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PATTERNS IN THE ORGANIZATION OF TRANSNATIONAL INFORMATION SYSTEMS

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Abstract

The objective of this study is to understand the organization of information systems and technology in organizations whose activities cross national boundaries.¹ Access to new markets for products, services, raw materials, and skills has always been a powerful incentive for organizations to expand internationally. The establishment of global alliances to leverage core competencies has led organizations to seek new ways of conducting business which have demanded a rethinking of organizational structures, processes, and culture. One of the fundamental tasks has been the establishment of appropriate information technology platforms to coordinate business processes for global business.

The study uses a previously-developed taxonomy that is based on five dimensions of transnational strategy: the configuration of value chain activities, the coordination of value chain activities, centralization, strategic alliances, and market integration. These dimensions define the manner in which the value-added activities of the firm are dispersed and coordinated across nations, the hierarchical structures responsible for decision making, the strength of the external alliances of the firm and the managerial philosophy of global business conduct. These dimensions have been shown to be a valid basis to identify a comprehensive taxonomy of transnational strategy.

A basic proposition of this study is that a firm's transnational strategy will be reflected in the design of its information systems. In order to address this proposition, a two-stage questionnaire study was conducted. Respondents included 150 multinational corporations from 20 countries and 25 industries.

The study proposes hypotheses to examine the alignment of information technology in the various types of firms that are identified by the transnational strategy taxonomy. The study empirically determined the existence of three types of transnational information systems strategies. These are:

1. A low dispersal-high centralization strategy which is adopted by export-oriented and portfolio firms,

¹We refer to these organizations as *transnational* or *multinational*. Thus, the terms *transnational corporations* and *multinational corporations* are used synonymously.

2. A high dispersal-low centralization strategy which is primarily used by parent-child firms, and
3. A high dispersal-high centralization strategy which is most suitable for global firms.

The study has implications for practitioners in critically evaluating existing transnational business strategies and designing effective transnational information systems. It should also help researchers in determining factors that impact on the design of transnational information systems.

1. INTRODUCTION

This study focuses on the issues associated with designing strategies for, and managing the information technology (IT) and information systems (IS) operations of, organizations whose activities cross national boundaries. The general term “transnational information systems (TNS)” is used to describe these systems and technologies. The focal question is, “How do different types of multinational corporations (MNCs) organize their TNS operations?” Two basic assumptions are implicit in this inquiry: first, that MNCs have intrinsic differences that may be used to categorize them into meaningful groups; and, second, that differences among MNCs will be reflected in different TNS organizational styles. TNS configurations may vary because of rational choice or because of proactive intervention by the organization desiring to make TNS configurations conform to organizational characteristics. TNS differences may also reflect a reactive adjustment to business operations. While proactive intervention may lead to a normative match between the organization and its information systems, it is perhaps too simplistic to argue that most transnational organizations have achieved this theoretical “equilibrium.”

This study explores the manner in which information systems are organized in MNCs. In order to do this, this study makes use of a previously developed (King and Sethi forthcoming) empirical categorization of MNCs and examines differences in TNS characteristics across these categories. This study provides a framework that is both empirical and comprehensive. The framework identifies several aspects of information systems that form the linkages between transnational business units. It also allows for a prioritization of IS variables that may be further adapted for empirical studies.

2. A TAXONOMY OF MULTINATIONAL CORPORATIONS

Over the last several years, there has been an increase in research on multinational firms. Firms have been defined as “multinational” based on their operations, ownership, managerial attitudes, and social responsibility, among other criteria. A multinational firm has been characterized as (Raghunathan and Chandran 1990):

1. A network of subsidiaries with an organizational structure to enable high coordination;
2. A global arrangement of activities with world-scale volume and the flexibility of arbitrage;
3. Product diversity and a worldwide distribution system to enable cross-subsidization among products and markets.

The above criteria emphasize various aspects of multinational firms and their operations, including simple variables such as percentage of foreign sales, as well as more complex constructs such as global flexibility, diversity, and competitive advantage. Several empirical studies of MNCs have used the simple variables such as relative sales, assets, profits in foreign markets, number of countries in which the firm does business, and the number of foreign subsidiaries. Raghunathan and Chandran review approximately 50 articles that have operationalized the concept of globality using such measures. Other studies, such as Hirsch and Lev (1971), use an entropy measure or the Herfindahl-Hirschman index (Hirschman 1964), which uses a weighting scheme for business segments, to measure globality.

The strategic management aspects of MNCs have been the focus of studies employing the resource-based approach to international diversification (Caves 1982). These studies have led to various interpretations of international strategy (Sullivan and Bauerschmidt 1991). Common to these approaches is the idea that the focus of management in MNCs is global integration and local responsiveness: how to best meet local demand while capitalizing on worldwide competitive advantages. Pressures for

global integration are industry forces such as global consumer demand and product and process standardization that necessitate worldwide resource standardization. An organization chooses to exploit its firm-specific advantages, especially in production operations (Rugman and Verbeke 1992). On the other hand, local responsiveness pressures are industry forces that necessitate local context-sensitive strategic decisions. Specifically, local customer needs, market conditions, and governmental regulations provide incentives to firms to develop local-bound host country specific advantages. Balancing global coordination with local responsiveness has been the focus of studies in this area.

2.1 Dimensions of Globalization

Based on the above conceptual studies, it has been shown (King and Sethi forthcoming) that the following dimensions can be used to differentiate multinational corporations: (a) value-chain configuration, (b) value-chain coordination, (c) strategic alliances, (d) centralization, and (e) market integration.

2.1.1 Value-Chain Configuration and Coordination

Value-chain configuration refers to the geographic dispersal of value-chain components. *Value-chain coordination* refers to the manner in which the dispersed components are linked. These dimensions are based on an analysis by Kogut (1985), which focused on two questions:

1. Where should the value-added chain be broken across borders?
2. On which functional activities should a firm concentrate its resources?

The basis of his analysis is that value-chain components can be organized for maximum global advantage, and this organization can be used to describe elements of global strategy (Porter 1986). Configuration specifies the country locations of each functional activity of the firm, with each location designed to exploit comparative advantages across countries. A company may rank low on configuration (i.e., have concentrated activities), which implies that individual activities are located in a single country. Alternatively, an organization may have a high configuration level (i.e., have dispersed activities), in which case an entire value-chain is replicated in each country of business.

2.1.2 Strategic Alliances

The term *strategic alliances* refers to the interdependencies that exist among global organizations. Strategic alliances are interorganizational relationships in which the partners make substantial investments to develop a long-term collaborative effort and a common orientation toward their individual and mutual goals. The process of alliance formation is encouraged by increasing competition, accelerating technological change, the need for information, and the realization that alliances present opportunities that might otherwise be unavailable (Hamel, Doz and Prahalad 1984).

2.1.3 Centralization

Centralization refers to the central control of organizational resources by the corporate office (Murray and Murray 1986). According to Bartlett and Ghoshal (1985), the two extremes along this dimension are the centralized hub, where decisions are concentrated, and the decentralized federation model, where strategic decision making is distributed. Picard (1977) and Hedlund (1981) have used similar definitions of centralization while Goehle (1980) focused more on the relative levels of influence exerted by subsidiary and headquarters management.

2.1.4 Market Integration

Market integration refers to the extent to which the parent corporation views the international market as a single competitive arena. This dimension is derived from Perlmutter's (1969) taxonomy. The importance of this characteristic is emphasized by Bartlett and Ghoshal (1989), who note that a company cannot manage globally if its managers identify with local, parochial interests and objectives.

Dimension	MNC Type Export Orientation	Parent-Child Configuration	Portfolio Configuration	Global Firm
Value-Chain Configuration	Low	High	Low	High
Value-Chain Coordination	Low	Medium	High	High
Strategic Alliances	Low	Low	Medium	High
Centralization	High	Low	High	Low
Market Integration	Low	Low	Medium	High
Examples		Goulds Pumps (Sawyer 1990)	Tioxide Group (Benford 1985)	3M Company (Zottola 1990)

Figure 1. MNCs and Their Hypothesized Characteristics

2.2 An MNC Classification Scheme

The above five dimensions (value-chain configuration, value-chain coordination, strategic alliances, centralization, and market integration) have been used to define a comprehensive taxonomy of MNCs which has previously been empirically validated (King and Sethi forthcoming). Differences along the five dimensions can be used to identify four types of multinationals: export-oriented, parent-child, portfolio, and global. These differences are shown in Figure 1 and described below.

2.2.1 *Export-Oriented Firms*

This category is similar to Leontiades’ (1985) export organization. Here a corporation serves the international market through export departments organized along functional lines. The emphasis is on marketing and distribution effectiveness and on the success of channel members, such as trading companies, distributors, and marketing agencies. This category ranks low on strategic alliances and value-chain configuration and coordination. Market integration is also low because the scope of markets is concentrated, focusing on specific segments only. However, centralization is high because the parent corporation controls all resources and decision making.

2.2.2 *The Parent-Child Configuration*

Compared to export-oriented firms, multinationals in this category display greater management experience in international markets in addition to positive returns from exports. A parent-child corporation creates structural units in the form of marketing and/or manufacturing subsidiaries in one or more countries. Each subsidiary interacts with the parent corporation through a flow of capital, providing remittances to the corporation and receiving developmental funds from it. This category ranks low on centralization and market integration because the functional areas of the subsidiaries, especially finance, marketing, production, and logistics, operate independently of each other as well as of the parent corporation. Strategic alliances and value-chain coordination are also low because each subsidiary is responsive only to its local area needs and maintains a simple organizational structure. However, since multiple units operate independently, these organizations rank high on value-chain configuration.

2.2.3 Global Firms

A global firm is one whose competitive position in one country is significantly affected by its position in other countries (Porter 1985). The global firm targets the international market without distinguishing national or political boundaries. Thus, it ranks high on market integration. Its structural considerations also demand high value-chain configuration and coordination. In general, centralization is an integral part of this configuration because all foreign operations are controlled by the parent corporation. However, in global companies, decision making is fairly decentralized (Thompson, Faigle and Short 1987). Strategic alliances are high because the corporation and its subsidiaries aim to achieve long-term profitability through entrenchment in host countries.

2.2.4 Portfolio Management

In addition to the above three types of firms, there are organizations which have approached the international market by focusing on a specific region, especially for production facilities, even though marketing and distribution activities are conducted globally. Japanese firms, for example, have transferred manufacturing bases to Pacific Rim countries such as Thailand and Singapore.

Portfolio firms share characteristics with each of the other types of firms. Like global firms, their value chain activities are concentrated and demonstrate high coordination and centralization. These organizations therefore rank low on configuration but high on coordination, centralization, and market integration. Strategic alliances are not the norm for these firms although such relationships may develop in their host countries during formation.

3. RESEARCH MODEL AND HYPOTHESES

The TNS issues studied here are based on studies such as those by Karimi and Konsynski (1991), Jarvenpaa and Ives (1993), Bradley, Hausman and Nolan (1993), and King and Sethi (1991).

These studies suggest that the organizational environments for the four types of MNCs represent different levels of (1) diversification, (2) environmental uncertainty, (3) environmental instability, (4) limitations of organizational memory, and (5) need for information integration (Child 1972). All of these characteristics are believed to impact the design of information systems and the use of IT in an organization.

In addition, two prior research streams have described the impact of the organizational environment on the design of IT in multinational corporations: the *information processing perspective* of organizational design and the *strategic view* of the multinational corporation.

The *information processing perspective* regards the organization as consisting of systems that gather, transform, store, and communicate information (Galbraith 1973) and seek to utilize this capacity to reduce environmental uncertainty. Effective organizations are those that fit their information processing capacities to the amount of uncertainty they face. Studies such as those by Burns and Stalker (1961) and Kmetz (1984) have used information processing as the central concept for linking an organizational design to contextual factors and strategic conditions. In the specific context of the MNC, Egelhoff (1988) used information processing as the key element to link different MNC structures (functional divisions, product divisions, international divisions, and global regions) with elements of strategy (foreign product diversity, product modification, product changes, size of foreign operations, size of foreign manufacturing, number of subsidiaries, and the extent of acquisitions).

The *strategic management* literature has also discussed the manner in which MNCs structure business functions. These studies can be used to identify IT requirements for transnational firms. For instance, a multinational firm may choose to allow a subsidiary autonomous growth and to advance local learning. Complete global flexibility will, however, require a mix of global and local perspectives. In this environment, an open exchange of information is necessary for one organizational unit to learn about and benefit from other units. These information flows permit the MNC to develop the critical capabilities outlined by Doz, Prahalad and Hamel (1990):

- Efficiency in executing agreed-upon strategies through control of subsidiary actions;
- Ability to adjust headquarters-subsidiary and subsidiary-subsidiary relationships to permit changes in strategic direction to take place; and
- Flexibility to bring subsidiaries together to compete in a coordinated fashion.

What implications for TNS are inherent in these requirements? Hagstrom (1990) argues that a system that allows complex information flows in MNCs requires standardization that goes beyond technical compatibility and relates also to content as in the case of Electrolux (the world's largest white goods manufacturer), which explicitly uses computer-based reporting systems as a primary integrative mechanism. Global networks must provide links to internal and external stakeholders. The same conclusions are reached by Roche (1992, p. 82), who notes:

IT is used to coordinate the functions of headquarters and subsidiaries. It allows the many types of information flowing from the headquarters to the subsidiaries to be controlled and used in the planning process. Also, central deposits of information can be used to keep standardized records. In addition, subsidiary-to-subsidiary information flows are common in manufacturing enterprises and may also be coordinated through IT.

Both of the above research streams have been used to formulate the specific hypotheses for this study. These hypotheses are:

H1. Export-oriented and portfolio firms will have geographically concentrated and centralized IS strategies.

H2. Global firms will demonstrate geographically dispersed and centralized IS activities.

Increasing interdependency among subunits in an organization has consistently been found to increase requirements for coordination and information processing (Tushman and Nadler 1978). If centralization is viewed as an information-processing mechanism, decision making for a given subunit should be more centralized when there is a higher degree of interdependency between the subunit and the rest of the organization. In this instance, centralization provides coordination and integration across the interdependency. Therefore,

H3. Parent-child firms will demonstrate geographically dispersed and decentralized IS activities.

4. STUDY DESIGN

The study used two questionnaires directed at the IS managers of MNCs. Both questionnaires were first pilot-tested. The first questionnaire was sent to the CEOs of 3,600 MNCs selected from the following sources:

1. *International Directory of Corporate Affiliations*, National Register Publishing Company, 1991
2. *Directory of Multinationals*, Stafford, Parkis and Stopford (editors), Stockton Press, 1989
3. *Principal International Businesses*, Dun & Bradstreet International, 1989.

The principal criterion used for the selection of this sample was the presence of at least one international subsidiary unit. Of the 3,600 companies selected, 1,539 were U.S.-based MNCs and 2,061 were non-American, representing a total of 43 countries and 28 industries.

The first questionnaire was sent to the full sample of companies. Of the 3,600 MNCs, 281 companies agreed to participate in the study giving a response rate of 7.8%, which was lower than expected. The low rate can be attributed to the international nature of the survey and the fact that the two-part questionnaire required a significant time commitment from the respondents. Of the 281 organizations, 143 were U.S.-based and 138 were non-U.S.-based MNCs. A total of 150 final questionnaires representing 20 countries and 25 industries were received for a response rate of 53% for this phase of the study. Descriptive statistics of firms responding are shown in Table 1.

Table 1. Descriptive Statistics of Firms Responding

	Mean	Minimum	Maximum
Sales (billion \$)	9.0	0.0015	124
Employees	22,805	4	261,000
Number of Subsidiaries	31	1	218
Number of Countries	11	1	65

A non-response bias test was conducted by comparing the characteristics of firms that responded to the final questionnaire (150 firms) with those who did not (131 firms). This test showed that firms that did not respond had lower sales and fewer subsidiaries than the firms that did respond. There were no statistical differences in the number of employees and the number of countries between the two categories of firms. A second comparison was conducted between the 150 firms that responded and a random sample of 150 firms selected from the non-respondents in the original sample of 3,600 firms. Again, the non-respondents were firms with less multinational activity, as measured by the number of subsidiaries and the number of countries in which business was conducted. This implies that firms with smaller international and IT operations are not represented in this study.

4.1 MNC Dimensions

Five MNC dimensions were used for the purpose of classification: value-chain configuration, value-chain coordination, strategic alliances, centralization, and market integration. The development of measures for these dimensions is described in King and Sethi (forthcoming), which provides the details of the measures, validity, and reliability analyses.

4.1.1 Value-Chain Configuration

This dimension is based on Porter (1986) and operationalized by Roth, Schweiger and Morrison (1990). These studies selected 14 functional activities and, for each functional activity, asked respondents to indicate whether the activity was performed in a single country or in multiple countries for their business unit. In the current study, the choices for number of countries were given as ranges: 1, 2-9, 10-25, 26-50, 51-100, and more than 100. A configuration index was then calculated for each organization by averaging the responses across all value activities. Thus a score of 1 would indicate that all activities were performed in one location and a score of 100 would indicate that all activities were performed in more than 100 countries. An overall index (*CONFIGURATION*) was derived from the above 14 items (Cronbach's alpha = 0.95).

4.1.2 Value-Chain Coordination

The value-chain activities used to measure configuration were also used to operationalize coordination. For each of the 14 activities, executives were asked to indicate, on a five-point scale, the extent to which the activity was coordinated across countries. A coordination index was then calculated by summing each response. Thus a score of 1 would indicate that the activities of the business were not coordinated and a score of 5 would indicate high coordination. An overall index (*COORDINATION*) was created by totaling responses across the 14 coordination items (Cronbach's alpha = 0.86).

4.1.3 Strategic Alliances

No instrument was available to measure the strength of strategic alliances. A measure was created based on Spekman and Sawhney (1990), who specify the following dimensions of this construct: goal compatibility, strategic advantage, interdependence, commitment, communication, conflict resolution, coordination of work, and planning. Nine items were used to evaluate

the above characteristics. Eight of the nine items loaded on one factor and accounted for 71% of the variance. Cronbach's alpha for these eight items was 0.94. These eight items were grouped into a strategic alliance scale (*ALLIANCE*).

4.1.4 Centralization

Centralization was operationalized based on Egelhoff (1988), who examined 22 decisions that have to be made as a part of the management and operation of most foreign subsidiaries. He measured the degree of centralization in a parent-subsidiary relationship by asking the respondents which hierarchical level in the organization would have to actually approve a decision.

Egelhoff's set of 22 decisions was used in this study with modifications to reflect decisions regarding both products and services, and five new decisions were added based on a literature review. The 27 items were factor analyzed but did not reveal any clear pattern. Each was then correlated with the centralization response from the first questionnaire, and only those items that correlated with this response were retained. In the first questionnaire, respondents had been asked to rank on a scale (1 to 5) the degree of centralization of decision making in their organization. Five items for which the correlations were not significant were dropped. An overall centralization scale was created (*CENTRALIZATION*) by averaging the remaining 22 decisions (Cronbach's alpha = 0.89).

4.1.5 Market Integration

Market integration refers to the extent to which the parent company views the international market as a single competitive arena. No instrument was available for measuring this construct. A measure was created based on Perlmutter (1969). Four items were used to operationalize market integration. One item was dropped after factor analysis and an overall index (*INTEGRATION*) was created using the remaining three items (Cronbach's alpha = 0.85).

4.2 TNS Variables

In order to judge the degree of centralization and configuration of IS activities, two questions were included in the survey:

1. In your opinion, how physically dispersed are your firm's information systems?
2. In your opinion, how administratively centralized are your firm's information systems?

The above questions were used to examine the primary hypotheses of the study related to the linkages of multinational strategy and IS configuration. It is also of interest to further examine TNS elements that are affected by the dispersal/concentration and centralization/decentralization dimensions of TNS configuration.

Several TNS elements were included in the study based on studies such as those by Karimi and Konsynski (1991), Jarvenpaa and Ives (1993), Bradley, Hausman and Nolan (1993), King and Sethi (1991; forthcoming). TNS elements included TNS planning practices, standardization of data, applications, technology, communications, IS orientation, and IS personnel policies.

Questions related to *TNS planning practices* examined whether formal TNS planning exists in organizations, planning areas which make up the TNS plan, and the role of corporate and subsidiary IS groups in the planning process. The *IS architectural elements* of data, applications, communications, and technology were studied in order to examine if there were standardization of these elements across subsidiaries. *IS orientation* questions were included to examine the mechanisms that linked IS plans with business plans. Finally, *IS personnel policies* were examined to determine whether personnel policies were implemented globally and if training programs were implemented across subsidiaries.

These variables are listed in Table 2 together with the number of items used to measure them, and Cronbach's alpha if a scale was created for that variable.

Table 2. TNS Elements Used in the Study

TNS Element	Number of Items	Sample Item	Alpha
Presence of TNS planning	1	Does your organization have a formal strategic IS plan for international information systems?	NA*
Planning areas in TNS plan	15	Is the business plan summary included in the TNS plan?	NA*
Role of corporate IS group	8	Develop company-wide long-term IS objectives	0.91
Role of subsidiary IS groups	8	Develop company-wide long-term IS objectives	0.91
Mechanisms linking the IS plan with the business plan	8	Participation of IS executives in business planning	Corporate level - 0.70 Subsidiary level - 0.74
IS orientation	4	Extent of developing IS for internal company operations	Internal - 0.69 External - 0.74
Presence of environmental scanning	7	Gathering information about international political trends	Corporate = 0.95 Subsidiary = 0.96
Compatibility of databases	3	Extent of compatibility database standards across subsidiaries	0.91
Standardization of applications development	3	Extent of standardization of applications	0.53
Use of global vendors for applications development	1	Extent of reliance on global vendors when purchasing applications	NA*
Use of private international networks	1	Extent of use of private international networks	NA*
Use of telecommunications technologies	10	Extent of use of X.400 based messaging systems	Corporate = 0.83 Subsidiary = 0.88
Standardization of IT technologies	6	Extent of standardization of operating systems	0.91
Use of global hardware vendors	2	Extent of standardization of global vendors	0.84
Use of corporate IS personnel in subsidiaries	2	Extent of use of expatriate employees	NA*
Presence of worldwide training programs	2	Extent of use of worldwide training programs	0.80

*NA = No scale was created.

Table 3. Cluster Means

Cluster	1-(Export)	2-(Global)	3-(Portfolio)	4-(Parent-Child)
Frequency	n=17	69	30	34
Variable				
<i>CONFIGURATION</i> ¹	9.0	30.0	10.0	22.0
<i>COORDINATION</i> ¹	2.1	3.4	3.5	3.0
<i>CENTRALIZATION</i> ¹	1.7	2.0	3.0	1.8
<i>ALLIANCE</i> ¹	3.2	3.8	3.0	2.4
<i>INTEGRATION</i> ¹	2.7	4.6	4.0	3.6
Sales ²	3.5	8.0	6.5	14.0
Employees ³	6057.0	27000.0	11000.0	30000.0
Subsidiaries ⁴	13.6	36.0	17.7	41.0
Countries ⁴	5.3	13.0	6.4	13.0
Total SICs ⁴	3.5	5.0	3.6	5.2

¹ANOVA results show $p < 0.0001$ across clusters.

²Not significant

³Significant at 0.09

⁴Significant at 0.01

5. RESULTS

The analysis was performed in two phases. First, a cluster analysis of MNC dimensions was used to detect patterns of MNC strategy. Then the hypotheses were tested based on these clusters. The cluster analysis is described in detail in King and Sethi (forthcoming).

5.1 Cluster Analysis of MNC Dimensions

Using the five dimensions, cluster analysis was performed to classify the MNCs. The clustering strategy was based on Punj and Stewart (1983). The procedure resulted in four clusters whose frequencies are shown in Table 3. The table also shows the means of the clustering variables across clusters.

Examining other characteristic variables for each group provides a clearer picture of the clusters. Table 3 shows the means of sales, employees, number of subsidiaries, number of countries, and total SIC codes (number of industries) across subsidiaries. This demonstrates the clarity of the clusters by providing evidence for differences among clusters based on non-classifying variables.

Cluster 1 contains the export-oriented firms, which rank low on configuration, coordination, and market integration. Further, as can be seen from Table 3, this group has smaller values for sales, employees, number of subsidiaries, and number of countries.

Cluster 3 firms rank about the same as export-oriented firms on configuration but much higher on coordination. They also show a higher degree of centralization, strategic alliances, and market integration than the export-oriented firms. They are large in size and operate in a large number of countries. These characteristics indicate that these are portfolio firms.

Cluster 4 firms rank high on configuration and market integration but low on coordination and centralization. These are the parent-child conglomerates; this can be seen from their high values for sales, number of employees, number of subsidiaries, and number of countries of operation.

Cluster 2 firms are global organizations ranking about the same as parent-child firms in configuration. Coordination, strategic alliances, and market integration values are the highest for these firms. These firms operate in a large number of countries (73) and have a high count of subsidiaries (36).

5.2 Hypotheses Testing

In examining the relationship between organizational and TNS architectures, one important issue is whether TNS management strategies correspond to organizational strategies. Configuration and coordination of business activities have traditionally been used to analyze organizational management strategies. This is consistent with Porter’s (1986) exposition of global strategies. The question of interest then is whether TNS strategies follow the same pattern.

The mean values of the responses to the TNS dispersal and centralization variables described above across the firm-type clusters are shown in Table 4 (1 = low dispersal, 5 = high dispersal; 1 = very centralized, 5 = very decentralized). ANOVA results for the dispersal scale indicate significance at $p = 0.03$ and for the centralization scale at $p = 0.05$. Further, clusters 3 (portfolio) and 4 (parent-child) differ at $p = 0.1$ for both scales. The two scales show a very high correlation ($r = 0.38$, $p = 0.0001$), indicating that greater dispersal is related to decentralization. While this result is perhaps obvious, its pictorial representation on a 2 x 2 matrix together with four clusters is very interesting. This is shown in Figure 2. Export-oriented and portfolio firms follow a low dispersal, high centralization IS strategy; parent-child firms adopt a high dispersal, low centralization strategy; and global firms employ a high dispersal, high centralization IS strategy.

These results support the study hypotheses.

Finally, correlations of IS dispersal and centralization with the TNS variables and architecture items show significant results, which are shown in Table 5. This table demonstrates that high IS centralization is related to: (1) organizational centralization, (2) communication of IS subsidiary groups with corporate IS, (3) use of international networks, and (4) standardization of applications, IS components, and data across subsidiaries. Low centralization is positively related to: (1) organizational configuration, (2) number of telecommunications technologies used at the subsidiary level, and (3) the number of planning areas incorporated into the IS plan.

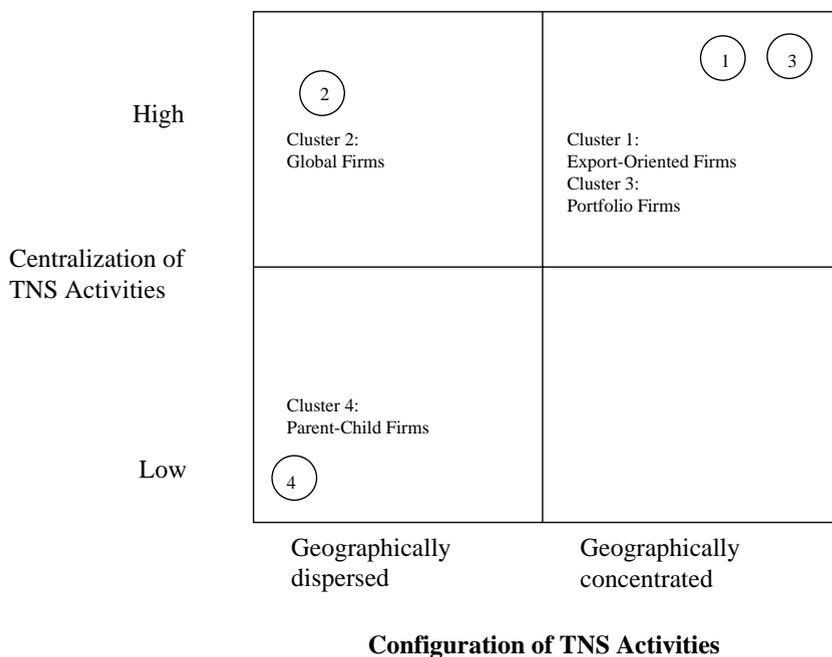


Table 4. Mean Values of Centralization Across Clusters

Cluster	1-(Export)	2-(Global)	3-(Portfolio)	4-(Parent-Child)
Dispersal ¹	3.4	3.7	3.1	3.9
Centralization ²	3.3	3.6	3.2	3.9

¹Overall significance at p = 0.03.

²Overall significance at p = 0.05.

Table 5. Significant Correlations of IS Dispersal and Centralization with TNS Elements
(P values are shown in parenthesis)

Variable	IS Dispersal (1=low, 5=high)	IS Centralization (1=high, 5=low)
<i>CONFIGURATION</i>	0.16 (0.05)	0.14 (0.09)
<i>CENTRALIZATION</i>	-0.3 (0.003)	-0.23 (0.0064)
<i>COORDINATION</i>	-0.14 (0.09)	
Use of technology at the subsidiary level		0.17 (0.06)
Communications of corporate/subsidiary IS groups		-0.20 (0.01)
Use of international networks		-0.19 (0.02)
Role of subsidiary IS group		0.19 (0.02)
Application standardization	-0.15 (0.07)	-0.17 (0.04)
Technology standardization	-0.20 (0.01)	-0.15 (0.06)
Data compatibility	-0.29 (0.0006)	-0.29 (0.0006)
Linking mechanisms at subsidiary	0.19 (0.02)	0.15 (0.07)
TNS planning areas at subsidiary		0.16 (0.05)

Correlations of IS dispersal show the following results. High IS dispersal is associated with: (1) high organizational configuration, (2) low organizational centralization, and (3) low organizational coordination. In addition, high configuration is negatively correlated with the standardization of applications, IS components, and data.

6. DISCUSSION

The results of the study support the proposition that the organizational characteristics of centralization, dispersal, and coordination are reflected in a firm's IT configuration. In a centrally-coordinated business structure, IT is also globally centralized. Local autonomy appears to be a moderating variable as can be seen from the differences in the IS characteristics of global and parent-child firms. Summary characteristics of each of these strategy types are shown in Table 6.

6.1 Low Dispersal–High Centralization Strategy

Although this strategy is followed by both export-oriented and portfolio firms, there are significant differences between the IS characteristics of the two groups.

Table 6. IS Strategy Characteristics

<p><i>Low Dispersal–High Centralization IS Strategy</i></p> <ul style="list-style-type: none"> • Few firms have independent TNS plans. • TNS plans, when present, are in wholly-owned subsidiaries. • Number of planning areas is lowest. • Number of planning areas for subsidiaries is lowest. • Contribution of IS groups at the subsidiary level is lowest. • High standardization of data and technologies. <p><i>High Dispersal–Low Centralization IS Strategy</i></p> <ul style="list-style-type: none"> • Firms have both domestic and international IS plans. • More joint venture firms have TNS plans. • Number of planning areas included in the subsidiary level plan is the highest. • Telecommunications issues are very important. • Contribution of subsidiary IS groups increases over export-oriented and portfolio firms. • Lower standardization of data. • Lower worldwide IS training programs as compared to global firms. • High participation of business executives in IS planning at the subsidiary level. <p><i>High Dispersal–High Centralization IS Strategy</i></p> <ul style="list-style-type: none"> • Most firms have both domestic and TNS plans. • This is true for both wholly-owned subsidiaries and joint ventures. • Highest number of planning areas at the corporate level. • High number of planning areas at the subsidiary level. • Telecommunications issues are very important. • Contribution of the subsidiary level IS group is highest. • Compatibility of data and technologies lies between export-oriented and parent-child firms. • The number of worldwide training programs is the highest for global firms. • Participation and communication between business and IS groups at the subsidiary level is high. • There is an indication of focus on external applications. • Environmental scanning at the corporate and subsidiary levels is highest.

Within this strategy, few firms have independent IS plans for international operations. Much of the planning for international IS operations is subsumed under the domestic IS plan. Written comments on the questionnaire confirm this. International IS planning when present occurs mostly in wholly-owned subsidiaries as opposed to joint ventures. This indicates the impact of ownership on the IS planning process.

At the corporate level, the number of planning areas within IS was found to be lowest for export-oriented firms and almost negligible for subsidiaries. Major areas included in the IS plan are software planning and systems development, followed by the IS plan and charter. Also, as expected, the contribution of corporate IS groups toward formulating the IS plan is maximal for this kind of strategy while the role of the subsidiary IS groups is the least. In addition, when building IS plans, the subsidiary groups tend to present problems and alternatives to the parent for discussion and/or advice, again reflecting a high degree of centralization of IS groups.

Portfolio firms seem to adopt a strategy of using global vendors for both applications and hardware to maintain standardization across subsidiaries. Environmental scanning is undertaken mainly at the corporate and not at the subsidiary level, by both export-oriented and portfolio firms.

6.2 High Dispersal–Low Centralization Strategy

Firms following this strategy have both domestic and international IS plans. The number of wholly-owned subsidiaries and joint ventures that have their own strategic IS plans increases over export-oriented and portfolio firms. The number of planning areas that are included in the IS plan at the subsidiary level is the highest for companies pursuing this strategy, the parent-child firms. This reflects the decentralized nature of their operations. Telecommunications issues, IS issues and risks, and contingency plans head the list of planning areas most frequently included in IS plans. Further, the contribution of both subsidiary and corporate IS groups increases from that of export-oriented/portfolio firms. Firms in this TNS strategy group indicated that communications between subsidiary and corporate IS groups generally consist of asking the corporate group for more information while building the IS plan.

Decentralized strategies for these firms lead to a lower standardization of applications and IS components across subsidiaries even though firms in this sample indicated that they tend to rely on global vendors for applications and hardware. Another indication of the decentralized nature of operations is their preference for public telecommunications networks over private networks.

The number of worldwide training programs for IS employees is low overall for all clusters including the parent-child configuration. Further, the participation of subsidiary business executives in subsidiary IS planning is relatively high. This participation includes face-to-face communications between the corporate and subsidiary groups in formulating IS plans.

Overall, this strategy indicates decentralization of IS functions that mirrors organizational local autonomy.

6.3 High Dispersal–High Centralization Strategy

The advantage of both IS strategies discussed above appears to be that they reflect the business processes of their organizations. A hybrid of these two strategies is the high dispersal - high centralization strategy adopted by global firms.

Firms following this strategy are most likely to have both domestic and international IS plans. This applies to both wholly-owned and joint venture subsidiaries. Although this number is lower for joint ventures, it is still the highest among all four types of clusters. The number of planning areas indicates that IS plans incorporate the highest number of planning areas at the

corporate level and are second only to parent-child firms at the subsidiary level. The most frequently incorporated IS areas are those regarding telecommunications, as is also the case with parent-child firms. The contribution of both the corporate and subsidiary level IS groups is highest, which indicates that subsidiary groups are much more involved in IS planning in global firms.

Compatibility of IT components and applications falls between those found for portfolio and parent-child firms. As with parent-child firms, global firms tend to rely on global vendors for applications and hardware. The use of new telecommunications technologies is the highest of all types of firms, both at the corporate and subsidiary levels.

As with parent-child firms, global firms use local IS employees in their subsidiaries. Global firms have the most worldwide training programs among the four clusters. This indicates a high coordination strategy for worldwide human resource development.

Participation and communication between business and IS groups at the subsidiary level is high. Communication between corporate and subsidiary IS executives is also higher than in portfolio firms.

IS orientation toward external applications is seen to increase although these results are not statistically significant. Environmental scanning at the subsidiary level shows a clear jump for global firms. All four types of firms rank about equal on the scanning index at the corporate level. However, at the subsidiary level, environmental scanning is much more prominent for global firms. This indicates increasing effort to gather external information to support coordinated worldwide strategies.

7. CONCLUSION

This study details a variety of organizational characteristics dealing with a firm's business environment, its structure and management processes, and its information systems configurations.

The study has examined several issues related to the use of information technology in a global environment. These have included IS planning, orientation, architecture, human resources, and environmental scanning. The focus of this study has been to understand if there are differences in the manner in which different types of multinational firms have employed IT. Three types of transnational IS strategies have been identified in this study. These strategies are based on the level of dispersal and centralization of IS activities and appear to follow the framework established by the firm's overall business processes. Thus, organizations that tend to centralize business decision making appear to reinforce this decision-making structure by using centralized IS as well. Firms that are more dispersed with autonomous subsidiary units follow a decentralized management philosophy, which is also reflected in the design of their information systems. As was noted above, the current IS strategies in organizations have been shaped both by proactive managerial intervention and by responding to current information needs. The three transnational IS strategies reflect this perspective.

While the proposed relationship between organizational centralization and IS centralization is not new, this study provides an empirical basis for the design of future studies related to multinational organizations. The descriptive framework presented here may be adopted for normative analysis by including variables such as IS effectiveness and the contribution of IS to organizational effectiveness.

One conclusion of the above is that the collection of subsidiary data is essential to an understanding of transnational information systems. Conclusions reached here are limited by the study's focus on the corporate office of the multinational corporation. Sometimes this may not present a complete picture of the organization. An important extension of this study, therefore, is to gather data at the subsidiary level and incorporate subsidiary level variables into the analysis. This could include, for example, the influence of ownership structures, market positions, and regulatory issues on a subsidiary.

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