studies

The part of the theoretical framework to which the questionnaire did not speak, and the issues for which the questionnaire analysis suggested the need for further investigation are examined in the case studies. They are as following:

1. The fourth kind of coordination of internal activities, coordination associated with product diversification, has not been presented. This coordination seems to be the most sophisticated and complex of the four, and it is the most difficult to measure on a questionnaire.
2. The questionnaire analysis does not explain certain factors that may affect patterns of configuration of activities, such as government regulations, regional economic pacts, and historical management style, factors that may affect configuration and coordination of inputs, such as comparative advantages, oligopolistic competition, and bilateral relationships between countries.
3. The questionnaire analysis has not provided insights into the implementation of global strategies, especially for surmounting the difficulties for implementing a simple global strategy (headquarter-driven) and complex global strategy (with more dispersed configuration).
4. The practical patterns of the transformation of the E&C firm from multi-domestic or national to global firms have not been presented. Since a change in strategy always requires a significant amount of adjustment in organization, management, and various corporate systems, there might be certain paths which an E&C firm must follow through to transform itself into a global firm. Particularly, it is interesting to know what triggers a firm to adopt a global strategy (not becoming geographically global).

## CHAPTER 5

### EMPIRICAL STUDIES BY CASES

Chapter 4 explored empirically the patterns predicted by the theoretical framework of globalization of E&C firms. This chapter uses case studies to examine the issues that the questionnaire data of Chapter 4 could not measure. These issues include the coordination associated with product diversification; some additional factors affecting concentration and dispersion of activities (i.e., government regulations, regional economic pacts, and behavioral factors such as historical management tradition); and some of the more complex factors affecting configuration and coordination of inputs (i.e., comparative advantages, trade barriers, oligopolistic competition, and bilateral relationships between countries). The cases also explore how different global strategies have been implemented.

The cases are based on interviews of top executives of nine firms and managers of the international departments of two firms as well as on publicly available data. Four cases are examined intensively as major cases and the remaining seven are used to complement the points which the four major cases do not cover adequately. These cases are listed below. The twelve cases cover firms from six nations and all different types of E&C firms.

#### Major Cases

Case A: Firm A (West Germany)	Case B: Firm B (U.S.)
Case C: Firm C (U.K.)	Case D: Firm D (Japan)

#### Complementary Cases

Case E: Firm E (U.K.)	Case F: Firm F (Italy)
Case G: Firm G (Italy)	Case H: Firm H (Italy)

Case I: Firm I (Italy)

Case J: Firm J (Korea)

Case K: Firm K (Korea)

Case A describes a West German engineering contractor. (Each firm in which executives or managers were interviewed is referred to by an identifying letter, such as Firm "A" in the first case.) The case demonstrates geographic globalization through proprietary process technology. Although proprietary technology implies a simple global strategy in theory, the case shows that the firm's strategy is actually closer to a complex global strategy. The case also shows requirements and difficulties for implementing a simple global strategy.

Case B presents a U.S. engineering contractor which is diversified into multiple segments. This case shows extensively the coordination associated with product diversification. It also presents Firm B's formulation and implementation of a complex global strategy.

Case C illustrates the implementation of a multi-domestic strategy by a diversified U.K. engineering contractor. The case also shows the relationship among acquisition of firms, geographic expansion, product diversification, and types of strategy. It also addresses how various factors affect types of configuration and coordination of internal activities, such as the tradition of management style, organizational structure, oligopolistic competition, and differences in market segments.

Case D describes a Japanese contractor. The case presents, through the transformation of the firm, the difficulty of competing on the basis of a pure multi-domestic strategy. The case also reveals factors which commonly affect the strategies Japanese contractors encounter in finding an effective global strategy, such as the historical development of management style in a firm, or a segment of

a firm. The case also illustrates part of the reason for the strong proclivity of Japanese firms to source goods from Japan.

Complementary cases demonstrate additional factors and issues arising connected with the implementation of a global strategy. These include factors affecting configuration and coordination of activities (e.g., the effect of regional economic pacts, especially the European economic unification of 1992), government regulations, (especially in developed countries), and behavioral factors (e.g., management tradition). The cases also explore those factors, which affect configuration and coordination of inputs, such as comparative advantages (i.e., Korean firms' cheap labor and materials) and trade barriers (especially those in developed countries). Issues crucial to implementing global strategies include the relationship between an E&C firm and its parent firm; the effects of fluctuations in demand (especially contraction) as a trigger to change strategy and structure; relationship among specialization, diversification, and global strategy; the industrial structure of construction industry (particularly in relation to Italian firms); development of a firm to a level at which its managers may perceive the benefits of global strategies; and top management's ability and perceptiveness.

### 5.1 Case A - Firm A, a West German Engineering Contractor

Case A provides a good example of a firm geographically globalizing on the basis of proprietary knowledge. As predicted in theory, Firm A, possessing proprietary process technology, has adopted a strategy close to a simple global strategy. The case shows both the efforts required and the difficulties in implementing the simple global strategy. Change and fluctuation in demand force the specialized, proprietary firm to diversify in proprietary knowledge. Also, serving worldwide markets requires flexibility in many respects, such as procurement, ways of establishing a local presence, and project formation.

#### Outline of the Firm

Firm A is a subsidiary of a large German conglomerate. The annual revenue of the parent firm reached approximately \$7 billion in 1987. The parent firm has diversified into three major sectors, raw materials (i.e., trading and production of raw materials), chemicals, and plant engineering and contracting (Firm A). The raw materials sector accounted for 65-70 percent of the entire revenue of the parent firm, the chemical sector 8.5 to 9.1 percent, and E&C (in Firm A) 9.5 to 10.5 percent, which was approximately \$700-750 million, in the period between 1985 and 1987. The remaining 15 percent of the total business is made up of a number of less salient sectors.

Firm A was started at the beginning of this century. The parent firm traded various metals to clients, some of the whom also needed special engineering technology for processing the purchased metals. Firm A began as a metallurgy division of its parent company. In 1919 Firm A was established as an independent firm providing engineering in metallurgy. However, since then, Firm A has continued to expand its expertise in various process technologies by spawning

further independent firms with different types of expertise. In the early 1980s, the firms merged into one.

### Expertise and Markets

Firm A now specializes in engineering design and construction of complete turn-key plants, plant units, and equipment in 19 different segments.<sup>1</sup> Currently, the leading segment of Firm A is environmental control processes, particularly the so-called "circulating fluid bed combustion systems"<sup>2</sup> for power stations. The segment accounts for over half of total sales, and has become increasingly important segment.

The largest competitive advantage of Firm A comes from its engineering expertise represented by some 200 proprietary processes which it has developed. Firm A also complements its own processes by another 300 processes developed elsewhere. It maintains 500 research and development engineers at an R&D center close to its headquarters. The center develops and licenses processes and related equipment, tests raw materials and products to determine their usability and potential of commercialization, and finds the most efficient ways of utilizing

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1. They include beneficiation, roasting and calcining, inorganic chemical, fertilizer, electrochemical, non-ferrous metallurgy, ferrous metallurgy, upgrading of solid fuel, circulating fluid bed combustion and gasification, gas production, gas conditioning, hydrocarbon, petrochemistry and synthesis, fibres, environmental protection, air pollution control, waste water and products, special separation, edible oil and fat.

2. Circulating fluid bed combustion refers to the environmentally acceptable combustion of solid and liquid fuels. It is characterized by a firing system which offers built-in pollution control but also maximum fuel and sorbent flexibility; combustion of low-grade fuels such as high-sulfur coal, high-ash coal, lignite, anthracite culm, oil shale, coal upgrading residues, bark, peat, wood wastes, sulfite liquor, cow manure, etc. with high carbon burnout and minimum fuel preparation requirements; use of limestone, lime, dolomite or oil shale for desulfurization; suitability for all boiler systems, e.g., natural or forced parameters and excellent part-load behavior; generation of steam, electricity and process head; and production of an ecologically harmless ash, which can be dumped or used in the building industry. (Source: a corporate brochure of Firm A)



them and applies the results to industrial practices. On average, it spends approximately \$25 million annually, about 3 percent of its revenue, on R&D.

To sell its process engineering know-how through engineering design, it provides all comprehensive services related to process engineering. Such services typically include feasibility studies, plant proposals, procurement, quality control, expediting, erection and start-up, guarantee testing, and training of the clients' personnel. It provides its technology in various forms, including consulting, design, licensing, and management of construction in a separate contract, as well as everything in a package in a turn-key contract. Since Firm A recognizes that its true competitiveness exists in its pure engineering knowledge, it provides construction management services only if clients require or if combining design and management will ensure that its technology will be utilized appropriately. An executive of Firm A asserted that "It is very likely that our company forms a consortium with Bechtel or Fluor, which is more like a management-oriented firm and has the ability to mobilize labor on a large scale. Our company provides supervision of engineering while Bechtel provides management of construction."

Firm A also provides financing for industrial projects in cooperation with the countertrade specialists of its parent firm, help clients market their products, and develops overall plant concepts, taking everything into account, from conceptualization of a plant to building and operating it to selling the products produced in the plant.

Utilizing its proprietary process technology, Firm A is active in 50 countries, including the U.S. and Canada in North America, 7 countries in Latin America, 14 in Europe, 2 in the Middle East, 12 in Asia, and 4 in Africa. Pertaining to its historical development in foreign markets, its executive asserts, "It is not an issue of development but an issue of demand. For example, when there is a

problem of special beneficiation of iron ore, we are in demand. It is because we have established our reputation so firmly and worldwide for various process technologies. However, I would like to emphasize that we have developed processes according to the demand in world markets and our marketing emphasis has always been changing." Because of the recent, strong demand in pollution control systems, more than a half of Firm A's revenue comes from western industrial countries, where the regulation of pollution have become increasingly stringent.

Firm A's major competitors vary from segment to segment. However, those competing face to face on a worldwide basis include Davy-McKee (a U.S. subsidiary of Davy Corp. of U.K.), Linde AG (a division of TVT of West Germany), Toyo Engineering (Japan), and Chiyoda Chemical Corp. (Japan).

#### Configuration and Coordination of Internal Activities

Firm A has a significant concentration of activities at its headquarters. About 3,500 out of the its 4,300 employees (engineering and administrative staff) work at its headquarters. The new building complex built in 1987 has brought geographically scattered activities into one location. Also, approximately 500 of the 3,500 employees work at its R&D center, located close to its headquarters.

At the headquarters, Firm A has three major operating divisions, 1) energy and environmental technology; 2) gas and hydrocarbon technology; and 3) chemistry, metallurgy, and general contracting. Based on the types of process technology, the three operating divisions consist of the 19 different segments mentioned earlier. Each of the three operating divisions serves as a profit center. The three operating divisions are assisted by various functional service departments also located centrally in the headquarters.

Firm A has developed a simple global strategy for internal activities, and exports know-how from headquarters where most activities are concentrated. The firm is internationally active but not multinationally organized, and is not physical-construction-oriented. The strategy allows it to worry less about local factors and to take advantage of its competitiveness in proprietary knowledge.

The concentration of activities at headquarters provides Firm A with the following advantages. First, it provides an opportunity to make maximum use of its limited human resources for multiple projects in pre-construction activities (feasibility study, financing, schematic planning, etc.), which are generally common to many segments. (This is one aspect of the fourth coordination, that associated with product diversification.) Also, it allows the same engineer to work on multiple projects because it competes in terms of engineering hours, which are called an "indicator of competitiveness". Dispatching many engineers exclusively for particular projects may lower its cost-competitiveness.

Second, it allows central coordination of worldwide flows of knowledge. The headquarters not only coordinates the flow of its own proprietary knowledge but other expertise as well so that the flow delivers the best selection and best mix of knowledge for the varying requirements of each project.

Third, the firm facilitates coordination between design and procurement and between design and R&D which have their close relationships. The design of each facility determines what should be procured; the best design requires the latest technology to be incorporated in the planned facility and the design process provides hints for the development of new processes, and the refinement of existing processes.

Fourth, the firm deals with increasingly complex engineering demands by integrating several different kinds of engineering expertise into comprehensive

packages. (This is another aspect of the coordination associated with product diversification.)

Fifth, proximity to its parent firm - a result of concentration - enables Firm A to take advantage of relations with its parent company in financing, as mentioned above, and marketing (i.e., the parent firm's trading of chemical and mineral products provides very fast and accurate information on demand and technical problems for clients producing chemical and metal products).

Sixth, concentration of activities make management of risks associated with foreign exchange and technology easier. Foreign exchange management is assisted by its parent firm which possesses sophisticated foreign exchange management know-how accumulated through the trading of various mineral and chemical materials. Management of technology risks is particularly important to Firm A, because it guarantees not only its engineering but also the technologies on which it holds patents. An executive notes, "Many other European and American engineering firms purchase patents for certain processes, and design and construct plants by using them, but they guarantee only the performance of their engineering works, not the process itself. If the plant does not work as we promised to our clients, we will go bankrupt. Our risk is certainly much higher than theirs. To manage the risk, headquarters must centrally watch what happens in the plants designed and constructed worldwide by us."

Last, and related to the fifth point, in addition to coordinating the worldwide flow of new technology developed at its R&D center, the firm, by concentrating activities, is able to collect and digest the feed-back of engineering know-how as plants begin to operate. Such refinement is practically as important as developing a new process technology. The refinement of existing technology allows Firm A to remain technologically competitive and it also enables it to identify new segments in which it can be a technological leader in the future.

Firm A gives its clients the latest technology and know-how in exchange for, under contractual agreements, feed-back on how well it is working. An annual meeting is held with clients to exchange market and technological information with its clients at several locations in the world.

In contrast to the centrally concentrated activities, Firm A has subsidiaries located at 23 largest cities worldwide. These subsidiaries perform marketing and procurement activities coordinated by headquarters. A small engineering staff is maintained only in the subsidiaries located in major markets. Each subsidiary cooperates with headquarters for project surveillance and targeting, and procures materials and equipment sourced in the country for projects located worldwide. It is also important to note that Firm A maintains, in addition to the 23 major subsidiaries, cooperative relations with certain foreign firms, and representative offices and agents at other countries. These loosely associated organizations are linked to headquarters in much the same way its subsidiaries are linked, and they basically perform the same activities as subsidiaries if needed. Therefore, the network of Firm A is much larger than that represented in its subsidiary-network.

#### Configuration and Coordination of External Inputs

The organizational and engineering practices of Firm A enables each project to be conducted on a flexible and individual basis. Since Firm A is not dependent on affiliate manufacturing firms producing materials and equipment, it is free to select the most suitable manufacturers in terms of quality, reliability, and financing terms, including those in the client's country and third countries. The configuration of inputs is dispersed truly worldwide. The firm ships materials and equipment sourced worldwide to project sites also located worldwide. As mentioned above, its worldwide network of subsidiaries, cooperating firms,

representative offices, and agents source goods and services available within their territories and ship them to projects in other parts of the world under the coordination of the headquarters.

### Flexibility of International Involvement

Firm A is flexible in the contractual forms in which it engages, in addition to the types of activities it performs in each project and the way in which it sources materials and equipment. The firm may provide its know-how through an engineering design, a license, consultancy, or project management, depending on the requirements of a client and the degree of technological difficulty involved. Also, while basic engineering may be performed at headquarters, detailed design could be done either by a foreign subsidiary, joint venture partner, or other associate.

Flexibility certainly affects the configuration of the firm's activities, particularly insofar as it helps the firm serve world markets through the concentrated activities. For one thing, it enables the firm to adjust to fluctuations in demand in a particular country. For example, for the configuration of engineering activities, the firm may license a certain process technology to a local engineering firm instead of maintaining its own engineering staff in the country; Firm A has recently restructured its activities in the U.S. in this way. As the total volume of business in the U.S. remained too small to justify the existence of an engineering subsidiary, the firm has transferred its successful business in power plants based on the circulating fluid bed to a U.S. power engineering firm. In so doing, it reduced its work force in the U.S. by 130 personnel, who have been taken on by the U.S. power engineering firm. Firm A continues to supply the basic engineering and receives commensurate royalties. Its presence in the U.S.

is maintained through a marketing office. Contracts in other sectors in the U.S. are handled in cooperation with suitable partners.

Because of its ability to generate new proprietary processes, to specialize in pure engineering rather than management of physical production, and to act on advantages stemming from its flexibility, the firm does not favor acquisitions of local firms. Organizational flexibility in conjunction with the concentration of activities provides Firm A with a significant hedge against the risk of fluctuations in demand.

## 5.2 Case B - Firm B, a U.S. Engineering Contractor

Among the interviewed firms, Firm B is the only E&C firm which strongly recognized the importance of a global strategy and executed a corporate-wide effort to formulate and implement its own one. This case illustrates why Firm B needed to adopt a global strategy and how it has been formulated and will soon be implemented. It is particularly important to note that Firm B configures its activities from a global perspectives. The configuration provides Firm B with firm-specific knowledge to be coordinated activities in across segments and geography.

### Overview of Firm B

Firm B, a subsidiary of a large industrial firm, is a large U.S. engineering-contractor specializing in design, engineering, and construction of facilities in several industries. Its markets are segmented into manufacturing and process (e.g., pulp and paper, manufacturing, and minerals and metal industries), power, petroleum and chemical, heavy civil (e.g., water resources, transportation, flood control, environmental, port and harbor), and oil and gas.

### Issues Which Faced Firm B

In the mid 1980s, Firm B simultaneously confronted several problems crucial to its parent. Six problems were identified:

1. Both Firm B and its parent were committed to the energy industry that the group was vulnerable to fluctuations in the industry. The slow-down of the energy industry in the early to mid-1980s significantly hurt the performance of the group. Moreover, the entire world industrial sector, including that of



the U.S., slowed down in the period. Other large engineering contractors had similar problems and were forced to downsize their organizations.

2. Only the marine sector in Firm B acquired projects worldwide on a continual basis. Other sectors, too, had international projects but in a sporadic way.
3. Each segment within Firm B was managed with a high degree of autonomy.
4. Firm B was considered less competitive than "global players" (i.e., competitors competing worldwide in a coordinated way). There was an increasing fear that these global players might dictate the markets in which Firm B operates and that they eliminate Firm B eventually.
5. Scarcity of projects became significant in many segments both in the international and the domestic markets.
6. Performance deteriorated due to the five reasons cited above.

Firm B had to become more diversified in segments and geography, and much more flexible, competitive, and profitable firm. Formulating and implementing a global strategy was considered to be a key to achieve the goal of Firm B.

#### Global Strategy Formulation

Firm B's global strategy has three specific aspects, as listed below. It is particularly important to note that Firm B recognized that the coordination across different product segments was a major issue.

1. Three sectors leading Firm B's global expansion were identified as marine, chemical and petroleum, and heavy civil engineering. The three sectors were expected to resolve the concentration problem and seek worldwide operation, which at that time was limited to the marine sector.

2. Each identified sector is headed worldwide by one person who exerts leadership from a particular location on the globe, based on the scope of geographic market and activities for the sector.
3. Activities are coordinated worldwide within each and across the three sectors. The coordination is focused primarily on project development activities, particularly financing projects. Such coordination not only enables Firm B to increase its competitiveness and enhances opportunities to acquire projects but also helps it develop projects by itself.

### Implementation of Global Strategy

Implementation of the global strategy adopted by Firm B is four-fold, including acquisition of foreign firms; viewing each country from global perspective; reinforcing the project development division by emphasizing the role of project development division and establishing a finance division; and enhancing its communication capability. Each implementation is illustrated below.

### Acquisition of two Foreign Firms

Two major acquisitions were made as part of the implementation of the global strategy. First, Firm B acquired a large European civil engineering firms specializing in water supply and resources. Seventy percent of its contracts are from outside the home country. The acquisition of the firm provides the Firm B with an inroad to the European market. Also, Firm B's engineering department in Europe merged with an European firm specialized in machinery design and production.

The first acquisition was aimed to broaden the foothold for the worldwide operation of the heavy civil sector while the second one upgraded the firm's level

of technological expertise, particularly for the marine sector. Both acquisitions expanded Firm B's geographic market by integrating the market already captured by acquired firms. Furthermore, it was expected that the two acquired firms would facilitate access to the European markets. Moreover, as one executive said, "putting on one country in Europe, we can get access to the countries to which we cannot reach from the U.S., commercially, politically, and financially."

### Global View of a Country

The most crucial element in implementing project development is to evaluate a country systematically not only as a market for projects within the country but also as a potential source of products, people, and funding. A comprehensive evaluation of a country will include consideration of any bilateral or trilateral agreements it may have with other countries in a wide range of aspects, such as economic, commercial, political, religious, financial, linguistic, cultural, or political. Firm B studies all information about each country provided by local and U.S. banks, ministries, consultants, and people familiar with the country. Then, it decides whether it is worthwhile to have a committed presence in the country.

This enables Firm B to source goods, labor, internal engineers, subcontractors, joint venture partners, and financing organizations for a project in a particular third country. The firm also acquires projects in third countries by taking advantage of the relationships between each target country and the country in which the firm already has a committed presence. Furthermore, all the three identified segments of the firm share the bilateral and trilateral relationships between countries. Thus, the meaning of configuration of activities is quite different for Firm B. It is shaped not only by the hope of obtain projects in each country in which the firm has a presence but also by strategic decisions

to utilize goods, services, labor, capital, and access from the countries in which it has an established presence to third countries. Moreover, learning about the bilateral or trilateral paths for goods, services, capital, and access becomes valuable knowledge specific to Firm B; this knowledge is, in a coordinated way, exchanged and shared among its units at all geographic locations and segments.

### Project development

Firm B fortified its project development division by creating project development and finance (PDF) divisions. The two divisions work closely to make maximum use of the identified bilateral or trilateral relationships between countries for developing a project.

A key issue for project development is how effectively the division can coordinate information between local units and the central office in order to nurse an identified business opportunity into a full-fledged project. The primary means for project development are the use of the firm's communication network, which is addressed later, and the specialized personnel going back and forth between a country with a possible business opportunity and the headquarters.

A major role of the PDF division is to develop optimal financing for each project. The PDF division analyzes a project by evaluating financial packages available through bilateral and trilateral linkages between countries. Such financial packages include discovering how to enhance the value of a facility to generate more money for the client. The global view of a country plays an important role in PDF, too. PDF investigates for all possible ways of financing a project, both inside and outside the country. Financing might include a bilateral agreement or barter trade between countries, e.g., the U.K. and India, and Iraq and Brazil. It could involve export credit from a certain country for a project in a

third country with which it maintains a good relationships. The firm also could hire a Russian-speaking Hungarian engineer for a project in U.S.S.R.

### Information Network

Firm B established a worldwide networking system to coordinate E&C activities across geographic regions. The system is composed of computers (main and personal), CAD (Computer Aided Design) facilities, and plotters. The system is connected by telephone lines and satellites. Through the system, Firm B can internally exchange messages, documents, drawings, and data worldwide. Organizational units located at different parts of the world share softwares installed in the mainframe computer at its headquarters. These units also provide various inputs (e.g., information for goods and services to be sourced, projects, and customers) for the use of other units. Thereby, large operating centers, such as those in the U.S., Europe, the Middle East, and Asua, are tightly connected.

### 5.3 Case C - Firm C, a British Engineering Contractor

This case illustrates the factors which forced Firm C to adopt a multi-domestic strategy and how it affects the way the firm manages its worldwide operation. The factors include the competitive and technological characteristics of the segments in which the firm engages, the extent to which its knowledge is proprietary, the type of knowledge the firm possesses, historical style of management, its nationality, and how it favors acquisitions of firms to obtain different technological expertise or access to a specific market. As the case will demonstrate, these factors are mutually related in a very complex way.

#### General View of the Firm

Firm C is a subsidiary of a large British building and transportation conglomerate. The conglomerate parent firm, with the group revenue of approximately \$4.4 billion in 1988, is a very diversified firm, comprised of more than 130 subsidiary firms. Many of these joined the conglomerate through acquisitions. The parent firm engages in four major sectors, construction and engineering, commercial and residential property development, passenger and cargo shipping and hotel operation, and oil and gas.

The construction and engineering sector is the largest in the group, accounting for a little more than a half of its revenue and approximately 20% of profits in 1988. The sector is comprised of four major segments, 1) building and civil engineering (for general building and civil works primarily in the U.K. plus a small amount of work in the U.S. and Hong Kong through acquired local firms); 2) offshore and structural engineering (for off-shore steel structure construction in both the U.K. and overseas); 3) overseas (for works primarily in Africa through partly acquired local firms); and 4) process plants provided exclusively by Firm C, which was acquired by the current conglomerate parent in 1986. (The

segments of Firm C are mixed by those based on industry segments and those based on group firms.)

#### Historical Development of the Firm

Firm C, founded in the early 19th century, has its roots in the most dynamic period of the Industrial Revolution in the U.K. as an engineering firm for the construction of a nationwide railway network. The firm entered process engineering and construction for oil refineries in the late 1940s. The firm was, by the mid-1950s, able to provide comprehensive engineering and construction service to overseas clients. In the late 1970s, the firm acquired a U.S. chemical engineering firm, which not only complemented Firm C's oil refinery expertise but also added a foundation for expanding markets in the U.S. and Continental Europe through its subsidiaries.

#### Organization, Expertise and Market

In terms of organization and expertise, Firm C *per se* has a structure quite as diversified and complicated as its parent has. Firm C owns over 20 subsidiary firms in five sectors; four of the five sectors include U.K. and non-U.K. manufacturing firms, such as a firm producing tunnel boring machines in the U.K. and a firm producing turbines in the U.S.

Eliminating the four manufacturing sectors, Firm C is basically a combination of two firms, the original body of Firm C specializing in E&C for oil refinery plants and the acquired U.S. firm specializing in E&C for chemical plants. Under a holding company which serves as the headquarters, Firm C operates three major subsidiaries at five operating centers. The first major subsidiary has two operating centers in the U.S., in Connecticut and Texas; the second major subsidiary has two operating centers in the U.K., at London and Portsmouth; and the third major subsidiary itself is a fifth operating center

located in the Netherlands. The two operating center in the U.S. were created by combining the acquired U.S. firm and Firm C's U.S. office which existed before the acquisition of the U.S. firm. The operating center in Portsmouth is primarily the successor to the Portsmouth office of the acquired U.S. firm. The operating center in Netherlands used to be the subsidiary of the acquired U.S. firm.

Because of the difference in expertise of the original Firm C and the acquired U.S. firm, the expertise and role of each operating center are different. Export of E&C services is provided by only two operating centers in U.K., through the Portsmouth and London offices. The Portsmouth office exports chemical process E&C and the London office exports E&C for on- and offshore oil and gas fields and nuclear power plants. The two U.S. offices basically serve only the U.S. market. The Dutch office provides E&C services to the markets in Benelux, but its service to the region is not considered to be an export because of the tight economic links within Benelux. It is important to note that each major operating center commands different technological expertise, and is also able to complete entire projects without help from any other unit. Firm C also maintains foreign subsidiaries in six countries, Canada, U.S.S.R., Saudi Arabia, United Arab Emirates, Argentina, and Indonesia. Each subsidiary exclusively serves the country in which it is located.

The number of countries from which Firm C obtains contracts varies from year to year, ranging from 10 to 30, but primarily in the U.S., western Europe and U.S.S.R. Activity in Asia and the Middle East is limited. Annual revenue also varies considerably ranging from \$560 to nearly \$2 billion between 1986 and 1988.<sup>1</sup> The basis for providing E&C services has changed since the late 1970s. An executive of

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<sup>1</sup>. The number of countries which Firm C obtains contracts and its revenue figures are from Engineering News Record (7/16/87, 7/7/89, 7/13/89). The revenue figures are at the erection values of facilities which Firm C built.



the firm said, "Because of the increasing competition in many parts of the world markets and shrinkage of the markets in value, we have had less export of E&C services and more E&C service production on a local basis." In other words, Firm C's marketing strategy has been to establish a firm basis for providing E&C services in each geographic market important to it. In this sense, the Soviet market, in which the firm acquired 20 to 25 contracts in the past 20 years, will become more important to the firm. Early in 1989, Firm C acquired 35 percent of interest in a French firm. Also, according to the executive, Firm C "is prepared to acquire one or two more firms in Continental Europe."

#### Geographic Globalization

Firm C's process engineering segments, each working with a very different, idiosyncratic technology, generally tend to force dispersion of the structure of the firm. Process technology for oil and gas differs significantly from that for nuclear fuel or chemical products. Even in chemical products, a process for ethanol production is very different from that for polystyrene. The technological difference between different processes is much larger than the technological difference between dams and bridges in heavy construction. Therefore, it seems to be more difficult for a process engineering firm specializing in one segment to diversify into other segments in process engineering. As a result, it may be easier to acquire a firm specializing in a different segment than to start from a scratch. Moreover, when a process engineering firm acquires a firm with different technology, the structure after the acquisition tend to be dispersed like that of Firm C. In other words, the firm has different operating centers with different technology at different locations. Furthermore, the significant differences in technology between segments in process engineering makes it difficult for a process engineering firm to

coordinate activities between segments. As Case B has revealed, different segments tend to have different geographic markets as well. Therefore, coordination between segments becomes even more complicated.

### Configuration and Coordination of Internal Activities

The configuration of the activities of Firm C is very dispersed. Except for the two U.K. offices, each subsidiary essentially serves only the country in which it is located. Moreover, each of the five operating centers has the capability to complete projects in each country although the expertise of each differs. The recent acquisition of a French firm and a planned acquisition in Continental Europe will further disperse the configuration of activities of Firm C.

It is important to note that each operating center has considerable autonomy and that the headquarters, the holding company, does not play any significant role for acquiring or executing contracts except for approving tenders beyond a certain value or assisting an operating center when it gets into a trouble. Although it has quarterly meetings at the headquarters for senior executives from all operating centers and subsidiaries, the coordination accomplished in this way are between individuals from the separate operating units, and are pursued on quite a personal basis.

Decentralization also characterizes Firm C's operation and strengthens its multi-domestic orientation. Its decentralization policy is apparent in its top management's statements. In the word of the executive, "the central coordination of various functions is based on a completely different philosophy. We believe that the more you delegate, the better. It is not efficient and not economic to have a large central organization. Central overhead could grow quickly and be very expensive. Furthermore, when you move functions to the head office, decision making is more difficult and slower." Also, he says, "In the E&C business, it is

much more difficult to acquire economies of scale. In a manufacturing firm, if you make a breakthrough in production technology, it is much easier for you to ensure the technology is used in all manufacturing units worldwide. But it is not easy in the E&C business because our business is people-oriented rather than machine-oriented." In considering the diversification of Firm C, it is important to recall that Firm C itself is a conglomerate, as its large number of different business indicates. (It is comprised of four manufacturing sectors in Firm C.) Therefore, it may be quite natural that Firm C, too, treats its operating engineering units as mere parts of its entire business.

For Firm C, its executive emphasizes, "Acquisitions of local firms are strategically very important. In many countries, it would not be possible to set up a local firm from scratch. It often takes too much time before seeing the result and it is too uncertain." Also, there is another reason why Firm C favors acquisitions of local firms. It is because "often, an acquisition is the only way to acquire contracts in many countries, such as India, Brazil, and Argentina." However, Firm C also admits difficulties in acquiring firms in the E&C industry. He explains, "Unlike manufacturing, the assets of E&C firms are people. They may walk out of the door when you take over the company. Also, the system of a company may be very incompatible. Even though the company you acquired is willing to change its system, it still takes time and money to fix everything. Furthermore, the problem is larger when the firm is computerized."

#### Configuration and Coordination of External Input

Procurement, on either a lump-sum or reimbursable basis, is an important factor of competition for Firm C. According to its executive, "We are selected for engineering skills. The first criterion for selection will usually be on technical basis. You have to have some technology. If not proprietary, you have to have a

track record. Otherwise, you are not considered. Such technology or engineering skills usually include engineering itself and procurement." It is, however, important to note that worldwide sourcing is not always the optimal procurement solution. With worldwide sourcing, Firm C cannot use British credit. This is part of the reason why Firm C does not necessarily source worldwide. However, he said, "British firms have a disadvantage against firms of certain other nationalities, such as West German firms because quite a lot of equipment does not exist any more in the U.K. There is quite a gap in economic development."

#### Technology, Market Segment, Configuration, and Strategy

It appears that there are certain relationships between technological strength, configuration of activities, market segment, and strategy. First, process engineering segments, which comprise a number of segments with very different, idiosyncratic technologies, generally move a process engineering firm toward a dispersed structure. As pointed out earlier, technology in process engineering sectors differs so significantly from one to the other that firms tend to acquire firms to obtain new technology. However, differences in the systems between the firm and an acquired firm, especially when the system of two firms are computerized and they use different software and hardware, further hinder coordination between the two units. Moreover, Case B has revealed, different segments tend to have different geographic markets as well. This further complicates coordination between segments.

Second, proprietary technology seems to drive a firm possessing such technology to a concentrated structure. Firm C's executive said that "Firms which have truly proprietary process technology, such as Linde (West Germany), Lurgi (West Germany), Lummus Crest (U.S.), or Stone & Webster (U.S.) have centrally controlled organization around their proprietary technology. They must not have

two units developing the same technology independently." This relation has also been illustrated in Case A.

Third, as a result of the first and second points above, process engineering firms may be of two distinctive types. The first type of firm having proprietary technology may concentrate its activities in headquarters because of the need to coordinate proprietary knowledge, and adopt a strategy close to a simple global strategy (but not necessarily a pure simple global strategy as Case A demonstrated). The second type of firm does not have much proprietary technology. They tend to be more management-oriented. As they are diversified into several segments, they have different operating centers (often subsidiaries) with different expertise and serve different geographic markets. These firms are further divided into two types in management. One group of firm retains the unique characteristics of each segment and does not coordinate among segments. These firms tend to pursue a multi-domestic strategy. The other type of firm, like the firm in Case B, coordinate activities over different segments and often over different geographic markets. These firms tend to pursue a complex global strategy.

Fourth, process engineering segments are much smaller than general building or heavy engineering segments. The sizes of the markets depend on the capital expenditure of the chemical and energy (e.g., oil, gas, coal, power) sectors. Thus, combined with the idiosyncratic technology required in each sector, competitors in the segments are few and they often compete face-to-face worldwide. Therefore, market share is quite important for a process engineering firm and their behaviors are often very oligopolistic as verified by the statement of the executive of Firm C: "We compete with Davy Makee and Simon-Carves in the U.K. When they take contracts abroad, we must go too. Unless we also acquire contracts abroad, they may get stronger relative to us, and eventually squeeze us

out." He added "We must go abroad because the U.K. has a small construction market. Our segment is even more limited. Firms in the U.S. may not need to go out because they have a huge home market. Our activity in the U.S. is important in this sense, too." Also, because of the small size of the market for each process technology, most firms are quite well diversified into several processes.

#### Tradition of Management Style

The Firm C case proves the significance of the influence of tradition on the management style of E&C firms. Firm C's strategy appears to have particular influence from the management style of the British firms as pointed in Chapter 2<sup>1</sup> and proved partially in the previous chapter.<sup>2</sup> Coordination on a personal basis at the executive level rather than through formal structure, and financial control, rather than coordination of technical or operational details, characterize Firm C's management style. Also, its willingness to delegate more operating independence and strategic freedom to their major operating centers and highly autonomous foreign subsidiaries, which are managed more as a portfolio of offshore investments rather than as a single international business, are significant in Firm C.

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<sup>1</sup>. See Bartlett (1986) in Chapter 2 of this study.

<sup>2</sup>. For example, U.K. E&C firms have dispersed sourcing activities regardless of the types of firms.

#### 5.4 Case D - Firm D, a Japanese Contractor

Firm D is the only contractor in the major cases. This case demonstrates that a contractor's limited ability to differentiate itself through engineering expertise forces the firm to rely more on a strong commercial presence in the market and to pursue a strategy close to the multi-domestic strategy. Also, the case shows the limited internationalization of Japanese contractors. Their lack of capability (most notably in procurement) and competitiveness directs their international involvement to the projects in developing countries financed by the Japanese government and the projects in developed countries pursued through their own investments in real estate and by following Japanese multinational clients. However, the case also demonstrates how a global strategy is important to even a not very internationalized firm like Firm D. The case shows that although its strategy is very multi-domestic, it must coordinate the flow of technology and relationships with Japanese clients and investors worldwide in order to compete in the markets in developed countries.

##### Outline of Firm D

Firm D, founded early in the 19th century, has been the leading general contractor in Japan since its incorporation early in the twentieth century. It is currently one of the largest general contractors not only in Japan but also in the world in terms of the annual revenue. Firm D earned approximately \$9 billion in 1987 and \$12 billion in 1988. However, like most of its Japanese counterparts, its international involvement is very small. For example, the revenue earned in the international market accounted for only 8% of its entire revenue in 1988.

Despite its relatively small international revenue, the configuration of the firm's international activities is very wide, covering 25 countries in the seven major continents. Its recent market emphasis, however, has been to move out of

the Asian market, in which the presence of Japanese contractors has been very significant, into markets in developed countries, such as the U.S., western Europe, and Australia. In the developed countries, the firm is primarily engaged into real estate investment and construction related to real estate investment.

### Expertise and Market

Like many other contractors in Japan, Firm C provides comprehensive design and management for building and heavy facilities. It provides structural and a limited amount of mechanical and electrical engineering but not specialized engineering, such as chemical, petrochemical, and thermal engineering.<sup>1</sup> Therefore, Firm C provides design and management of construction for only a limited group of industrial facilities, e.g., oil and LNG (liquefied natural gas) storage tanks and parts of industrial plants, e.g., footings and control buildings, which can be constructed without specialized engineering expertise. Its engineering expertise limits the international market which Firm C can tap.

As technology is a very important source of competitiveness for engineering firms, it is also a strong source of competitiveness for Firm D in both domestic and foreign markets. Since the foundation of its R&D office in the mid-1940s, it has played an important role in shaping competitiveness and sustaining growth through diversification in the segments in which technology is an

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1. Japanese firms comparable to the engineering firms in the U.S. and Europe are of five kinds: 1) Firms which originally were oil refinery or chemical process firms, e.g., JGC Corp., Chiyoda Chemical, and Toyo Engineering; 2) general machinery firms (primarily ship-building or heavy machinery firms), e.g., Mitsubishi Heavy Industry, Ishikawajima-Harima Heavy Industry (known as IHI), Kawasaki Heavy Industry, Mitsui Shipbuilding, and Hitachi Shipbuilding; 3) engineering department of steel manufacturing firms, e.g., Nippon Steel, Nippon Kokan KK., and Kobe Steel Ltd.; 4) engineering department of heavy electric or communication machinery firms, e.g., Hitachi, Toshiba, Mitsubishi Electric, and Fujitsu; and 5) Machinery or plant department of general trading firms (primarily serve as project coordinators), e.g., Mitsubishi-Shoji, Mitsui-Bussan, Marubeni, and C.Itoh & Co., Ltd. (Nakamura 1985)



important component of construction, such as large-scale underground electric substations or clean rooms. Firm D now maintains over 600 researchers with an annual R&D budget of \$60 million. Although its major R&D efforts are made for the Japanese markets, the importance of technology in the international market is reflected in the firm's acquisition of a design contract in 1986 for a R&D facility requiring sophisticated clean room technology for a computer manufacturing firm in the U.S. However, the effects of technological expertise on Firm D's competitiveness are still limited compared to engineering firms. One of its managers says, "Ideally, we would like to provide technology only available at our company. But currently management expertise is still more important to us."

In 1988, total revenue (domestic plus international) from the management of building construction accounted for 77%, from the heavy construction 17%, and from real estate investment and engineering (mostly structural) the remaining 6%. The percentage of revenues by segments in building and heavy construction is provided in Exhibit 5.4.1 and 5.4.2.

Exhibit 5.4.1: Percentage of Revenues by Segments in Building Construction in Firm D (1988)

Offices	Factories, Warehouses	Houses	Education	Hotels	Others	Total	(Percent)
31.6	17.0	13.2	12.6	6.3	19.3	100.0	

Source: Firm D's annual report.

Exhibit 5.4.2: Percentage of Revenues by Segments in Heavy Construction in Firm D (1988)

Land Development	Highways Streets	Water Systems, Sewerage	Civil Works in Industrial Facilities	Railroads	Others	Total	(Percent)
19.9	18.3	17.2	9.7	6.0	28.9	100.0	

Source: Ibid.

For Firm D, the geographic markets and modes of involvement in international markets in the 1980s have changed dramatically as they have for many Japanese contractors. First, although Asia still is a single region in which the firm's construction activities are intensively concentrated, the revenue earned in developed countries has become an important source of its international revenue.

Second, it is important to note that construction in developed countries usually comes either from the firm's real estate investment, or from Japanese clients who establish facilities in the countries. Exhibit 5.4.3 demonstrates the current percentages of international construction revenues and real estate investment in different geographic regions in Firm D in 1988. Asia still accounts for 45.7 percent of the firm's total international construction revenue. However, the total construction revenue earned in developed countries (i.e., U.S.A., Europe, and Oceania) accounts for nearly a half. The concentration of its real estate investment in the developed countries, which accounted for almost 90 percent of all total real estate investment, shows the close link between Firm C's construction and real estate investment. Exhibit 5.4.4 and 5.4.5 lists the firm's major projects completed and acquired in 1987. While projects both completed and acquired in developing countries are gained through competition, those in the developed countries either derive from Japanese clients or are related to the firm's own real estate development.

Exhibit 5.4.3: Percentage of Values of Construction Revenue and Real Estate Investment by Region in Firm D (1988)

	(Percent)					
	U.S.A.	Europe	Asia	Australia	Others	Total
Construction	29.5	9.6	45.7	10.7	4.5	100.0
Real Estate Investment	45.7	15.2	6.5	28.3	4.3	100.0

Source: Ibid.

Exhibit 5.4.4: Major Projects Completed by Firm D in 1987

Country	Project Type	Remarks
North America	Compact disc factory	From Japanese clients
North America	Stamping plant	
North America	Hotel	From Japanese clients
Europe	Printer factory	From Japanese clients
Oceania	Office building	Real estate investment
South East Asia	Building for a bank	
South East Asia	Apartment	
Middle East	Power Station	

Source: Ibid.

Exhibit 5.4.5: Major Projects Acquired by Firm D in 1987

Country	Project Type	Remarks
North America	Camera Factory	From Japanese clients
North America	Hotel	Real estate development
Europe	Office	From Japanese clients
Europe	Distribution facility and office for factory	From Japanese clients
Oceania	Hotel	Real estate development
South East Asia	Hospital	
South East Asia	Houses	
Middle East	Power station	

Source: Ibid.

Incentives for Firm D to develop international markets seem to differ significantly from the firms in other cases of this chapter. A manager of Firm D asserts, "The importance of international construction changes from time to time. It depends on the balance between the condition of the Japanese market and that of the international markets. We are different from specialized engineering firms which earn revenues from international markets, and the home market is very important to most of us (contractors). When the home market is in a slump, we tend to emphasize international markets. But, when it is not, we come back to the home market. In the early 1980s, many Japanese contractors came back to the

home market. It was the time when we were losing big money in the international markets. Currently, because of the tremendous construction boom in Japan, many Japanese contractors are reluctant to develop their international markets very aggressively."

#### Configuration and Coordination of Internal Activities

The configuration of internal activities in Firm D is very dispersed. In Firm D, foreign subsidiaries are the centers for local operations. For example, in the U.S., Firm D operates through control of its subsidiary under which there are several firms with different activities, including design, real estate development, construction management, and finance. This structure enables the firm to deal with diversity over different geographic markets. Its executive asserts, "This is not an era when headquarters controls everything. We must not have a fat central organization and we must have flexible approaches. Market segments, clients, and infrastructure of construction are very different from country to country. Markets in developed and developing countries are especially different." Firm D's different approach is, as addressed earlier, most clearly seen in its differing approaches to construction in developed and developing countries.

Firm D emphasizes a strong local presence for construction in developed countries because government regulation requires that certain physical inputs must be local, e.g., the "Buy-American" provision. Many materials, equipment, and subcontractors are available locally; and often it is difficult for labor to enter these countries. Moreover, real estate development requires the assembly of a number of local factors, such as timely information sources for investment, local partners for investment, financing institutions, and information about local

contractors<sup>1</sup>. Therefore, for development-related construction, Firm D established a number of foreign offices and subsidiaries in developed countries after it started to emphasize real estate investment in the late 1970s.

In contrast, Firm D displays significant and complex coordination in its pursuit of new technology and in its treatment of Japanese clients and partners for real estate investment. For pursuing new technology, in addition to the technology developed in its R&D facility in Japan, it has also established many technological links with foreign firms since the 1970s to acquire advanced technology not available in Japan. Moreover, the firm has a U.S. office whose role is exclusively to source technology. The general manager of the office asserts, "All technology cannot be developed internally. We must be flexible in sourcing technology. In doing so, it is most important to judge which technology we develop and which we purchase outside our company." The technology sourcing office cooperates with top management and its R&D center in Japan and the three different units coordinate the inflow of technology. In fact, it has had an extensive network with foreign firms for infusion of technology.<sup>2</sup>

Firm D is also significantly coordinated in its relationships with Japanese clients. As Japanese manufacturers and service firms establish their production plants and offices in foreign countries, it is very likely that these clients will favor Japanese contractors to provide E&C services. Very often, a project plan

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1. Although Firm D may serve as an investor (or client) and a prime contractor for a construction project associated with real estate development, Firm D actually may not only subcontract most of the construction work but also assign a large part of the project management function to a partner contractor, if available.

2. Firms which supplied technology to Firm D include: Skanska Cementgjuteriet AB. of Sweden, Gadelius international AB. of Sweden, introduction of technology for cooling towers from a West German firm, introduction of plastic coating technology for underground water conveyance system for in-ground tanks from Lubon Co. of France, introduction of prestressed concrete bridge-spanning method from Polensky & Zollner of West Germany, and many others. (Source: corporate brochure of Firm D)

starts and a contractor is selected in Japan. The project is developed through coordination between the contractor's offices in Japan and in the foreign country. Effective coordination between the domestic office which maintains the relationship with the client and the office which actually manages the construction plays a crucial role. As the number of Japanese clients building offices and production facilities abroad increases and as the locations of projects become dispersed, successful acquisition of such projects requires even more complex and crucial coordination.

#### Configuration and Coordination of External Inputs

The configuration of inputs to Firm D varies markedly depending on the country in which a project is executed. Generally, it sources labor, materials, and equipment worldwide for a project in a developing country. However, for a project in a developed country, such as the U.S. or U.K., these are procured in the country in which a project is located. Most of the labor, materials, equipment, and subcontractors are available, and more importantly, it is often hard to import them due to the government regulations. Therefore, the configuration of inputs in developed countries is quite dispersed and less coordinated.

However, it is important to note that in the words of its manager Firm D "does not have a worldwide sourcing capability internally. For sourcing worldwide, we often rely on a Japanese general trading firm, which is often a part of a consortium executing the project, or an international consultant specializing in procurement. In fact, the least competitive activity of Japanese contractors is probably procurement and we are less competitive in cost. A part of the reason comes from our relationship with manufacturers in Japan. Unless we procure goods from them, future projects from the manufacturers in and outside Japan may go to somebody else." This may be a part of the reason why Japanese

contractors source goods and services from Japan as we have seen in Chapter 4. The practice appears to derive not only from their use of tied-loans for acquiring projects but also from the industrial relationship in Japan.

## 5.5 Complementary Cases

### Complementary Case E: Firm E (U.K.)

Firm E is a U.K. contractor specializing in project management of conventional buildings and heavy civil facilities. Its international contracts account for only 10 percent of its entire revenue. Like Firm C (also from the U.K.) described above, Firm E has adopted a typical multi-domestic strategy. While it has foreign subsidiaries in 13 countries, each subsidiary operates only in the country where it is located. This seems in line with the British firms' historical multi-domestic management confirmed in Case C.

Also, Firm E competes with local firms primarily because it lacks the factors to differentiate itself within the general building and heavy segments. This also seems to support the idea that types of strategy (i.e., combinations of configuration and coordination) are influenced by the segment and degree of technological expertise confirmed in Cases A, B, and C.

Firm E wants to gain more contracts in the countries in which it already has a commercial presence but is not interested in competing worldwide in a coordinated way.

### Complementary Case F: Firm F (Italy)

Firm F is a subsidiary firm operating in the power line division of a Swiss conglomerate manufacturing electric products and performing electric E&C work. Firm F specializes in E&C in electrical works, such as power generation plants (e.g., hydroelectric, nuclear, gas), power transmission and distribution lines, and substations, and is operating in diverse geographic markets, in the Middle-East, Central America, northern Latin America, Africa and Italy. It also has acquired the general contracting expertise to perform E&C on a turn-key basis in diverse



segments through the acquisition of a more diversified Italian electric E&C firm in 1987. The segments include water supply and treatment plants, chemical, petrochemical, and other industrial plants, and infrastructure systems (ports, airports, railways, etc.).

This case provides three implications for the discussion of globalization. First, this case supports the finding in Chapter 4 that many E&C firms source electrical work subcontractors worldwide. As this case shows, electrical work subcontractors have (geographically) globalized.

Second, the diversification of the electric E&C firm suggests the difficulty of (geographic) globalization on the basis of specialization.<sup>1</sup> The acquired Italian electric E&C firm annually acquired over \$3 billion in contracts in the early 1980s. However, its contract volume rapidly diminished each year and it acquired only \$600 million in 1987 before it was acquired by Firm F. During the process of the market contraction for electric works, the firm was forced to diversify into general contracting in multiple segments as addressed above.

Third, Firm F's strategy and structure are significantly influenced by its parent's strategy. The acquisition of the Italian electric E&C firm was aimed to enhance the parent firm's overall position in the electric industry by strengthening the power line division through the addition of the turn-key capability; to reduce competition (by actually creating the world largest electric E&C firm) and duplicated activities and market presence; and to obtain rapid diversification into segments other than electrical work. Furthermore, after the merger of its parent with the Swedish electric conglomerate and a subsequent restructuring of the organization, certain activities in the parent firm, such as marketing, technology, procurement, finance, and business development, have

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<sup>1</sup>. This point has been suggested earlier in Case A also.

been centralized as support activities at the parent's headquarters, serving for all divisions of the parent firm, including the power line division. Moreover, following the merger of its parent, Firm F and its foreign subsidiaries were positioned to serve specific geographic markets under its parent's global strategy. Firm F now serves only the Italian market.

#### Complementary Case G: Firm G (Italy)

Firm G is a large engineering contractor and is 100 percent owned by a large manufacturing firm. Firm G is actually a holding company controlling more than 100 affiliate firms with different expertise and often different geographic markets. While some of these are 100 percent owned by Firm G, many are partly owned. About a half of the affiliates operate in the Italian market, and the others in the foreign markets, very often with local firms. Segments in which the affiliate firms operate are quite diverse, including general building, heavy civil, and various kinds of plants except process plants. Some of the affiliates are engineering firms while others are contractors. Firm G's annual international revenues are \$1.2 billion to \$2 billion and account for 50 to 85 percent of the firms' entire revenue. The geographic markets obtained through its affiliates include nearly 50 countries in all major markets except for Asia. Historically, about half of its foreign contracts come from the parent firm when it builds, expands or repairs its foreign and domestic production facilities.

Experiencing the sharp decline in demand for E&C worldwide in the mid-1980s, Firm G restructured its group. The goal of the restructuring was to obtain more managerial and operational capability for the group primarily through enhanced coordination by Firm G. The coordination includes that of affiliate firms, the pre-construction activities including feasibility studies and financial packaging for projects, and the formation of a consortium among affiliates

according to the requirements of each project. The enhanced coordination of Firm G enables the group to combine different types of expertise to capture complex projects which require multiple engineering know-how available in its affiliate firms (including the parent firm); physical erection of different kinds of facilities, and a sophisticated financial package. This would typically be a large, complex turn-key project, such as a regional transportation development.

Under the restructuring, the firm emphasized the domestic and European markets (what they call, "mini-globalization"). This enables them to cope with the shrinkage in the international market and to anticipate issues raised by the economic unification of Europe in 1992. In fact, the firm's contracts from the European market accounted for over 80 percent of revenue in 1987 but only for 30 percent in 1985.

The case of Firm G has several interesting implications for this study. First, Firm G is one of the two firms which clearly dealt with coordination across different product segments. Firm G's coordination across different segment resulted in an enhanced capability for the group, and especially in dealing with complex projects on a turn-key basis.

Second, a driving force behind Firm G's geographic globalization was its parent's expansion of production facilities. This seems to be a corollary to the prediction that geographic globalization might be expected on the relationship between an E&C firm and multinational clients.

Third, with respect to the relationship between an E&C firm and its parent, it is important to note that the parent's segment was included as Firm G developed its group capability through coordination across different segments. The enhanced capability, which is a composite of organizational capability and technological expertise acquired through coordination, has become proprietary

(or at least firm-specific) know-how, driving the firm towards further geographic globalization.

Fourth, the structure of the Italian construction firm seems to affect the configuration of activities of Firm G. In Italy, it appears quite typical that instead of diversifying internally in segments and geography a firm does so by partially (or wholly) acquiring or investing in a large number of small firms, each specialized in a narrow segment and often a limited geographic market. This characteristic is seen even in relatively small firms such as those reviewed in other cases in this study. A firm, especially a large one such as Firm G, typically has a structure in which a holding company holds the controlling share in numerous small affiliate firms having different expertise and market. The looser ownership structure of Italian firms seems to require coordination and configuration specific to them. In other words, their configuration and coordination is not directed toward activities but toward affiliate firms.

Fifth, triggers of Firm G's taking a global strategy through the configuration and coordination of the group affiliates were first, the contraction of the international markets in which the firm operates and second, the unification of Europe. While the first stimulus is quite common among the firms studied in this chapter, the second seems to be an extremely strong factor for European firms.<sup>1</sup> In the case of Firm G, their concern over European unity led the firm to "mini-globalization" within Europe. "Mini-globalization," on the one hand, suggests that the advantage obtained from pursuing a global strategy is applicable to a smaller geographic market. On the other hand, it implies that the blocking of markets may well limit the geographic globalization of E&C firms.

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<sup>1</sup>. Recall the concern by Firm C on invasion of firms in the Continental Europe and Firm C's acquisitions of firms in the continent.

### Complementary Case H: Firm H (Italy)

Firm H, founded early this century, is a small contractor specializing in the construction of infrastructure, such as hydroelectric and other water systems, highways, railways, bridges, ports, and airports. It earned approximately \$200 million in 1987. (It earned nearly \$1 billion in the early 1980s.) Firm H itself operates only in the Italian market, but through a firm owned by it and two other Italian E&C firms (earning its \$260 million overseas at 100 percent), it operates in the infrastructure segment overseas, particularly in hydroelectric and maritime systems, in developing countries in Asia, Africa, and Central and Latin America.

This case suggests two points important to our discussion of globalization. First, the development of Firm H clearly follows the path to a (geographically) global firm proposed in Chapter 3. As the firm grew (specializing in hydroelectric systems), and internal human resources increased, it began to diversify into other segments in infrastructure in order to maintain the internal resources. Furthermore, the firm started to expand into foreign infrastructure markets in order to make maximum use of its internal resources and to sustain the fixed cost of internal human resources. The Italian market was simply too small.

Second, this case provides a part of the reason why many E&C firms have central concentration of activities. (It has been found that Firm H has fairly concentrated activities in sourcing and financial activities in Chapter 4.) When Firm H faced a further expansion of its geographic market and increasing competition at the beginning of the 1980s, it had to concentrate many activities in order to reduce fixed costs, adjust its worldwide human resources against fluctuation of demand, make maximum use of its technical staff and computer facility, and coordinate better feed-back between management and engineering experience. It is important to note that another driving force behind Firm H's

central concentration and coordination of activities that it is privately owned and the owner exercises strong leadership.

#### Complementary Case I: Firm I (Italy)

Firm I is also a small contractor specializing in infrastructure in highways, railroads, bridges, hydroelectric systems, and airports. It had an annual revenue of \$250 million in 1987. Combined with the international revenue from a jointly acquired British E&C firm, it earned \$110 million of foreign revenue, operating primarily in Africa and Latin America.

Two points are important to note. First, this case confirms the difficulty of geographic globalization through specialization. When demand for infrastructure diminished in developing countries, the firm diversified into industrial plant construction. The necessary know-how was acquired through a joint venture with an engineering firm specializing in plant construction.

Second, the interview with an executive from Firm I suggests it seems not to have a global perspective in terms of configuration and coordination of internal activities and external inputs primarily because it does only limited business in international E&C and geographic markets. This suggests that unless a firm expands geographically to a certain extent and its international activities become truly important to the firm, it may be difficult for the firm to come to terms with the difficulties that arise from managing large-scale activities in widespread geographic areas.

#### Complementary case J: Firm J (Korea)

Firm J is an engineering contractor in one of the four large conglomerates in Korea. The parent conglomerate is diversified into manufacturing of automobiles and their parts, shipbuilding, trading of commodities, financial

services, and E&C through Firm J. Firm J is well diversified in engineering and construction in building, heavy civil, and industrial plant segments, and is the largest E&C firm in Korea. Its international revenue accounted for 70 to 85 percent between of all revenues between 1980 and 1986 (but much lower after 1987) and it earned nearly \$3.5 billion in the international market in 1982. A manager of its international department asserts that the firm's primary competitive edge came from the cheap labor and materials imported from Korea and other areas in Asia. However, its international revenue has continued to diminish since then, amounting to only little over \$400 million in 1988.<sup>1</sup>

The reduction of the firm's international revenue is considered to be the consequence of its concentration in the Middle East market since the 1970s. The shrinkage of the Middle East market after 1983 significantly affected the firm's international revenues. Also, the rising wages of Korean labor adversely affected its cost competitiveness. Since 1986, Firm J has been seeking markets in developed countries by establishing a number of local offices, particularly in the U.S. and Japan. However, the process has been difficult primarily because the firm cannot import the cheap labor and materials it has depended on for competitiveness into these countries and it cannot technologically differentiate itself from indigenous firms. (Firm J is more a management firm than an engineering firm.) Its manager asserts that Firm J has been seriously considering the approach taken by Japanese contractors in the U.S. market, in obtaining construction project through involvement in real estate development.

The case has two important implications. First, as Case D suggested earlier, E&C firms may have to adopt different strategies for operating in developing and developed countries, particularly in sourcing inputs. Very often, the import of

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<sup>1</sup>. Values of contracts are obtained from ENR and are at the erection values of constructed facilities.

labor and goods is prohibited or strictly restricted particularly in developed countries. Indigenous firms are well established and competitive.

Second, a comparative advantage, such as cheap Korean labor and materials, seems to be less important as a source of competitiveness to an E&C firm than the firm's ability to coordinate internal activities and external inputs when operating in diverse geographic markets including those in developed countries. In fact, Firm J changed its sourcing pattern from home-country-sourcing to worldwide sourcing for many goods and services as price levels of Korean labor and goods increased in the mid-1980s. Also, it has rationalized its sourcing activities by concentrating them at headquarters.

#### Complementary Case K: Firm K (Korea)

Firm K is a contractor. Its market is a limited number of countries in the Middle East and Asia. Because the Middle East was its major market, it has a problem similar to that of Firm J. Its international revenue diminished sharply from \$750 million in 1982 to only \$140 million in 1987. However, Firm K's strategy shows an interesting contrast to those of Firm J. It has not changed its market strategy and still sticks to the Middle East and Asian market. Its top management asserts, "We will tolerate the situation until the next construction boom comes."

Comparison of Firm K's strategy with that of Firm J provides an interesting perspective. It seems that though the two Korean firms despite having similar national characteristics and competitive edges responded to shrinkage in their geographic markets with markedly different strategies. First, although Firm J attempted to expand their market to developed countries, Firm K did not even expand its geographic market. Also, Firm J rationalized its operation by concentrating its sourcing activity at its headquarters, sourced goods and services worldwide, and attempted a strategy similar to that of Japanese contractors to get



into the U.S. market. For the expansion of geographic markets, two strategic factors are important, first, the capability of top management and second, a firm's infrastructure. The importance of the first factor is demonstrated by the statement of Firm K's top management presented above. The second factor is associated with differences in organization among the two firms. Firm J is a part of a large conglomerate that operates other segments in a large geographic area including developed countries. It also has a network of offices around the world. However, Firm K is a stand-alone E&C firm with a quite limited infrastructure. Thus, there may be good reasons for firm K to be more cautious in expanding its geographic market.

## 5.6 Summary

(Issues predicted but examined only in this chapter are underlined.)

Cases B and G demonstrate that coordination across product segments, one of the aspects which have not been examined in the previous chapter, is to be crucial to E&C firms. In Case B, the coordination is concerned with the use of firm-specific knowledge by multiple segments which are considered to be worldwide. The firm-specific knowledge is associated with the bilateral and trilateral relationships between and among countries, and the knowledge affects the firm's sourcing and project acquisition capability.

In the case of Firm G, the effort to coordinate across segments is concentrated on integrating different areas of expertise into a package. Such expertise includes not only engineering expertise but also financial expertise. It is important to note that the coordination leads to the up-grade of Firm G's expertise, acquisitions of high-tech, complex projects, and the creation of a new segment.

Also, Case B shows that the configuration of activities is determined not only by the availability of projects at the location of configured activities but also by such bilateral or trilateral relationships. Moreover, Case B demonstrates not only the importance of configuration across segments but also the impact of another theoretical prediction, the influence of government (or country) relationships on configuration and coordination of internal activities and external inputs.

The influence of behavioral factors, particularly management tradition, another aspect not examined in Chapter 4, was demonstrated by several cases. Case C clearly demonstrated a management style unique to U.K. firms, in which the

firm gives maximum autonomy to its foreign subsidiaries. Considering that this was also true for Firm E, another U.K. firm, the general rule on U.K. firms appears to apply to U.K. E&C firms as well. Also, oligopolistic competition forced Firm C to configure its local presence to certain geographic regions and to maintain geographic globalization (or remain in the international markets).

Case C shows that firms adopting such a management style are likely to pursue a multi-domestic strategy. The case also demonstrated that it is difficult to coordinate activities of acquired firms, especially if they are computerized. The case confirms that engineering firms are more likely to have a dispersed configuration characterized by multiple operating headquarters. This is because the considerable differences between the segments of process technology make it difficult for a firm to diversify internally; it is easier for a firm to acquire a specialized firm. Even then, coordination across segments become very complicated as demonstrated by Cases B and G.

The effects of the anticipated economic unification of Europe (an example of regional economic pacts, which has been predicted but not analyzed by the questionnaire) on configuration were clearly demonstrated by Case C and G. In response, firms seem to have narrowed their geographic perspectives and configuration. However, the European unification has affected only European firms in a visible way.

Cases J and K illustrate, through the examples of Korean firms' efforts to penetrate markets in developed countries, the effects of non-tariff barriers on configuration and coordination of inputs, a theoretical prediction made by the framework. Since export of cheap labor and materials, particularly the former, to developed countries is legally prohibited, Korean firms seem to be unable to export their E&C services. Also, competitive advantages based on comparative

advantages, such as cheap labor and materials, seem to be effective only in limited geographic markets, most notably in developing countries. Also, such advantages are less useful in pursuing geographic globalization than are the advantages based on proprietary knowledge or on organizational and managerial expertise, such as those obtained through global strategies.

A comparison of engineering firms (Cases A, B, and C) suggests that firms with proprietary technology are more likely to have concentrated configurations while those without it are likely to have more dispersed configurations. A comparison of firms competing on the basis of engineering expertise and on management expertise suggests that the former have more concentrated configurations than the latter. Contractors whose competitive edge depends on project management expertise tend to have a more dispersed configuration, operating through the establishment of the so-called "local presence" in several locations. Related to this, Case A also supported the prediction in the theoretical framework that geographic globalization could be developed on the basis of proprietary knowledge. Moreover, case C showed that oligopolistic competition, which may characterize certain segments, such as those requiring high engineering expertise, influence geographic globalization and configuration of internal activities (for Firm C, in the form of acquisition of national firms).

Regarding the issues crucial to the implementation of global strategies, the most common factor triggering a change of strategy and structure was fluctuation of demand, particularly contractions of demand, and subsequent unsatisfactory performance or a danger to the viability of firms. However, whether firms perceive the benefits of a global strategy and adopt one or not seems to be influenced not only by economic calculation of the costs and benefits of such a move (as Porter argues) but also by the tradition of management as

demonstrated by Case C and E (and also nationalities insofar as the to the tradition is correlated with specific nationalities, such as in U.K. firms). A related factor is the historical development of a firm, most clearly demonstrated by Japanese firms which have limited international exposure and have not experienced the difficulties of managing truly worldwide operation. The critical importance of top management's capability and value perception is clearly demonstrated by the comparison of the three Korean firms, and most vividly articulated by the statement of the top management of Firm C in evaluating the difference between global and multi-domestic strategies.

Although specialization on the basis of proprietary knowledge promises in theory a penetration of worldwide markets, in practice this seems to be very difficult. First of all, very circumscribed proprietary knowledge assures only a small market, which may not be enough to sustain the internal assets of the firm for long. Also, such a firm may be very vulnerable to demand fluctuation. As Cases A and H clearly demonstrate, firms usually diversify into other segments to sustain the internal assets developed at the time of the maximum demand. Also, Case A suggests that changes in demand for a particular technology over time force the firm to diversify itself to cope with the change.

It is surprising to find that six out of the eleven firms have parent firms. (Only Firm D, E, H, I, K are stand-alone firms). The six cases demonstrate that the difference in ownership structure seems to affect the strategy and structure of E&C firms. Firm A's parent firm influenced its ability to provide financial packages in the form of barter trade and technological input. Firm A concentrates activities close to its parent in order to take advantage of the linkages. The global strategy of Firm F, in terms of configuration and coordination, was very heavily influenced by its parent's global strategy. Furthermore, a comparison of the two

Korean firms shows that the infrastructure of the parent seems to accelerate the geographic expansion of one Korean firm to developed countries while the stand-alone firm was more cautious in expanding.

As competition on the basis of a pure simple global strategy is increasingly difficult (due mainly to the flexibility required by different types of projects in different countries as indicated by Case A), a competition in terms of a pure multi-domestic strategy is also becoming difficult. This is supported by Case D which shows how Japanese firms have coordinated the relationships with Japanese clients and real estate investors and extended this coordination into developing and sourcing technology.

There seem to be some distinct national characteristics, most notably Italy and Japan, that shape types of global strategies. As Case G showed, the industrial structure specific to the Italian construction industry forced firms to take partial ownership of a large number of firms in order to diversify in geography and segment. Due to this ownership structure, Italian firms have developed a unique configuration, and therefore require unique coordination. In contrast, as Case D illustrated, one of the reasons why Japanese firms often source in Japan for international projects was the industrial relationship between Japanese E&C firms and other firms (often manufacturers).

The cases presented above amplify the predictions regarding the globalization of E&C firms in Chapter 3 and supported by the large-sample survey as reported in Chapter 4. Issues critical to implementation of global strategies have also been presented in this chapter. The next chapter provides an overall summary of crucial points of the thesis, an assessment of propositions, and strategic implications of the results of this study for international E&C firms.

## CHAPTER 6

### CONCLUSIONS, STRATEGIC IMPLICATIONS FOR INTERNATIONAL E&C FIRMS, AND SUGGESTIONS FOR FUTURE RESEARCH

#### 6.1 Summary of the Research

Chapter 1 demonstrated the significant changes in the demand and supply sides in the international E&C market in the 1980s. Simply said, the decade has been characterized by the interaction between an increasingly complicated environment (e.g., a shrinkage in volume of work vis-a-vis expansion of the geographic market) and E&C firms' efforts to adjust internal resources to cope with it. Chapter 1 has proposed that competing on a country-by-country basis is becoming a less adequate strategy, while globalization - competing worldwide in a coordinated way - may have been an increasingly dominant mode of competition for international E&C firms in the 1980s, and that the trend will be more significant in the 1990s.

Also, Chapter 1 has pointed out the need to study the production process of an international E&C firm, particularly the interaction between services and goods, modes of international involvement, and location and linkages of organizational units of a firm from the viewpoint of activities rather than rigid organizational structure.

In Chapter 2, four different perspectives have been reviewed to analyze the production process of an international E&C firm. Porter's concepts of the value chain and global strategies provide a basis for formulating a theoretical framework for globalization of E&C firms although several major refinements are necessary. Other related studies on globalization provide practical inputs to Porter's concepts. Trade theory suggests the implications of changes in trade

patterns in E&C services from inter- to intra-industry trade. Intra-firm trade also provides a theoretical explanation for the internal coordination of international flows of goods and services within an E&C firm. MNE theory, especially the transaction cost approach and the behavioral approach, provides a theoretical basis for the horizontal expansion of markets and the relationship between organizational form, and types of coordinations of E&C firms. Studies of services, especially Nusbaumer's work, illuminate the interactions between services and goods production activities in E&C firms. An examination of modes of trade in services explains the way an E&C firm serves foreign markets.

In Chapter 3, after the general mechanism of globalization is explained, a theoretical framework for the globalization of E&C firms is proposed. The framework is comprised of three elements of globalization: geographical, internal, and external. Also in this chapter, several associated issues, such as linkages between globalization and organizational forms, management style, and computer and communication technology are explored.

Chapter 4 and 5 present the results of a questionnaire survey and field interviews. On the basis of these findings, the patterns of globalization in the E&C are analyzed.

## 6.2 Evaluation of the Propositions and Conclusions

Chapters 4 and 5 examined the propositions, that international E&C firms have been increasingly global, as the theoretical framework predicts, and that, those adopting global strategies have recognized significant competitive advantages by adopting global strategies. The empirical analysis has supported the two propositions and confirmed the validity of the theoretical framework.



As predicted, the empirical research has shown that most of the sample firms are geographically global. They execute projects in many countries and several major geographic markets (geographic globalization). Only a small number of firms (all of which are contractors) with small amounts of international revenue operate in a limited geographic scope.

In addition, the sample E&C firms have shown a high degree of coordination in their internal activities although the configuration of internal activities varied by firm (internal globalization). All four kinds of coordination associated with duplication of activities, dispersion of vertically integrated activities, firm-specific knowledge, and product diversification have been confirmed by the analysis.

For duplication of activities, project development (especially in exploiting multinational clients and sharing project development personnel), sourcing (most notably channels of sourcing), and financial activities are intensively coordinated over geographic distances by the firms.

However, a more important element of coordination appears to be associated with dispersion of vertically integrated activities. Many firms have considerable concentration of activities at either headquarters (and subsidiaries probably serving as operating centers for a region or segment rather than national subsidiaries). Sourcing activities, which determine as much as 85 percent of project costs, were highly concentrated at headquarters in half of the firms. These firms coordinated flows of goods and services for their projects worldwide. In several firms, similar integration was seen at subsidiaries while in other firms several organizational units specialized in sourcing different goods and services and serving the other units of the firms. Financial activities are concentrated at headquarters in a substantially large number of firms. Many E&C

firms seem to remove as many activities as possible from project offices, concentrating at a few locations (or one location) and coordinate them worldwide in each firm in order to reduce costs and enhance efficiency and quality of work.

Many E&C firms, especially those concerned with engineering excellence, coordinate firm-specific knowledge worldwide. Engineering-contractors, which compete more often on this basis than contractors, seem to execute this kind of coordination more extensively than contractors. It is important to note, however, that firm-specific knowledge is not limited to engineering knowledge. E&C firms coordinate worldwide bidding activities, often from headquarters, because of the importance of financial packaging know-how which often includes sourcing choices. Concentration of activities facilitates financial packaging and the sourcing of goods and services.

Several E&C firms are more concerned with gaining competitive advantages by coordinating activities across both product segments and geographic distances. Coordinations identified in the surveyed firms include project surveillance (and development); enhancing levels of technological excellence and ability to deal with large scale, complex projects by combining different types of expertise; sharing firm-specific knowledge by multiple segments, such as that associated with project development and financing; and creating a new segment by refining expertise from several other segments.

The analysis has confirmed that E&C firms significantly coordinate the flow of external inputs (external globalization). Half of the surveyed firms source in their home countries and coordinate flow of goods and services worldwide. Also, quite a few firms source goods and services worldwide and coordinate flow of them to projects dispersed worldwide.

Based on these results, many E&C firms have become global -- geographically, internally, and externally -- according to the theoretical framework of globalization of E&C firms has presented in Chapter 3.

The results of the empirical analysis suggest that various kinds of coordination are recognized as significant sources of competitiveness by the sample firms though not as significant as the most well-known, static sources of competitiveness, such as engineering or project management expertise or financial packaging capability. Equally important, the analysis of the results suggested that the static sources of competitiveness are enhanced by the "dynamic" sources of competitiveness inherent in global strategies. These empirical results clearly support the second proposition.

As a background to the framework, both the survey and the interviews indicated that advances in communication technology have helped an E&C firm's headquarters, subsidiaries, and project offices to work together and have enabled the firm to coordinate activities across geographic distances. Furthermore, the patterns of internal communication of the surveyed firms suggest the same categorization of firms identified in the configuration and coordination framework, that is, multi-domestic, "simple global," and "complex global". It is important to remember that the heavy, multi-directional communication by five firms suggest a "new breed" of E&C firms which have flexible network in their organization worldwide.

Based on these results, the proposed theoretical framework has clearly been justified. We can conclude that international E&C firms are global and the top executives of these firms have recognized importance of competitive advantages gained through global strategies. The state of globalization reflected

in the data represents the *status quo* of globalization of all international E&C firms and the entire E&C industry. Taken together, knowledge about the justified framework and the *status quo* of globalization suggest important strategic implications for the globalization of E&C firms.

### 6.3 Strategic Implications for International E&C Firms

#### International Competitiveness

This study suggests that international E&C firms shape their competitiveness not only by expertise and know-how demonstrated at project sites or through the engineering capability of their engineering departments but also on the basis of their organizational systems in terms of where they place various kinds of activities, how they internally coordinate such activities, where they source external inputs (goods, services, labor, and capital) and how they manage the flow of externally sourced inputs. This study also suggests that well-known sources of competitiveness, such as project management capability, can be reviewed from this standpoint. This study has revealed that project management capability largely depends on how well E&C firms' organizational systems internally coordinate the various activities included in project management. In other words, how organizational systems of E&C firms work effectively over large geographic markets not only forms a source of their competitiveness in its own right but also influences other sources of their competitiveness.

However, the recent emphasis on local activities and rising protectionism in many countries may discourage coordination of the flow of tangibles (e.g., goods, subcontractors). Such a mode of competition may be more important in developed countries, in which acquisitions of national firms seem to be becoming popular and E&C firms often compete through acquired national firms as already

indicated by several cases in the U.S. market, such as Jones Group, Inc. acquired by Philipp Holzmann of West Germany, Lehrer McGovern Bovis Inc. by Bovis of the U.K., and Dinwiddie Construction Co. and two others by Fletcher Construction Co. of New Zealand.<sup>1</sup>

Nevertheless, lower coordination of tangibles may be offset by the well coordinated intangibles. The coordination of firm-specific knowledge (e.g., strategic decisions, proprietary engineering expertise, multinational clients common to several geographic markets) may increase their importance as a source of competitiveness.

#### Types of Global Strategies

This research roughly classified international E&C firms into three groups. The first two types of firms are global in three elements, one competing on the basis of efficient operation internally and externally, the other competing on the basis of advantages specific to their home countries (possibly driven by home country sourcing in conjunction with home governments' subsidies). The third type competes on the basis of exceptional knowledge of local conditions derived from a local presence.

The first type of firm may continue to become more efficient (cost and quality) by coordinating internal activities and flow of goods and services sourced at optimal locations and coordinating the flow of such goods and services for its projects distributed worldwide. This type of firm may be very competitive in the countries into which foreign goods and services can be imported, e.g., many developing countries. However, they may have to change their strategy in certain developed countries, such as the U.S., western Europe, and Japan. In these countries, national markets (or regional markets for Europe, especially in

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<sup>1</sup>.ENR (7/13/1989).

anticipation of and after the economic unification) are fairly well developed. In the U.S. market, sourcing may be bound by protectionist regulations, such as the "Buy American" provision. Therefore, as these firms become more global geographically and more involved in the markets in developed countries, they are required to take a more flexible approach.

For the second type of firm, which includes majority of Italian firms, the major markets are developing countries. For these firms, the advantages specific to their home countries (or comparative advantages in a broad sense), including various financial packages, may be greater than the advantages specific to the other two types of firms. Whether such competitive advantages will continue to be effective is a difficult question. On the one hand, it must be emphasized that such a competitive position may not be maintained forever. (Consider the movement of the leading position in the shipbuilding industry from U.K. and other European countries to Japan to Korea). On the other hand, the continuous and dramatic decrease in commercial bank loans and export credits to developing countries after 1981 despite a slight increase in official aid (e.g., ODA - Official Development Assistance)<sup>2</sup> suggests that financing capability, and thus the use of tied loans and export credits by home countries, of E&C firms may become more important. However, the markets of developed countries, which may not require financing for projects, have more competitive firms, and are often colored by more protectionist sentiment. In these situations, strategies emphasizing home country advantages may at least have to be modified. For Italian firms, the unification of European markets may be a good test for how effectively they can adjust themselves to a highly competitive market.

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<sup>2</sup>. OECD (1989)

For the multi-domestic firms, it may become increasingly difficult to compete effectively with the other two types of firms in the developing country markets as more countries liberalize trade of goods and services and other firms become more competitive in cost and differentiation. However, in certain markets, mostly in developed countries, this strategy seems to be essential. Also, firms which do not compete on the basis of strong technological expertise will continue to rely on this mode of competition.

Given the complex environment surrounding E&C firms and the expansion of geographic markets by each firm, it is expected that E&C firms will move toward an increasingly complex mode of foreign operation represented by the "complex global" strategy (as found in several firms in the research) as an optimal solution.

Finally, for Japanese contractors, which have been unique in many respects, the good news for them is the ever increasing amount of ODA from the Japanese government.<sup>3</sup> Also, a rapid increase in foreign direct investment by Japanese firms in other sectors should also help Japanese E&C firms.<sup>4</sup> Furthermore, unless their positions in the huge Japanese market deteriorate immediately, they can afford to finance their own real estate investment. However, they must be cautious to their strategies for several reasons. First, the transformation of strategies and structure of firms of other nationalities are

<sup>3</sup>. ODA from the Japanese government recorded \$7.5 billion in 1987, gained the second after the U.S.(\$8.8 billion), and will increase until 1992 based on the Japanese government's five year plan. (Source: Ministry of General Affairs, Japanese government, 1989)

<sup>4</sup>. Amounts of foreign direct investment by Japanese firms since 1980 are given below.

	1975	1980	1982	1983	1984	1985	1986
Amount (US\$ million)	233	906	364	433	1,489	1,046	2,906

Source: Ministry of International Trade and Industry (1987)

driven by severe competition in the international markets while Japanese firms appear to be moving toward geographic areas and segments with less or no competition (such as E&C related to real estate investment in developed countries). Second, many international E&C firms of other nationalities seem to be becoming increasingly efficient in performing projects in a wide geographic area. In contrast, Japanese firms will not become truly competitive quickly, at least in developing countries, because of their lack of efficient internal systems (e.g., worldwide sourcing capability) and limited commitment to the international markets. Taking these into consideration, whether Japanese contractors will become truly global (even international) firms is very uncertain.

### Organization

The research suggests that the organizational forms of E&C firms have changed significantly as many have started to compete worldwide in a very coordinated way. Although the development of geographic globalization might induce enormous dispersion and duplication of activities at project offices, many functions which might have been performed at project offices have been integrated in a few (or one) locations. Organizational units in such locations are specialized in certain functions and serve the rest of the firm. Duplicated functions are connected to each other and form a network. Then, E&C firms adjust work between units, transmit work from one to the other, and more than make up the complexity arising from geographical globalization.

In this kind of organization, a rigid distinction among project office, subsidiary, and headquarters may no longer be appropriate for modern E&C firms, and a corporate hierarchy characterized by strictly defined functions and authority as well as channels of reporting drawn over a world map may mean less in the next decade and thereafter. While their headquarters are currently



playing a large role, their organizations seem to be becoming increasingly flexible in terms of where in the firm a job is performed. It may not be accidental that Fluor and Bechtel are now both concerned with how to move work to people (e.g., transferring engineering work to wherever engineers are available through telecommunication network) rather than with how to move people to the work. These firms are communicating in multiple directions on a daily basis.

The growth of loosely tied cooperation among firms may also be an indication of the organizational transformation of E&C firms. Covering numerous national markets not only impinges on their overhead costs but simply makes "standardized" operations based on a common approach to many national markets ineffective due to the differences in the competitive, economic, political, cultural, and general business environment in each market. E&C firms will become more flexible in their organizational forms in order to find the best fit for each country. Variations in organizational forms found in the E&C industry as exemplified by an increase in acquisitions in the U.S. market, cooperation between Japanese firms and U.S., European, and Korean firms, and joint ventures in many developing countries are good examples of how this is being done.

Such flexible organizations bear a close resemblance to "global" firms in other industries, such as Corning, which has adopted a "global network" organization, through which it maintains worldwide an interrelated group of businesses with a wide range of ownership structures (joint venture and partnership as well as its own subsidiary) and treats each part of a joint venture as important as working at the hub of the network.<sup>5</sup> E&C firms have, thus, come to resemble manufacturing firms even in organization.

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<sup>5</sup>. The New York Times, 9/24/89.

### Implementation of Global Strategies and Human Resource Management

Implementing global strategies is more difficult than formulating them, as the cases in this study clearly suggest. Difficulty in implementing global strategies is two-fold. First, such an implementation is difficult physically. In addition to the repositioning of people, firms must reconsider their entire operational and administrative systems. Since many modern E&C firms are computerized, computer systems must be made to fit the purposes of global strategies, a demanding task.

Perhaps more important, however, are changes in human resource management. Because in global E&C firms (especially complex or flexible ones) activities performed in one organizational unit affects the activities performed in other units, it is very important for all local managers and employees to share the firms' common goals and values. Consideration of their career opportunity is equally important in a practical sense. Firms must determine what information needs to be shared and disseminated beyond geographic distances and business segments. Moreover, the capability and value perception of top management may considerably influence the speed and extent of such organizational and managerial changes. (Recall the cases of three Korean firms.) The ability to design and manage production well may no longer be a sufficient qualification to become a top manager.<sup>6</sup> A person may have to be capable of sensing the perceptions and behaviors of local managers and employees with different cultural and linguistic backgrounds, for example. Because here may be no easy way to to teach or learn this, the issue will continue to be a major topic for future research.

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<sup>6</sup>. Wall Street Journal, 2/27/89.

### "Defensive" and "Aggressive" Global Strategies

This study has distinguished two kinds of motivations for global strategies, "defensive" and "aggressive". Aggressive globalization refers to the globalization through which a firm enhances competitiveness while defensive globalization means the globalization as a result of a firm's efforts to maintain its competitiveness. The empirical analysis of this study suggests that in most cases E&C firms globalized defensively, particularly in internal and external globalization. (Motivations for geographic globalization are diverse and complex as we have seen.) To understand the process of globalization, it may be meaningful to review the history of international E&C quickly.

International E&C, despite its long history which can be traced back to the 1860s, has truly developed only in the 1970s upon the construction boom in the Middle East. Prior to the time, most of international E&C occurred on the basis of colonial associations or for a few projects (financed by international lending organizations) in developed countries, but the overall size of the market had not been quite large. In addition, only a few firms (e.g., several U.S. firms which built transportation, energy, and oil refinery facilities) had been active truly worldwide in the 1940s through the 1960s. Even in such cases, these firms' ratios of international turnovers for their overall ones remained as high as teens.<sup>7</sup>

The explosive development of the Middle East market completely changed the magnitude and geography of operations of international E&C firms thereafter. It not only made the Middle East market the largest international one but the percussive effects of oil money helped launching numerous ambitious projects in Asia, Africa, and Latin America through international lending organizations. Then, E&C firms which emerged as international firms during the boom expanded

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7. Strassmann et al (1988), p.3.

geographically later, some having expanded aggressively by taking advantage of the expertise and experience acquired during the boom and others (probably majority of such firms) having defensively expanded to other geographic markets upon the decline of the Middle East and other developing markets.

The empirical analysis suggests that many E&C firms globalized internally and externally through the process in which they geographically globalized and faced difficulty in maintaining their competitiveness with their existing management of internal activities and external inputs. In other words, they internally and externally globalized through their defensive efforts to remain competitive in more diverse and complex markets by reorganizing and coordinating internal activities and external inputs. In other words, it is considered that firms which have not geographically globalized or have not compete seriously in the international markets may not recognize the importance of global strategies, and thus that they may not globalize.

## 6.4 Suggestions for Future Research

This study has rejected the widely prevailing model of international E&C firms competing on a country-by-country basis (multi-domestic competition) and has demonstrated that they, in fact, have been competing worldwide in a coordinated way. However, it must be emphasized that this research is only a first attempt to analyze the competitiveness of international E&C firms in terms of how the firms organize themselves for international production of E&C over a large geographic area so that this study may have captured only a part of the modern E&C firms. However, it has been found that there are several promising future research opportunities in this brand new area.

1. More Activities. This research has considered sourcing activities and financial activities only in order to examine the extent of coordination of internal activities. Although the two kinds of activities were sufficient for the purpose of this research, this investigation does not provide an overall picture of their international production. Examining the configuration and coordination of more (all, if possible) activities would provide a more vivid picture of the production process of international E&C firms under global strategies.

2. Longitudinal Research. The status quo for globalization of E&C firms provided in this research is a "snap shot" as of early 1989. Furthermore, combined with the fact that no study of this kind has existed before, it is hard to determine when and how E&C firms have transformed their operations from multi-domestic to global. A similar study, using the same framework, in three to five years from now, would show the dynamic process of transformation of E&C firms either towards more globalization or possibly towards some newer forms. Such a study would show the ways in which a firm's strategy and structure may change as its environment

changes and may be especially useful because the speed of such changes seems to be ever increasing.

3. More Management Study. This research has shown that the general direction for changes in firms' strategies and structures may be determined by economic rationales whereas actual decision making together with the extent of such changes is often determined by factors specific to each firm, especially management's ability to perceive the value of certain strategic decisions and the firm's historical, internal development relative to changes in its environment. More management study should provide a richer discussion of globalization.

4. More Organizational Study. Related to the point above, the concept of configuration versus coordination is concerned with how a firm organizes the production process internally in conjunction with inputs to it. In other words, it is more an organizational study than an exercise in production economics. Examining more rigorously the inside of an E&C firm from an organizational point of view and in the international context would further disclose the organizational capability of the firm as a crucial source of international competitiveness. Also, such an approach would fortify the results of this research, which has placed more emphasis on strategy formulation than on implementation.

5. Quantitative Measurement of Coordination. This study has attempted to quantify as much of the analytical procedures as possible. However, analyzing certain variables, such as the extent of coordination, was still performed qualitatively. More rigorous quantification would facilitate this kind of research in the future.

6. Other Participants in International E&C. This study has focused on the major players in international E&C, contractors and engineeringing contractors.

However, it has also shown that the extent of globalization of E&C firms is influenced by the extent and types of globalization of inputs, such as suppliers, subcontractors, financial institutions. Viewing the globalization of E&C firms from the view point of other participants in international E&C would be a very promising area of research.

7. Measurement of Competitiveness. It is theoretically and practically interesting to know the extent to which global strategies are effective in enhancing E&C firms' competitiveness in "real term," that is, in acquiring contracts. Unfortunately, however, conventional measures of competitiveness are by no means adequate. For example, an amount of contract is a function of several variables, e.g., extent of diversification of the firm and types of contracts. Also, a market share figure of a particular firm for a specific segment is not available. (Even, a size of international markets for each segment is not available.) To achieve this, more studies rigorously addressing the competitiveness of E&C firms are essential.

8. External Globalization and Diversification. Finally, it is worth mentioning that the model of globalization, which is basing essential elements on the model of globalization in manufacturing industry but takes into account of the idiosyncratic final products and international production process in the engineering and construction industry, might suggest an inclusion of external globalization and internal globalization associated with product diversification, for certain manufacturing industries. External globalization would be important for firms in the industries which require significant intermediate inputs of goods and services. Moreover, as firms in other industries increase dependency on external markets (or firms) for production, importance of external globalization would increasingly influence their overall competitiveness. Also, for firms which

diversify into several segments, global strategies may be more complex and firms may experience more difficulty in gaining benefits from adopting and implementing global strategies across different segments. This issue might be crucial for the firms hoping to become more competitive or stay competitive internationally since many firms actually are diversified.

The author would be very happy if this research serves as a catalysis for future researches in these areas.



## Appendix A

### Correlation Analysis for the Three Variables Associated with Globalization

Based on the data obtained from the sample firms, I attempted correlation analysis for the three variables which have frequently appeared in this research, 1) extent of geographic globalization, 2) configuration of internal activities, and 3) extent of internationalization.

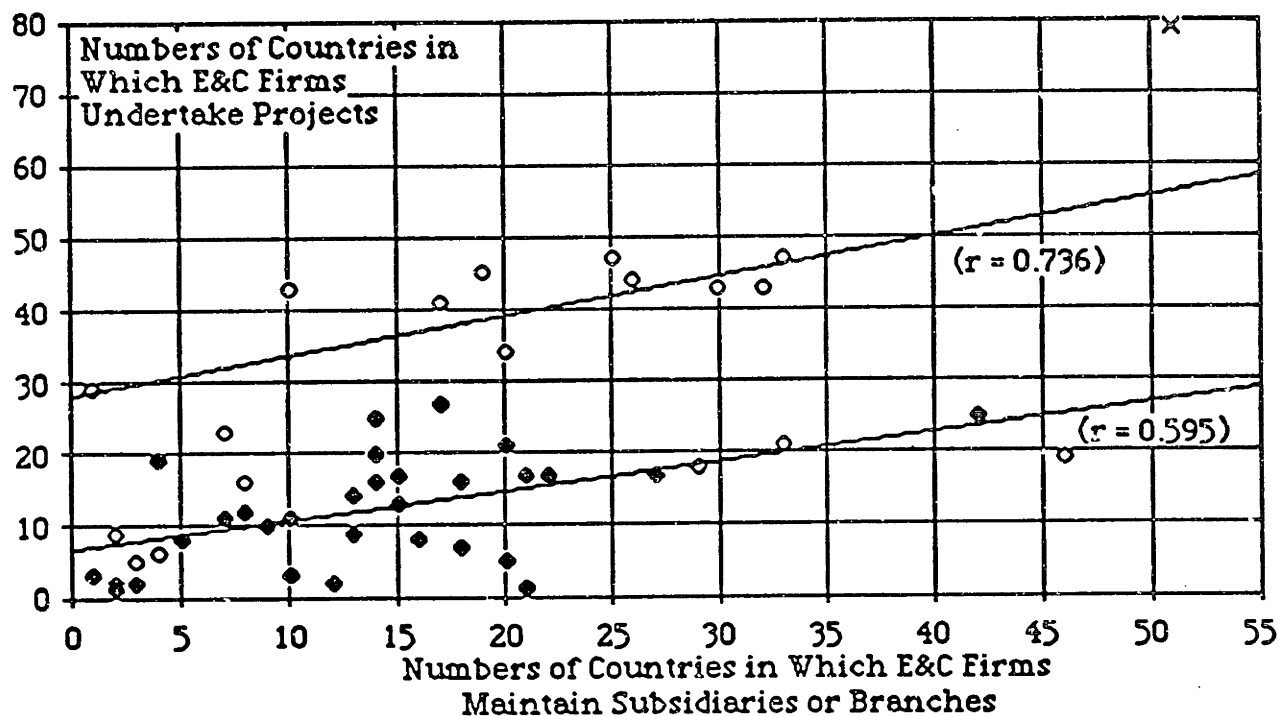
#### 1. Relationship between Extent of Geographic Globalization and Configuration of Internal Activities

Exhibit A-1 demonstrates the relationship between extent of geographic globalization measured by the number of countries in which the surveyed E&C firms undertook projects in 1987 and configuration of internal activities measured by the number of countries in which they had foreign subsidiaries or branches in the same year.

The correlation coefficient ( $r$ ) for all the firms was nearly zero ( $r = 0.016$ ), suggesting that there is no distinctive relationship between the two variables. However, a visual observation of the diagram suggests that there are two distinct groups of firms, one at the upper part of the diagram and the other at the lower part, each plotted from the lower left to upper right. There is a significant correlation between the two variables for the 11 firms in the upper group (-- correlation coefficient  $r = 0.736$  --). Correlation is also fairly strong, though less significant, between the two variables for the firms in the lower distribution (--  $r = 0.595$  --). The linear regression lines are also given in the exhibit.

## Exhibit A-1

Relationship between Extent of Geographic Globalization (Number of Countries in which the E&C Firms Undertook Projects in 1987) and Configuration of Internal Activities (Number of Countries in which They Had Foreign Subsidiaries or Branches in the Same Year)



Note: Black squares indicate contractor-type firms, white squares engineer-type firms, and "x" statistical outliers. The firms with identification numbers form the upper linear regression line while those with no numbers (but eliminating the statistical outliers) form the lower linear regression line. Correlation coefficient for each linear regression line is given in parentheses below the line.

Source: Questionnaire and publicly available brochures of the surveyed firms

It must be noted that the firms in the upper group are all engineering contractors. They account for 63 percent of the engineering contractors in the sample. In contrast, contractors are all in the lower group, accounting for 83 percent of the firms forming the lower group.

Equations for the two linear regression lines are:

$$N_p = 0.546 \times N_s + 28.993 \quad (\text{Upper line})$$

$$N_p = 0.418 \times N_s + 5.951 \quad (\text{Lower line})$$

Note:  $N_p$  denotes number of countries in which firms undertake projects while  $N_s$  denotes number of countries in which they maintain foreign subsidiaries or branches.

The equations suggest several things. First, as the number of countries in which E&C firms maintain foreign subsidiaries or branches increases, the number of countries in which they undertake projects increases, and vice versa. In other words, for a firm to geographically globalize (or capture a large geographic market), it must place its internal activities (or it must have local presence) in a large geographic areas. Roughly, a local presence in two countries seems to assure gaining a contract in one country each year.

Second, given the same number of countries in which subsidiaries or branches are established, the engineering contractors in the upper group acquire projects in a larger number of countries than contractors and other engineering contractors in the lower group. For example, having established 30 foreign subsidiaries or branches, the upper firms were able to obtain projects in approximately 45 countries while the lower firms obtain projects in about 18 countries. In other words, the upper firms serve foreign markets through an export mode more frequently than the lower firms, and thus, rely less on "local presence". Ideally, without any foreign subsidiaries or branches, the firms in the upper group would acquire projects in about 29 countries while the firms in the lower group in only 6 countries. Notice the points where the two linear regression lines intersect the vertical axis or the constants in the formulas.

Third, the relation between the two variables clearly supports the argument in the main text that the surveyed E&C firms are not truly restricted by

tariff and non-tariff barriers despite their potential to affect the firms' foreign operation greatly. Most E&C firms have already established local presences to assure acquisition of projects in the countries they have targeted. Such local presences seems to have minimized the effects of the trade barriers and helped firms to acquire projects in the countries.

## 2. Relationship between Configuration of Internal Activities and Degree of Internationalization

Exhibit A-2 provides an interesting relation between configuration of internal activities measured by numbers of countries in which firms maintain subsidiaries or branches and extent of internationalization measured by values of foreign contracts obtained.<sup>1</sup> and numbers of subsidiaries and branches. The outcome supports the conclusions in the previous discussion.

Although there is no correlation between the two variables for all the surveyed firms, two different groups of firms may be visually identified in the diagram. Firms in the upper group (those with identification numbers) include eight engineering contractors (eliminating the four firms indicated by "x" in the diagram as statistical outliers) while the lower group is comprised of 40 firms which are mostly contractors. The distribution of the firms in the two groups indicates a fairly strong linear relationship between the two variables ( $r=0.628$  for the upper group and  $r=0.653$  for the lower group). Equations for the two regression lines are:

$$F\$ = 23.550 \times N_s + 697.465 \quad (\text{upper line})$$

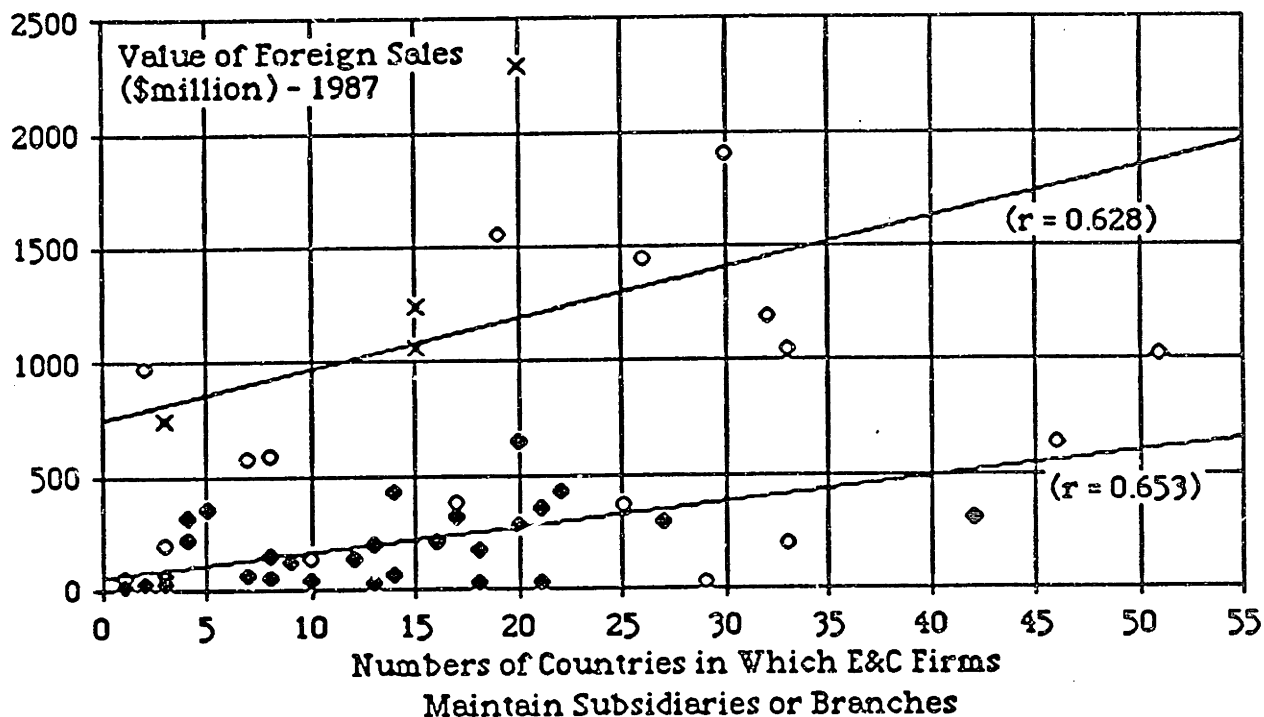
$$F\$ = 11.272 \times N_s + 43.127 \quad (\text{lower line})$$

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<sup>1</sup>. Amount of foreign contracts are erection value of facilities involved in contracts given by Engineering News Record.

Note: F\$ denotes foreign contracts won at erected values of falsities and Ns numbers of countries with foreign subsidiaries and branches.

Exhibit A-2 Relationship between Foreign Sales and Numbers of Countries in Which E&C Firms Maintain Subsidiaries or Branches



Note: Black squares indicate contractor-type firms, white squares engineer-type firms, and "x" statistical outliers. The firms with identification numbers form the upper linear regression line while those with no numbers (but eliminating the statistical outliers) form the lower linear regression line. Correlation coefficient for each linear regression line is given in parentheses below the line.

Source: Questionnaire, Engineering News Record (7/7/88), and publicly available brochures of the surveyed firms

The two regression lines suggest the following. First, in general an increase in geographic configuration of internal activities, or local presence, increases the extent of internationalization.<sup>2</sup> Another interpretation is that firms

<sup>2</sup> Firms 1, 5, 7, and 11 are eliminated. The peculiarity of Firm 1 is obvious by visual observation of the diagram. The position of Firm 1 may be the result of an extremely efficient system. But it is more likely that the value conversion of Firm 1's contract (which is mostly based on CM -- construction management --

must expand the configuration of their internal activities in order to raise the amount of their contracts.

Second the engineering contractors in the upper group seem to gain leverage in acquiring foreign contracts from establishing foreign subsidiaries or branches. The firms in the upper group acquire approximately \$23.5 million of foreign contracts annually by setting up a new subsidiaries or branches while the firms in the lower acquire about half (\$11.2 million, annually) through an extra subsidiary or branch.<sup>3</sup> Theoretically, without any subsidiaries or branches, the firms in the upper group could acquire about \$700 million in foreign contracts whereas the firms in the lower group could acquire only \$43 million. Also, given 20 subsidiaries, firms in the upper group would obtain about \$1,200 million in foreign contracts while the lower firms would obtain only \$250 million.

Third, similar to the previous analysis (relationship between configuration of internal activities and geographic globalization), this result seem to support the argument in the main text that E&C firms may have overcome various trade barriers by extensive "local presence".

### 3. Relationship between Geographic Globalization and Internationalization

Finally, Exhibit A-3 demonstrates the relationship between the extent of geographic globalization measured by the numbers of countries in which E&C firms undertake projects and extent of internationalization measured by the value

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contracts) to erection value of facilities involved in the contracts may be inappropriate. Firms 5 and 7 are Japanese contractors known for their involvement in projects related to real estate development. However, as pointed out in the main text, their project management practices (assigning most activities to subcontractors) in such contracts seem not to be equivalent to that of conventional project management. Reasons for the position of Firm 11, which is a U.S. contractor, cannot be determined due to the lack of data.

<sup>3</sup>. As defined earlier, these figures are erection value of facilities given by ENR as defined earlier.

of foreign contracts acquired by these firms. Once again, despite the insignificant correlation between the two variables for all sample firms (--  $r=0.004$  --), significant correlations were found in two groups of firms determined by visual observation of the diagram. The engineering contractors in the previous analysis are in the upper group of the diagram again, and other firms, mostly contractors, are plotted in the lower group. Correlation coefficients of the two variables are given as  $r=0.770$  for the upper group and  $r=0.646$  for the lower group. Equations for each linear regression line are:

$$F\$ = 24.357 \times N_p + 416.728 \quad (\text{upper line})$$

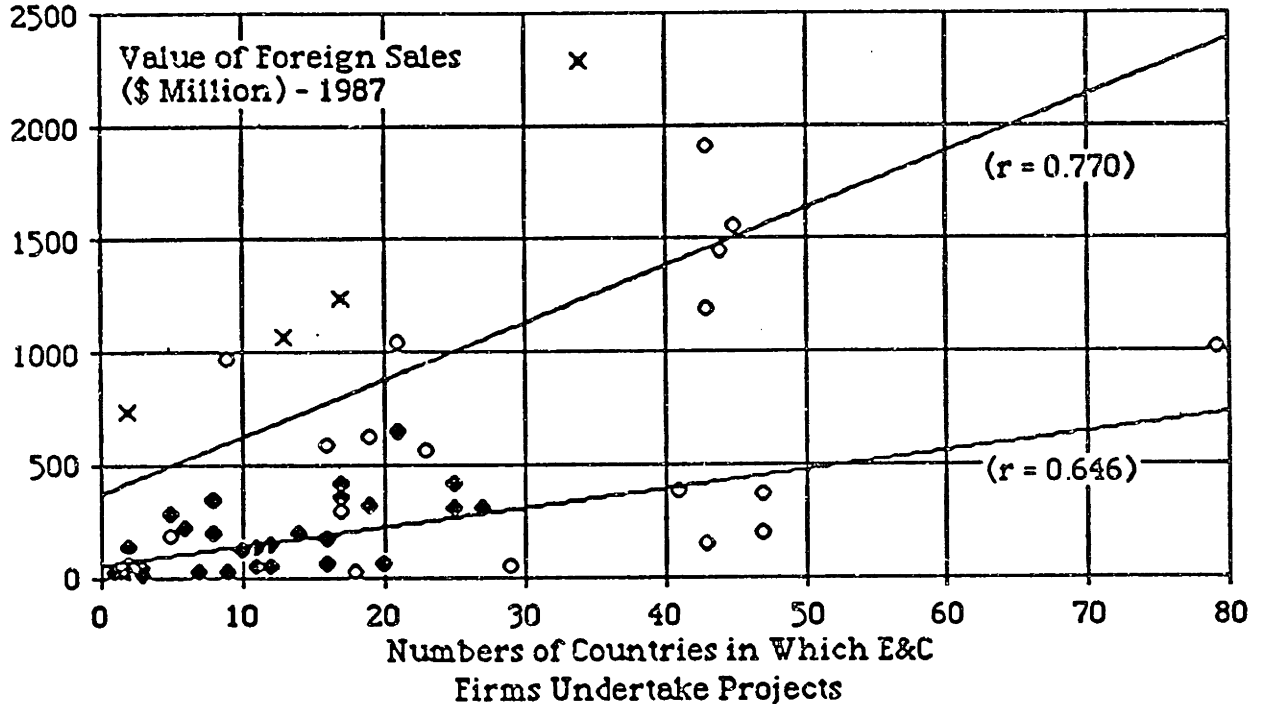
$$F\$ = 8.443 \times N_p + 72.973 \quad (\text{lower line})$$

Note: F\$ denotes foreign contracts won at erected values of falsities and  $N_p$  denotes numbers of countries in which E&C firms undertake projects.

The correlation between the two variables suggests that larger geographic globalization assures E&C firms a greater value in contracts. In other words, firms geographically globalize in order to raise their volume of contracts. Similar to the previous analysis, this correlation shows that the engineering contractors in the upper group gain more contract value for a marginal geographic market. As the upper firms capture one additional national market, they acquire \$24.4 million. In contrast, contractors acquire only \$8.5 million for each additional national market. This result appears to suggest that the amount of each contract acquired by an engineering contractor acquire is three times larger than for a contractor assuming the firms in the two groups gain the same number of contracts in a marginal national market. Thus, when firms capture 20 national markets, engineering contractors acquire \$900 million in contracts while contractors acquire only \$250 million. Thus, the effect of raising the amount of foreign

contracts seems to be larger for engineering contractors than for contractor-type firms.

Exhibit A-3 Relationship between Foreign Sales and Numbers of Countries in Which E&C Firms Undertake Projects



Note: Black squares indicate contractor-type firms, white squares engineer-type firms, and "x" statistical outliers. The firms with identification numbers form the upper linear regression line while those with no numbers (but eliminating the statistical outliers) form the lower linear regression line. Correlation coefficient for each linear regression line is given in parentheses below the line.

Source: Questionnaire, Engineering News Record (7/7/88), and publicly available brochures of the surveyed firms



#### 4. Summary of Correlation Analyses and Implications for the Study of Globalization

The three correlation analyses seem to suggest the following:

- 1) Geographic expansion of configuration of internal activities, or local presence, measured by the number of countries in which firms maintain foreign subsidiaries or branches help them to raise the amount of foreign contracts. However, the leverage effect is much larger for many engineering contractors than for contractors due primarily to the size of projects undertaken by each type of firm. A marginal increase in foreign subsidiaries or branches provides an increase of \$23 million annual foreign contracts for engineering contractors while compared to only \$11 million for contractors.
2. An increase in the extent of geographic globalization measured by numbers of countries in which E&C firms undertake projects also helps them to raise the amount of foreign contracts. However, the addition of each national market provides \$24 million in foreign contracts annually to engineering contractors but only \$8 million to contractors.
3. Geographic expansion of the configuration of internal activities increases the extent of geographic globalization of E&C firms. Regardless of the types of firms, the addition of a local presence in two countries assures the acquisition of contract(s) in one of the country.
4. Engineering contractors are more export oriented and rely less on competition on the basis of local presence than contractors primarily because of the greater importance of engineering (rather than management) for the engineering contractors.
5. E&C firms appear to have overcome barriers to trade by establishing local presences in many countries.

The result of these three correlation analyses illuminates another facet of globalization and provides a practical basis for the argument in the main text. First, geographic globalization seems to be best exploited by establishing a local presence. Relying only on export mode has a limit mode of exploiting geographic globalization.

Second, when a firm seeks geographic globalization (or the expansion of its market geographically), the firm necessarily faces a dispersion of internal activities (not at the project level but at the subsidiary or branch level). At this point, the firm possibly may have to tackle more coordination problems (e.g., more duplication in activities and more difficulty in linking vertically integrated activities). The problem may be larger for contractors, whose basis for competition relies on a local presence.

Third, (related to the second point) as a firm's activities are dispersed by geographic globalization, many of roles of a firm's foreign subsidiaries and branches may be stripped away and integrated in fewer locations in much the same way as the roles of project offices have changed. Otherwise, a looser form of local presence, such as cooperation with local firms or partial investment in local firms (or firms jointly established with local firms), may be adopted.

## Appendix B

### Questionnaire Text

*\* If you are uncomfortable answering to any question, please leave it blank.*

*\* For a diversified firm, please answer to the questions with respect to the business unit which carries out construction-related activities.*

#### Part I: International Operations and Construction Markets

##### Incentives for international operations

Q1. What was (were) the initial incentive(s) for your firm's involvement in international operations? Please rate each statement by circling the number, in terms of how important each incentive was initially. (1=unimportant --> 5=very important)

	Not as important			Very important
1) Size or growth potential of foreign markets	1	2	3	4 5
2) More profitability expected in foreign markets	1	2	3	4 5
3) To take advantage of lower cost than competitors	1	2	3	4 5
4) To take advantage of technological or management expertise	1	2	3	4 5
5) By invitation from a home country client	1	2	3	4 5
6) Competitors in home market that went abroad	1	2	3	4 5
7) Others [specify:	1	2	3	4 5]

Q2-1. To what extent are international markets important for your firm at present? Please indicate their importance for your firm by circling the appropriate number.

Unimportant	unclear	Important	Very important
1	2	3	4

**Q2-2.** If you have chosen 1 or 2 in the previous question Q-1, what is (are) the reason(s)? Please rate the significance of each factor by circling the appropriate number.(1=not as important --> 5=very important)

	not as important			very important	
1) Stagnant or shrinking foreign markets	1	2	3	4	5
2) Low level of profitability in foreign markets	1	2	3	4	5
3) Harsh competition in foreign markets	1	2	3	4	5
4) Have lost cost competitiveness	1	2	3	4	5
5) Have lost leading edge in technology or management in foreign markets	1	2	3	4	5
6) Trade barriers in foreign markets	1	2	3	4	5
7) Capacity is fully used for domestic markets	1	2	3	4	5

**Q2-3.** If you have chosen 3 or 4 in question Q-1, what is (are) the reason(s)? Please rate the importance of each factor by circling the appropriate number.

	Not as important			Very important	
1) Size or growth potential of foreign markets	1	2	3	4	5
2) More profitability abroad	1	2	3	4	5
3) To take advantage of lower cost than competitors	1	2	3	4	5
4) Opportunity to take advantage of technological or managerial expertise abroad	1	2	3	4	5
5) Financial capability enabling to win contracts	1	2	3	4	5
6) Increasing home country multinational clients abroad	1	2	3	4	5
7) Reputation or prestige of your firm	1	2	3	4	5
8) To raise total volume of construction	1	2	3	4	5
9) Competitors in home market are in foreign markets	1	2	3	4	5
10) Foreign operations offset fluctuations in demand and profit in domestic construction	1	2	3	4	5
11) Globally distributed operations, if managed as a single organ by headquarters, would create benefits which would not be obtained from either only domestic operations or performing foreign operations on a stand-alone basis	1	2	3	4	5

Q2-4. How important will foreign markets be for your firm in the next 10 years, compared to at present. Please rate their importance by circling the appropriate number.

Less important than at present	About the same	More important than at present
1	2	3

Barriers to trade - regulations and restrictions

Q3. In your firm's experience in international operations, to what extent did the following regulations and restrictions hamper your firm's international operations? Please rate the significance by circling the appropriate number.

	not as significant	.			very significant
<u>Regulations and differences in regulations</u>					
1) Differences in standard and specification for materials and equipment by country	1	2	3	4	5
2) Reciprocity of professionals' qualification between governments	1	2	3	4	5
3) Differences in bidding procedures, registration of firms, authorization to perform work by country	1	2	3	4	5
<u>Treatment of foreign firms</u>					
4) Unequal taxation of foreign firms	1	2	3	4	5
5) Restrictions on repatriation of profits	1	2	3	4	5
<u>Trade distorting measures</u>					
6) Restriction of the use of imported materials, machinery, and equipment as well as local content requirements	1	2	3	4	5
7) Duties imposed on imported materials and equipment	1	2	3	4	5
8) Governments' subsidies to local firms	1	2	3	4	5
<u>Discriminations against foreign firms/Market access</u>					
9) Difficulty of temporary movement of personnel as well as of getting working visas	1	2	3	4	5
10) Nationalistic awarding of contracts	1	2	3	4	5
11) Requirement to hire local subcontractors, or to form joint ventures with local firms, or to					

employ nationals	1	2	3	4	5
<u>Miscellaneous</u>					
12) Forced unfair pricing or dumping or unfair payment schedules	1	2	3	4	5
13) Markets are closed because of tied-aid agreement by governments	1	2	3	4	5
14) Collusive tendering	1	2	3	4	5

Multinational Clients

Q4. Construction firms might be able to get contracts in more than one country from the same multinational clients, which operate in multiple countries. Please check types of multinational clients, if any. In addition, if any such client originates from your home country, please also check them.

- |  |   |   |       |
|--|---|---|-------|
| 1) Private clients   | [ | ] | home? |
| 2) Public clients  |   |   |       |
| -- Governments or its agents, such as US corps of engineers  | [ | ] |       |
| -- International public financing agencies which may not be clients but influence clients' decisions, such as World Bank, Asian Development Bank | [ | ] |       |

Multinational Competitors

Q5. This question concerns the degree of your firm's repeatedly encountering the same competitors. Please indicate how often your firm is bidding against the same "global" competitors by circling the appropriate number.

Not at all	Sometimes	Often	Very often	Always
1	2	3	4	5

Incentives for forming a joint venture

Q6. A joint venture (JV) is frequently used in international construction. In your firm's past experiences, please rate the following factors in terms of how important these factors were as the driving force(s) of forming JV, by circling the appropriate number.

- |  |                  |   |   |   |                |
|--|------------------|---|---|---|----------------|
|  | not as important |   |   |   | very important |
| 1) Features of a project relative to your firm's expertise (complementarity of the JV partner) | 1                | 2 | 3 | 4 | 5              |
| 2) Size of a project relative to risks involved  | 1                | 2 | 3 | 4 | 5              |

3) Enhancing a degree of qualification to be nominated	1	2	3	4	5
4) Level of familiarity to the location of a project	1	2	3	4	5
5) Government requirement	1	2	3	4	5
6) Past relation with the JV partner	1	2	3	4	5
7) Cooperation agreement with the possible JV partner	1	2	3	4	5
8) Gaining more bond capacity	1	2	3	4	5
9) Others [Please specify:	1	2	3	4	5]

Where to find JV partners

Q7. Nationalities of joint venture partners also vary, depending on the incentives just listed in the previous question. For the most recent important foreign JV project in which your firm was engaged, please circle the appropriate number, in terms of where your firm has found your JV partners.

in the country where the site is located	in the region where the site is located	worldwide	from home country
1	2	3	H

Importance of mergers and acquisitions, and coalitions

Q8. How important are merger and acquisition of foreign firms and listed types of coalitions for your firm? Please rate their importance by circling the appropriate number.

	not as important			very important
1. Mergers and acquisitions of foreign multinationals including partial acquisitions	1	2	3	4 5
2. Mergers and acquisition of local firms	1	2	3	4 5
3. Long-term coalition with foreign multinationals	1	2	3	4 5
4. Long-term coalition with local firms	1	2	3	4 5

Part II: Procurement-Subcontractors/Suppliers/ManufacturersWhere to find subcontractors/suppliers/manufacturers

Q9. For the three most recent important foreign projects, please circle the appropriate number for the following types of items, in terms of where your firm has found these firms for the last three international projects.

	in the country where the site is located	in the region where the site is located	worldwide	from home
<u>Subcontractors for:</u>				
1) Unskilled labor	1	2	3	H
2) Civil works	1	2	3	H
3) Mechanical work	1	2	3	H
4) Electrical work	1	2	3	H
<u>Suppliers/Manufacturers for:</u>				
1) Bulk materials	1	2	3	H
2) Manufactured materials	1	2	3	H
3) Electrical equipment	1	2	3	H
4) Electronic equipment	1	2	3	H
5) Heavy equipment	1	2	3	H

How to find subcontractors/suppliers/manufacturers

Q10. How has your firm found subcontractors, suppliers, and manufacturers in the international operations? Please rate each of the following ways to find these firms, in terms of how important they are for your firm.

	not as important				very important
1) Past experiences working with or using these firms accumulated at headquarters	1	2	3	4	5
2) Owners' preferences	1	2	3	4	5
3) Design firm's preferences	1	2	3	4	5
4) Advertisement by local newspapers, magazines, trade organizations	1	2	3	4	5
5) Introductions by local firms, such as consultants, quantity surveyors, accounting firms, etc.	1	2	3	4	5
6) Introductions by home country firms already active in the host country, such as banks, trading firms, etc.	1	2	3	4	5



- |  |   |   |   |   |    |
|--|---|---|---|---|----|
| 7) Subcontractors' own marketing efforts | 1 | 2 | 3 | 4 | 5  |
| 8) Others [Please specify:               | 1 | 2 | 3 | 4 | 5] |

Who finds subcontractors, suppliers, and manufacturers?

Q11. Please indicate which unit of your organization -- local site, subsidiary, or headquarters -- has found the following in the three most recent important projects in which your firm was engaged, by circling the appropriate number.

Subcontractors for:

	Local site	Subsidiary	Headquarters
1) Unskilled labor	1	2	3
2) General civil works	1	2	3
3) Mechanical work	1	2	3
4) Electrical work	1	2	3

Suppliers/Manufacturers for:

1) Bulk materials	1	2	3
2) Manufactured materials	1	2	3
3) Electrical equipment	1	2	3
4) Electronic equipment	1	2	3
5) Heavy equipment	1	2	3

Part III: CommunicationIntra-firm communication

Q12. How often did your firm's site offices and subsidiaries regularly report to superior organizations in the three most recent recent important foreign projects? Also, how often did the site offices and subsidiaries communicate with superior organization on a "as-needed" basis, including a key person's trip? Please circle the appropriate number.

about several about about about almost  
 once times once once twice daily  
 a yr a yr a mon a wk a wk

Regular report

Site office --> Headquarters	1	2	3	4	5	6
Site office --> Subsidiary	1	2	3	4	5	6
Subsidiary --> Headquarters	1	2	3	4	5	6

Communications on a "as-needed" basis

Site office <--> Headquarters	1	2	3	4	5	6
Site office <--> Subsidiary	1	2	3	4	5	6
Subsidiary <--> Headquarters	1	2	3	4	5	6

Importance of information

Q13. As to many kinds of information exchanged among headquarters, subsidiaries, and site offices, please rate the importance of each of the following types of information by circling the appropriate number.

	not as important				very important
1) Market surveillance	1	2	3	4	5
2) Project targeting, and bidding strategy	1	2	3	4	5
3) Financial positions of the site office or subsidiary	1	2	3	4	5
4) Foreign exchange transactions	1	2	3	4	5
5) Work progress and scheduling	1	2	3	4	5
6) Subcontracting and procurement	1	2	3	4	5
7) Technical matters	1	2	3	4	5
8) Personnel management or recruiting	1	2	3	4	5
9) Others [specify:	1	2	3	4	5]

Effects of information/communication technology advance

Q14. The recent advance in information and communication technology (e.g. networking on microcomputers, data communication, and multiple share of database and CAD operation) has been reshaping sources of competitiveness in many industry.

Please rate the significance of the effects of the information and communication technology advance for your firm by circling the number.

	not as significant				very significant
1) Cost reduction by such technology's replacing intra-firm movement of human resources	1	2	3	4	5
2) Cost reduction by processing at headquarters all data collected from foreign sites and subsidiaries	1	2	3	4	5
3) More effective cooperation among headquarters, subsidiaries, and site offices for project information exchange and bidding	1	2	3	4	5
4) Local offices' easier and more effective access to centralized resources, such as technical data, drawings and so on	1	2	3	4	5
5) Headquarters' tighter control of local operation	1	2	3	4	5
6) Others [specify:	1	2	3	4	5]

Part IV: International Financial Management

Sources and uses of funds and their decision making

Q15. For each type of the listed uses of funds in the left vertical column, please indicate which organizational units sources and pays funds by putting S for sourcing, P for paying, and D for decision making. For 7, 8, and 9, please answer for only decision making. (Sourcing includes utilization of a clients' payment.)

	Site office	Subsidiary	Headquarters
<i>[Example] Quantity survey</i>	<i>P</i>		<i>S, D</i>
<i>Funds for quantity survey were sourced at headquarters and were sent to the site office and finally the site office paid for quantity survey. And, headquarters holds decisions for sourcing and paying .</i>			

	Site office	Subsidiary	Headquarters
--	-------------	------------	--------------

1. Bonds
2. Insurance
3. Equity participation
4. Payment to subcontractors
5. Payment to suppliers and manufacturers
6. Day-to-day payments (to workers, staff, etc.)
7. Local borrowing
8. Utilization (deposit or repatriation) of local funds and surplus
9. Foreign exchange transactions

Hedging foreign exchange risks

Q16. Please indicate how important the following measures for hedging foreign exchange risks were for your firm by circling the appropriate number.

	not as important				very important
1) Change sourcing countries for procurement according to exchange rate fluctuations	1	2	3	4	5
2) Use financial instruments to hedge exchange rate fluctuations, such as currency swaps, options, and forward contracts in accordance with contracts	1	2	3	4	5
3) Borrow in local currencies	1	2	3	4	5
4) Target projects in countries where the exchange rate of local currency is stable	1	2	3	4	5

- |   |   |   |   |   |    |
|---|---|---|---|---|----|
| 5) Balance foreign and domestic works according to relative strength of home currency | 1 | 2 | 3 | 4 | 5  |
| 6) Delay or speed-up financial transactions between headquarters and local sites      | 1 | 2 | 3 | 4 | 5  |
| 7) Others [specify:   | 1 | 2 | 3 | 4 | 5] |

Effects of headquarters' control of financial transactions

Q17. Please rate the importance of control by the headquarters in international financial transactions in your firm for the following objectives by circling the appropriate number. (1=not as important --> 5=very important)

- |  | not as<br>important |   |   |   | very<br>important |
|--|---------------------|---|---|---|-------------------|
| 1) reduce overall corporate tax                          | 1                   | 2 | 3 | 4 | 5                 |
| 2) reduce foreign exchange risks                         | 1                   | 2 | 3 | 4 | 5                 |
| 3) increase overall returns on deposits or investment    | 1                   | 2 | 3 | 4 | 5                 |
| 4) More effective intra-use of surplus funds             | 1                   | 2 | 3 | 4 | 5                 |
| 5) obtain funds with lower interest rates for local uses | 1                   | 2 | 3 | 4 | 5                 |
| 6) other objectives [please specify:                     | 1                   | 2 | 3 | 4 | 5]                |

Effects of globalization of financial markets

Q18. Please indicate how significant the effects of the globalization (worldwide linkage) of financial markets have been for your firm by circling the appropriate number.

- |  | not as<br>significan |   |   |   | very<br>significant |
|--|----------------------|---|---|---|---------------------|
| The globalization of financial markets has:  |                      |   |   |   |                     |
| 1) Facilitated (or forced) headquarters' central control of worldwide financial transactions   | 1                    | 2 | 3 | 4 | 5                   |
| 2) Facilitated headquarters' access to world financial markets   | 1                    | 2 | 3 | 4 | 5                   |
| 3) Facilitated local offices' (subsidiaries and site offices') access to world financial markets   | 1                    | 2 | 3 | 4 | 5                   |
| 4) created more competitive climate in the world construction markets by levelling off many firms' competitive ground in the finance portion | 1                    | 2 | 3 | 4 | 5                   |

5) Increased the competitiveness of firms with well developed financial markets at home over firms from countries with less developed financial markets

1 2 3 4 5

Part V: Technology/Know-how in International Construction

Importance of technology

Q19. Technology and know-how are very important factors for competition. They may be broadly defined as numerous kinds of knowledge with varying degree of engineering, project-management, and organization-wide management contents. Each type of knowledge may be combined with and embodied in either individuals, systems spanning whole corporate organizations, and equipment or machines for specific purposes.

In your belief, how important are the following kinds of technology or know-how for your firm? Please rate their importance by circling the number.

Not as  
important

very  
important

Engineering knowledge

- |  |   |   |   |   |   |
|--|---|---|---|---|---|
| 1) Broadly applicable general engineering knowledge  | 1 | 2 | 3 | 4 | 5 |
| 2) Engineering knowledge for dealing with a specific type of structure, soil/rock, and facilities  | 1 | 2 | 3 | 4 | 5 |
| 3) Application of CAD (Computer-aided-design) system tailored to your firm's operation in engineering, architectural design, and cost estimate | 1 | 2 | 3 | 4 | 5 |

Project management knowledge

- |   |   |   |   |   |   |
|---|---|---|---|---|---|
| 4) General project management skills and techniques   | 1 | 2 | 3 | 4 | 5 |
| 5) Project management skills and techniques for constructing large, complicated facilities, and/or high-tech facilities | 1 | 2 | 3 | 4 | 5 |
| 6) Computer-aided project management skills and techniques tailored to your firm's operation                            | 1 | 2 | 3 | 4 | 5 |

Systems, Equipment and machines

- |   |   |   |   |   |   |
|---|---|---|---|---|---|
| 7) Use of data resources (drawings, data for materials prices, budget, etc.) by multiple organizational units (including foreign units) within the firm | 1 | 2 | 3 | 4 | 5 |
| 8) Proprietary high-tech equipment, such as unattended tunnel boring machine with   |   |   |   |   |   |

preprogrammed control software	1	2	3	4	5
<u>Corporate management know-how</u>					
9) Know-how of managing whole foreign activities for the worldwide-base competition	1	2	3	4	5

Where to obtain technology

Q20. Please rate to what extent your firm has relied on the following possible sources of technology or know-how by circling the appropriate number. (1=none; 2=little; 3=moderate; 4=substantial; 5=heavy)

	none		moderate		heavy
1) Corporate research laboratory or in-house personnel	1	2	3	4	5
2) Engineering firm you hire or work with	1	2	3	4	5
3) JV partner	1	2	3	4	5
4) Customer	1	2	3	4	5
5) Subcontractor	1	2	3	4	5
6) Material supplier/manufacturer	1	2	3	4	5
7) Equipment supplier/manufacturer	1	2	3	4	5
8) Outside research organization	1	2	3	4	5
9) Learning by doing/experience	1	2	3	4	5
10) Other sources [specify:	1	2	3	4	5]

Future perspectives for technology

Q21. What is your firm's attitude for the utilization of emerging future technology? Please indicate how you agree with the following attitude by circling the appropriate number. (1=least likely --> 5=most likely)

	least likely				most likely
1) Develop proprietary technology, high-tech equipment or systems either in-house or with other firm, and tailor it exclusively for your firm (not licensed)	1	2	3	4	5
2) Wait for proprietary technology to be developed by somebody else, but as soon as it demonstrates effectiveness, purchase and utilize it	1	2	3	4	5
3) Either acquire, hire, or collaborate with a firm with proprietary technology, depending on the importance and urgency of such technology	1	2	3	4	5



- |  |   |   |   |   |    |
|--|---|---|---|---|----|
| 4) Purchase, only if necessary, ready-made technology, e.g. patents, software package, equipment, or systems | 1 | 2 | 3 | 4 | 5  |
| 5) Rely on conventional technology but focus more on building up reputation                                  | 1 | 2 | 3 | 4 | 5  |
| 6) Others [please specify:   | 1 | 2 | 3 | 4 | 5] |

**Part VI: International Competitiveness**

**Q22.** Please rate the following sources of competitiveness, in terms of how important they are for your firm's international competitiveness with respect to: a) project finding/acquisition, b) project implementation, and c) control of multinational organizations.

	not as important			very important	
<b><u>a) Project finding/acquisition</u></b>					
1) Lower cost than competitors	1	2	3	4	5
2) Proprietary engineering knowledge	1	2	3	4	5
3) Generally applicable engineering knowledge	1	2	3	4	5
4) Proprietary high-tech equipment	1	2	3	4	5
5) Project management expertise	1	2	3	4	5
6) Reputation of your firm	1	2	3	4	5
7) Political links to the market or project	1	2	3	4	5
8) JV with a foreign firm possessing complementary expertise	1	2	3	4	5
9) Linkage with home country design firms/consultants	1	2	3	4	5
10) Linkage with home country multinational clients	1	2	3	4	5
11) Linkage with home country financial institutions	1	2	3	4	5
12) Bonding capacity (for performance and bid bonds)	1	2	3	4	5
13) Financial packaging capability	1	2	3	4	5
14) Equity participation (for obtaining project)	1	2	3	4	5
15) Home government financial support	1	2	3	4	5
16) Foreign exchange rate of home currency	1	2	3	4	5
17) Use of the same technical standard and code as in home country	1	2	3	4	5
18) Vertical integration(design+management)	1	2	3	4	5
19) Vertical integration (management+ operation)	1	2	3	4	5
<b><u>b) Project implementation</u></b>					
20) Linkage with home country specialty contractors, suppliers, or manufacturers	1	2	3	4	5

21) Knowledge of local subcontractors and suppliers	1	2	3	4	5
22) Site office's procurement capability of local labor, materials and equipment	1	2	3	4	5
23) Language and cultural similarity	1	2	3	4	5
<u>c) Control of multinational organization</u>					
24) Headquarters' worldwide procurement capability	1	2	3	4	5
25) Headquarters' offering technical help	1	2	3	4	5
26) Headquarters' credit assurance in getting local funds	1	2	3	4	5
27) Headquarters' worldwide funds sourcing capability	1	2	3	4	5
28) Headquarters' management of corporate-wide financial transactions in globally distributed operations, such as taxes, remittance, and foreign exchanges	1	2	3	4	5
29) Headquarters' centralized data processing	1	2	3	4	5
30) Headquarters' management of worldwide information on subcontractors, suppliers, manufacturers obtained from globally distributed operations	1	2	3	4	5
31) Mergers and acquisitions of and long-term coalition with foreign (local and/or multinational) firms based on headquarters' strategy to serve the world markets	1	2	3	4	5

Part VII: Foreign subsidiaries and contracts

Geographical areas of international operations

Q23. Please put number of all foreign subsidiaries your firm operates in world. Then, for your operation in 1987, please put the approximate dollar value of foreign contracts awarded, the percentage of the value of foreign contracts awarded for the total (foreign+domestic) contracts awarded, and percentage of after-tax net income for total sales.

Number of foreign subsidiaries	[	]
Foreign contracts awarded in 1987	[\$	million]
Percentage of foreign contracts for total contracts awarded	[	%]
Percentage of after-tax net income for total sales	[	%]

Types of operations

Q24. Please check all the functions carried out by your firm in the international operations.

- 1) Preliminary consulting, such as feasibility study, master planning, preparation of specification and contract documents, etc. [ ]
- 2) Equity participation [ ]
- 3) Financial packaging [ ]
- 4) Architectural design [ ]
- 5) Engineering design [ ]
- 6) General contracting [ ]
- 7) Construction management [ ]
- 8) Specialty contracting [ ]
- 9) Services beyond completion of facilities [ ]

**THANK YOU VERY MUCH FOR YOUR COOPERATION**

We will send you the aggregated results of the research study.

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We would appreciate firms which would agree to be interviewed for further investigation on the globalization of engineering and construction firms. If you would agree to be interviewed, please check in the column below and send back the answered questionnaire and a copy of annual report (and brochure, if any) with your business card for facilitating contact later.

Yes, we agree to be interviewed. [ ]

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