DESIGNING MATRIX STRUCTURES TO FIT MNC STRATEGY

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Abstract

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The study extends existing strategy-structure theory for elementary structures in MNCs to include matrix structures. It uses an information-processing perspective to develop the conceptual framework and hypotheses. The information-processing capacities of the structural dimensions that make up a matrix structure are used to fit matrix structures to specific elements of MNC strategy. The overall information-processing capacity of a matrix structure is viewed as the sum of the information-processing capacities of its structural dimensions. A sample of 57 German MNCs with four different types of matrix structure is used to test the hypotheses. The matrix part of the well-known Stopford and Wells Model is not supported. The results support most of the proposed conceptual framework, providing new insight into how structural dimensions process information when they are used in matrix structures. The result is a more complex and specified theory for fitting matrix structures to multiple elements of strategy. A multivariate discriminant analysis provides evidence that MNCs are managing to simultaneously satisfy multiple fits with strategy.

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Matrix structures were once embraced as the best way to organize multinational corporations (MNCs) to deal with increasingly complex international strategies (Stopford and Wells, 1972; Davis and Lawrence, 1977; Galbraith and Nathanson, 1978). During the 1980s, however, many U.S. firms abandoned their matrix structures when they experienced difficulties managing them. While matrix structures remain out of favor among U.S. firms, Galbraith (2009) reports that matrix or dual reporting relationships occur frequently within MNCs such as IBM, Procter & Gamble, and Shell, often under a different name. From his own consulting experience, he reports increasing manager interest in understanding how to design and implement matrix structures. Many appear to realize increasingly complex strategies will force them to use more matrix structures, but their ignorance makes them fearful. As a result, there is a strong need to develop conceptually sound, practical theory for using matrix structures in MNCs.

Strategy-structure theory for MNCs with elementary structures is relatively well-defined, but little theory exists for MNCs with matrix structures. This is the gap the current study seeks to address. It is convenient to divide the problem into two parts: how to design matrix structures that best fit a given strategy, and how to successfully implement such a matrix structure. Our study focuses on the first problem. Its basic thrust is to extend existing strategy-structure theory for elementary structures to embrace matrix structures. The conceptual framework used to link strategy and structure is an information-processing perspective (Galbraith, 1973; Egelhoff, 1982). The next section reviews the existing literature as it currently applies to matrix structure MNCs. Subsequent sections develop new strategy-structure theory for matrix structures along with testable hypotheses, describe the research design, present the empirical findings, and discuss their significance for extending strategy-structure theory to embrace matrix structures.

EXISTING STRATEGY-STRUCTURE THEORY

Little empirical research has focused on the relationship or fit between matrix structures and strategy. One reason for this is that survey research samples have generally contained too few matrix structure firms to support meaningful analysis. Another reason is the lack of a specified theory linking specific matrix structures to specific elements of strategy, as exists for the elementary structures.

The elementary structures available to MNCs include worldwide functional divisions, international divisions, geographical regions, and worldwide product divisions (Stopford and Wells, 1972). Here authority and communications tend to flow along a single primary hierarchy or dimension. Matrix structures are an overlaying of two of the elementary structures (Davis and Lawrence, 1977). Under a matrix structure, a foreign subsidiary simultaneously reports to the parent along two of the elementary dimensions (e.g., it might report to a geographical region HQ and to a number of product division HQs). Using Davis and Lawrence's terminology, this is a "multiple command" or "two-boss” structure. It is important to distinguish between a matrix and a mixed structure. A mixed structure has some foreign subsidiaries reporting to the parent along one dimension (e.g., geographical regions) and other subsidiaries along another dimension (e.g., product divisions). This is still a one-boss or non-matrix structure because the two hierarchies do not overlap.

Davis and Lawrence (1977) developed one of the earliest conceptual frameworks for relating matrix structures to contextual factors and strategic conditions. From a number of case studies, they identified three conditions that seem to be necessary to the adoption of matrix structures: (1) outside pressure for dual focus, (2) pressures for high information-processing capacity, (3) pressure for shared resources. Since matrix structures are so difficult and costly to manage, Davis and Lawrence suggested firms should not adopt one unless all three conditions apply. While useful as an underlying foundation, this framework is very general. Since most large firms tend to face the above pressures, it largely suggests there should be a growing interest in matrix structures. It is difficult to turn this approach into a more specified theory for when to use the different types of matrix structure.

Taking a different approach, Chi and Nystrom (1998) further conceptualized the capabilities and limitations of matrix structures, emphasizing less the macro-level fit and coordination capabilities, and more the additional motivation and socialization potential provided by matrix structures (incentives and socialization can now occur along two hierarchies). They also identified three primary disadvantages: higher levels of conflict between the two hierarchies, more internal lobbying and influence seeking, and the degradation of performance measures due to more overlapping responsibilities. This conceptualization addresses the overall advantages and disadvantages of matrix structures in general and focuses more on the behaviors that are required to successfully implement matrix structures than on the criteria required to design specific matrix structures.

In our view, the above are the two most important attempts to conceptualize the use of matrix structures, as they can be applied to MNCs. It should be pointed out that there exists a substantial literature on matrix structures involving project management (Burns and Wholey, 1992; Ford and Rnadolph, 1992). This literature deals with a single, unique type of matrix structure, where a project dimension is matrixed with a functional dimension. We see this as a special case that is not generally relevant at the design level to the use of a wide variety of different matrix structures in MNCs. Project matrix structures largely focus on implementing a series of clearly-defined, temporary projects, while MNC matrix structures address the long-run management of entire businesses. While aspects of this literature are undoubtedly relevant to the implementation problems of matrix structures in MNCs, it is not relevant to the design problem. Framing the problem this way is crucial to developing a more specified theory about the design of matrix structures for MNCs. Much of the existing literature has failed to adequately distinguish between project management matrix structure and other types of matrix structure.

Empirical research on matrix structures in MNCs

All of the existing empirical studies include relatively few matrix structure firms amid larger samples of non-matrix structure MNCs. As a result, specifying the fit between matrix structures and strategy has generally been a secondary concern and the weakest part of most empirical strategy-structure studies. The Stopford and Wells (1972) study was the first significant survey research study of strategy and structure in MNCs. It included three matrix and 22 mixed structure MNCs in a sample of 162 U.S. MNCs. The study found that matrix and mixed structures (combined as a group) had both higher levels of foreign product diversity and larger foreign operations than firms with elementary structures. This relationship is reflected in the well-known Stopford and Wells Model (see Figure 1), which is still the most widely reported model of MNC strategy-structure relationships in today’s textbooks. The area in the upper

(Insert Figure 1 about here)

right-hand corner with the "??" is the space occupied by the matrix and mixed structure companies. Another early study by Franko (1976) contained six matrix and mixed structure MNCs (not separated) in a sample of 70 European MNCs. It found that the six firms had (1) higher levels of foreign product diversity and (2) manufacturing in more countries than did the elementary structure firms.

Habib and Victor’s (1991) study contained 16 matrix and mixed structure firms (not separated), in a sample of 144 U.S. manufacturing and service MNCs. Like the Stopford and Wells (1972) study, it found these structures were associated with high levels of both foreign product diversity and foreign sales. Another study by Chi, Nystrom, and Kircher (2004) contained 101 U.S. MNCs. It measured the extent to which each firm possessed a product dimension and a geographic dimension, without categorizing a firm as having a specific structure. While the study confirmed the traditional relationships of the Stopford and Wells model, its principle new finding was: as the product and geographic dimensions both increase (which implies a tendency toward the matrix structure), there is a tendency for a firm to be associated with higher levels of technology intensity (R&D/sales).

Empirical studies of strategy-structure relationships by Egelhoff (1988a, 1988b) and Wolf and Egelhoff (2002) also included matrix structures and took a somewhat different approach. Egelhoff’s study contained seven matrix structure firms in a sample of 50 U.S. and European MNCs. The Wolf and Egelhoff study contained 24 matrix structure firms in a sample of 95 German MNCs. Both studies separated matrix and mixed structure firms and further distinguished among the different types of matrix structure. The first study contained three different types of matrix structure, the second four different types. Both studies used an information-processing perspective to assign different information-processing capacities to a functional division dimension, a product division dimension, and a geographical region dimension in a structure. They argued that a matrix structure which combines two of these dimensions should be viewed as possessing the combined information-processing capacities of the two dimensions contained in the matrix (Egelhoff, 1988b). Consistent with this, Wolf and Egelhoff (2004) developed hypotheses about the information-processing capacities of each type of structural dimension. These capacities are generally the same as those associated with the elementary structures (Egelhoff, 1982), since each elementary structure contains a single structural dimension. Any structure containing a given structural dimension is hypothesized to possess the information-processing capacities of that dimension. The hypotheses were tested by combining all structures that contained a specific structural dimension (e.g., a product division dimension) to see if the information-processing capacity of this dimension and its hypothesized relationship to various elements of MNC strategy was supported. This meant that elementary and matrix structure firms were grouped to test each hypothesis (e.g., elementary product division structure firms were combined with all matrix structure firms that contained a product division dimension to test the hypothesized relationships involving the product division dimension). While the results tended to support the hypotheses, much of the support was undoubtedly driven by the elementary structure firms in the sample. So these studies were only partial or incomplete tests of the proposed matrix logic. The present study uses the conceptual framework of the Egelhoff (1988a, 1988b), and Wolf and Egelhoff (2002) studies. It extends this framework by: (1) adding a new contingency variable, (2) more specifically conceptualizing the information-processing capacities of each type of structural dimension in a matrix, and (3) more fully testing the framework by using a sample that consists entirely of matrix structure firms.

The linkage of strategy-structure fit to performance

Like all contingency theories, models of the strategy-structure relationship state that good fit between strategy and structure causes relatively good organizational performance while poor fit causes relatively poor performance. While micro-level contingency theory studies have generally been able to demonstrate the influence of fit on appropriate micro-level measures of organizational performance, macro-level studies such as those involving strategy-structure fit have generally been unable to demonstrate a consistent or convincing linkage of fit to performance. The problem concerns identifying an appropriate measure of organizational performance or effectiveness (Hannan and Freeman, 1977; Zammuto, 1982). Goals (such as profitability and growth) vary across firms, and therefore what constitutes effectiveness varies. Also so many factors outside of strategy-structure fit impact broad measures of firm performance that the indirect impact of fit on such measures may be difficult to observe.

Given the above problem, most strategy-structure studies, including the present study, depend on the following argument. The study has sampled the population of surviving MNCs, and these MNCs operate in competitive environments. Using a population ecology perspective, one can argue that strategy-structure fits (which contribute to organizational effectiveness) will tend to be observed in such a sample while misfits (which detract from organizational effectiveness) will tend to be absent. This perspective would also suggest that if one could sample the population of failed MNCs, one would find more misfits and fewer fits than in the sample of survivors. Since the latter has not been done, the empirical study is always a partial test of this research design. Thus, performance becomes surviving in a competitive environment, a goal common to all firms. Studies that rely on this argument to link fit to performance must be able to logically define fit in a convincing way that is independent of the fact that such fit has already been observed in samples of surviving MNCs. The present study uses an information-processing perspective to develop a strong, independent theory for the hypothesized fits between strategy and structure. The idea is that if the fits are independently determined and sufficiently specified, even a partial test (using a sample of surviving MNCs with no sample of failed MNCs) presents a significant opportunity to falsify or discredit the theory.

HYPOTHESIS DEVELOPMENT

In this section we want to develop hypotheses that will empirically test both existing matrix theory from the Stopford and Wells Model (1972) and the proposed matrix logic derived from Egelhoff (1988a, 1988b) and Wolf and Egelhoff (2002).

Matrix theory from the Stopford and Wells Model

Existing strategy-structure theory that is based on the Stopford and Wells (1972) study argues that matrix structures should fit strategies that involve both high foreign product diversity and high levels of foreign sales. This is the upper right hand corner of the Stopford and Wells Model, where the matrix firms in the Stopford and Wells study tended to lie. It is important to recognize that this is largely an empirically derived theory, with little supporting conceptual logic for this part of the theory. The following two hypotheses test this theory:

> *Hypothesis 1: Foreign product diversity will be greater in matrix structure firms than in elementary structure firms.*

> *Hypothesis 2: The percentage of international sales will be greater in matrix structure firms than in elementary structure firms.*

Proposed matrix logic

The proposed matrix logic is that the information-processing capacities of an elementary structure will generally remain the same when that dimension is included in a matrix structure. To the extent that this is true, it means that the information-processing capacity of a matrix structure can be viewed as the addition or sum of the information-processing capacities of its dimensions. The study will test this logic by using the logic to hypothesize a series of relationships between specific structural dimensions of matrix structures and specific elements of international strategy. The information-processing capacities of a structural dimension must fit the information-processing requirements posed by the element of strategy.

Foreign product diversity

Many previous studies support the positive relationship between foreign product diversity and a product division structure (Stopford and Wells, 1972; Franko, 1976; Egelhoff, 1982; Daniels, Pitts and Tretter, 1984; Habib and Victor, 1991; Wolf and Egelhoff, 2002). The information-processing logic for this is described in Wolf and Egelhoff (2002). As product diversity increases, so does market diversity (environmental complexity) and manufacturing and technical diversity (technological complexity). As these increase, requirements for information processing between interdependent subunits in a firm also increase. There is a greater need for tactical and strategic information processing for product matters, since there will be more technical operating problems and a greater number of strategic product decisions. The structure providing the most product-related information-processing capacity between the centers of product knowledge and the foreign subsidiaries is a worldwide product division structure. It provides several separate information-processing channels between a subsidiary and other parts of the company, one for each product division in the subsidiary.

> *Hypothesis 3a: MNCs with matrix structures containing a product division dimension will tend to have greater foreign product diversity than MNCs with matrix structures lacking such a dimension.*

A functional division dimension in a structure also provides a high level of tactical information processing for product matters, but it does so along functional channels (Egelhoff, 1982). Marketing and manufacturing matters come together and are first integrated at the parent HQ level. This kind of centralization is only manageable if there is a narrow line of products. If significant product diversity were introduced, it would quickly overload the limited cross-functional information-processing capacity of the parent HQ.

> *Hypothesis 3b: MNCs with matrix structures containing a functional division dimension will tend to have lower foreign product diversity than MNCs with matrix structures lacking such a dimension.*

Size of foreign operations

The Stopford and Wells Model shows that as the percentage of foreign sales in a firm increases, firms tend to abandon an international division structure and adopt a geographical region structure. If this is accompanied by high levels of foreign product diversity, firms will move to a matrix or mixed structure. Egelhoff (1982) found that a relatively low percentage of foreign sales was the defining characteristic of an international division structure. Since the present study does not include or address an international division dimension, size of foreign operations requires a different structural logic here than it had in Egelhoff's earlier model. Here the logic must conceptually distinguish among functional division, product division, and geographical region dimensions.

When compared to the functional division and product division dimensions, a geographical region dimension reduces the geographic scope that HQ managers have to deal with. This allows them to specialize on a regional basis to develop regional synergies, economies of scale, and knowledge. But, unless the size of each region is relatively large, these synergies and economies of scale won't exceed the considerable cost of maintaining multiple regional HQs. Thus, using a geographical region dimension requires a high percentage of foreign sales. Neither the functional division nor the product division dimension shares this requirement, since the synergies and economies of scale realized within each functional or product division are global, and not dependent on the relative size of a firm's foreign and domestic operations. This logic differs from that used in existing theory and leads to the following hypothesis:

> *Hypothesis 4: MNCs with matrix structures containing a geographical region dimension will tend to have a greater percentage of foreign sales than MNCs with matrix structures lacking such a dimension.*

Number of foreign subsidiaries

Requirements for information processing between foreign subsidiaries and HQ increase with the number of foreign subsidiaries. This threatens to overload the information-processing capacities of the HQ. The structural dimension that best guards against this is the geographical region dimension, since it divides the number of foreign subsidiaries reporting in to a HQ into regional groupings. Since the functional division and product division dimensions are global, all subsidiaries containing a given functional or product area must report in to the given functional or product division HQ. Regional HQs are ideal for managing the high levels of routine day-to-day coordination that occur in most large MNCs. They reduce the geographic scope and span of control that a HQ must deal with. When matrixed with either a functional division or product division dimension, the geographical region HQ should provide a large part of the tactical information processing required to manage routine matters, while the global functional division or product division HQ largely addresses less frequent strategic and other non-routine information-processing requirements. This logic complements that developed for Hypothesis 4 and leads to the following relationship:

> *Hypothesis 5 MNCs with matrix structures containing a geographical region dimension will tend to have a larger number of foreign subsidiaries than MNCs with matrix structures lacking such a dimension.*

Size of foreign manufacturing

Egelhoff (1982) argued that a geographical region structure provides good information processing among subsidiaries within a region, but poor information processing with subsidiaries in another region or with the home country. As a result, it fits a regional manufacturing or sourcing strategy, and not a sourcing strategy based on exports from the home country or another region. Since the functional and product division structures provide high levels of information processing between home country and foreign operations, they can support either high levels of parent exports or high levels of foreign manufacture. When foreign manufacturing becomes relatively large and parent exports relatively small, Egelhoff (1982) argued that opportunities for synergy and economies of scale will tend to be more intraregional than global, and the advantages of the geographical region structure will tend to outweigh those of the functional or product division structures. Egelhoff's (1982) data supported this argument, and twenty years later Wolf and Egelhoff's (2002) new data again supported this argument, that international manufacturing strategies tend to be more concerned with implementing regional integration than global integration. This leads to the following hypothesis:

> *Hypothesis 6 MNCs with matrix structures containing a geographical region dimension will tend to have a greater percentage of foreign manufacturing than MNCs with matrix structures lacking such a dimension.*

Strategic orientation

All of the contingency variables considered thus far have appeared in previous research studies of the strategy-structure relationship (although new logic has been used to link some variables to specific dimensions of structure). In addition to these variables, the present study also sought to include the international strategic orientation of a firm as a new and potentially important contingency concept for international structure. Different strategic orientations create different interdependencies and, consequently, different information-processing requirements.

Based largely on the work of Perlmutter (1969), Porter (1986), and Bartlett and Ghoshal (1989), four different international strategic orientations have been defined:

> <u>Multidomestic strategy</u> – products are developed for each local market and respond to local market conditions; each foreign subsidiary possesses its own unique domestic strategy; subsidiaries tend to possess a full value chain of activities and to be relatively independent.
>
> <u>International strategy</u> – products are developed for the home country market and are moved into international markets with little or no adaptation.

> Global strategy – products are developed to fit the common demands of global markets; standardization of products and processes attempts to realize global economies of scale; value chain activities are located to optimize factor cost differentials and economies of scale.
>
> Transnational strategy – attempts to simultaneously realize the local responsiveness advantages of the multidomestic strategy and the efficiency advantages of the global strategy.

Respondents in the study were asked to estimate what percentage of their firm's sales fell under each of the four strategic orientations. This measurement provides a strategic orientation profile for each firm.

Several distinctions among the strategic orientations appear to have implications for structure. An international strategy orientation tends to be ethnocentric (Perlmutter, 1969). Products are developed for the home country market and sold with little or no adaptation into international markets. Under this strategy, there is little need for parent HQ to understand foreign markets and, hence, a relatively low requirement for information processing between HQ and foreign subsidiaries. The firm largely views foreign markets as similar to and an extension of the domestic market. Since the home country operations of the firm will tend to have either a functional division or product division structure, it will be logical to simply extend the home country structure to encompass the foreign operations. There is no reason to employ a geographical region structure under this strategic orientation, since the information-processing requirement that exists is between the HQ and a subsidiary, not between subsidiaries. A geographical region structure facilitates information processing among subsidiaries located within the same region, but it hinders information processing between foreign subsidiaries and home country domestic operations. This leads to the following hypothesis:

Hypothesis 7 MNCs with matrix structures containing a geographical region dimension will tend to have a lower level of international strategy orientation than MNCs with matrix structures lacking such a dimension.

Since a geographical region dimension facilitates information processing among subsidiaries in a region, it provides horizontal or lateral coordination across the various functional and product subunits in a region. The functional division or product division dimension that is matrixed with the geographical region dimension provides vertical coordination between these subunits and a global HQ. When such horizontal and vertical coordination are combined in a matrix structure, it facilitates implementing a transnational strategy. The functional division or product division dimension provides the standardization and centralized coordination required to implement the global efficiencies associated with a global strategy. The geographical region dimension provides information processing that helps to reconcile these global requirements with the regional and local requirements associated with a multidomestic strategy. This leads to the following hypothesis:

Hypothesis 8 MNCs with matrix structures containing a geographical region dimension will tend to have a higher level of transnational strategy orientation than MNCs with matrix structures lacking such a dimension.

METHOD

Sample

The research sample consists of 116 German manufacturing and service firms, each with foreign sales of 10 percent or more. There are 57 firms with a matrix structure and 59 firms with an elementary structure. Industries included in the sample are: chemical, steel and nonferrous metals, machinery, automotive and transportation, electrical equipment, textile, food products, construction, publishing, and retailing. Firm size varies from 44 million to 83 billion Euros in annual sales, with a mean of 5.9 billion Euros. The sample was constructed by combining data collected in two different studies. One study occurred in 2000 and the other in 2005.[1] The sample was chosen to represent German firms in the above industries that have significant international business. By including both relatively large and small firms, the sample differs from most strategy-structure studies. The latter have typically focused on large Fortune 500 firms. In Germany a large amount of international business is conducted by relatively small firms.

Data

Data collection was by mail questionnaire. Measurement of organizational structure and the eight strategy variables are described in the Appendix. Table 1 shows the means, standard deviations, and correlations among the elements of strategy. While

(Insert Table 1 about here)

there are some significant correlations among the contingency variables, the levels are sufficiently low that each variable can be viewed as representing a different element of the firm’s strategy. Four different types of matrix structure appear in the sample. Nineteen firms have a functional division by product division matrix (FDxPD), nine a functional division by geographical region matrix (FDxGR), seventeen a product division by geographical region matrix (PDxGR), and twelve a tensor matrix structure. The "tensor" structure is a uniquely German term, which defines a three-way matrix involving functional, geographical, and product division dimensions. While three-way matrix

[1] We combined samples to obtain as large a sample of matrix structure firms as possible. The same measures were used in both studies, although strategic orientation was only measured in the latter study. There is nothing in the conceptual framework that would restrict the hypothesized relationships to the typical sample of Fortune 500 manufacturing firms (naturally percent foreign manufacturing is a missing variable for the service firms).

structures exist outside German firms, the significant number of such structures in the sample is interesting.

Analytical approach

Three types of analyses were used to examine the hypothesized relationships between strategy and structure. First, t-tests were used to test the hypothesized differences between matrix and elementary structure firms expressed by the Stopford and Wells Model (Hypotheses 1 and 2). Second, bivariate ANOVA contrasts were used to test separately each relationship expressed by Hypotheses 3 – 8. Then, a multivariate discriminant analysis was used to examine simultaneously the relationships between type of matrix structure and the contingency variables (elements of strategy).

RESULTS

Testing the hypotheses

Table 2 contains a summary of each hypothesis and the results of the associated t-tests and ANOVA contrasts. For Hypotheses 1 and 2, t-tests were used to determine the

(Insert Table 2 about here)

significance of differences between matrix structures (as a group) and elementary structures (as a group). Neither hypothesis is supported by the sample data. The interaction of the two variables (product diversity multiplied by size of foreign operations) also showed no significant difference between elementary and matrix structure firms. While both increasing product diversity and increasing foreign sales increase strategic complexity and thus encourage the adoption of matrix structures, this part of the Stopford and Wells Model is clearly too general and underspecified to accurately distinguish (even as a group) the wide variety of matrix structures used by today's MNCs. Our intention here is to justify why further specification of the strategy-matrix structure relationship is required for today's MNCs, since most texts stop with the presentation of this relationship.

The data strongly support hypothesis 3a, linking high foreign product diversity to matrix structures containing a product division dimension. While the three relationships hypothesized by Hypothesis 3b are all directionally supported, only one is statistically significant. It is important to realize that for the two matrix structures containing both a product division (PD) and a functional division (FD) dimension, Hypotheses 3a and 3b are contradictory (the PD dimension fits high product diversity and the FD dimension fits low product diversity). It is interesting to observe that when both dimensions are present in a matrix structure, the PD dimension dominates this fit and allows the structure to successfully manage a strategy with high foreign product diversity.

Hypothesis 4, involving the size of foreign operations, is supported by the findings. It argues that a geographical region (GR) dimension in a matrix requires relatively large foreign operations to provide adequate regional economies of scale. Hypothesis 5, involving the number of foreign subsidiaries, deals with a similar concept, and it is also supported by the data. It argues that the GR dimension also fits a high number of foreign subsidiaries because it reduces the geographic scope and span of control that a HQ must deal with, and thus prevents information-processing overload at the HQ level. The two variables and hypotheses represent different aspects of the size of international operations and their implications for structure.

Hypothesis 6, involving the size of foreign manufacturing, is also supported by the data. The argument is that more foreign manufacturing tends to be associated with regional manufacturing strategies than with global manufacturing strategies, and a GR structure or dimension is ideal for coordinating a regional manufacturing strategy. The data support the view that most foreign manufacturing for German MNCs is still regionally coordinated.

Hypotheses 7 and 8 involve respectively the percent of a firm's sales associated with an international strategy and the percent associated with a transnational strategy. The logic underlying these hypotheses is new and argues that a GR dimension misfits a high level of international strategy (Hypothesis 7) and fits a high level of transnational strategy (Hypothesis 8). The findings tend to support Hypothesis 7 at the .10 significance level or better, but they only directionally support Hypothesis 8 between the .15 and .20 significance levels. The strategic orientation variables were missing for 15 of the 57 cases, so the sample size is smaller.

A multivariate test of fit between strategy and type of matrix structure

The preceding subsection dealt with fit between strategy and structure in a bivariate manner. It is easier to model and conceptually understand a complex situation as a collection of independent bivariate relationships, each with its own logic. This is where most previous research on the strategy-structure issue has stopped. But in the real world an MNC must select one type of matrix structure and simultaneously attempt to satisfy as many of the crucial bivariate fits with strategy as it can. In order to test how well MNCs actually do achieve simultaneous fit between type of matrix structure and the various elements of their strategies, multivariate analysis is required. Since structure was measured as a nominal variable, a multiple discriminant analysis was run using the four types of matrix structure as the groups and four of the elements of strategy as the independent variables. The variables measuring strategic orientation were not used, since the number of missing cases would unduly reduce the size of the sample.

The results of the discriminant analysis are presented in Table 3. The standardized discriminant coefficients indicate the relative contribution of an independent variable to a discriminant function. Only the first two discriminant functions are statistically significant.

(Insert Table 3 about here)

Table 4 shows how successful the discriminant functions were in predicting the type of matrix structure for each company, given measures of the elements of its strategy.

(Insert Table 4 about here)

In 60 percent of the cases the discriminant model could predict the actual structure of a company, which is significantly better than the chance probability of predicting only 28 percent of the cases correctly. Size of foreign operations and size of foreign manufacturing provide the most discriminating power, followed by number of foreign subsidiaries and product diversity. Each of these variables was hypothesized to be an important element of strategy for type of structure to fit. While the analysis confirms that companies in the sample tend to realize a significantly higher level of simultaneous fit with these four elements of strategy than might be attributed to chance, it is useful to further understand where the model succeeds and where it fails.

Table 5 shows the centroids of each of the four groups (types of matrix structure) measured along the three discriminant functions. The first function in Table 5 clearly

(Insert Table 5 about here)

discriminates the FDxPD structure (which contains no GR dimension) from the other three types (all of which contain a GR dimension). From Table 3 one can see that the first discriminant function largely measures the size of foreign operations. So size of foreign operations largely discriminates between matrix structures which possess a GR dimension and those which don't. This is consistent with the conceptual logic underlying Hypotheses 4 and 5. Large foreign operations increase information-processing requirements and threaten to overload the limited information-processing capacity of HQ. The GR dimension creates multiple GR HQs to address this requirement and buffer the MNC from information-processing overload at the top.

The second discriminant function most strongly represents product diversity. In Table 5 it largely separates the FDxGR structure (which lacks a PD dimension) from the FDxPD and PDxGR structures (which contain a PD dimension). This discrimination is consistent with the logic in Hypothesis 3a, that high levels of foreign product diversity create the information-processing requirements that call for a PD dimension in an MNC's structure. Unfortunately, the second discriminant function also separates the Tensor structure (which contains a PD dimension) from the other two types of structure that contain a PD dimension. This is confusing and an area where the model starts to fail.

The third discriminant function, which largely measures size of foreign manufacturing, discriminates the tensor structure from the other three structures. While Table 2 reveals that size of foreign manufacturing is greater in the tensor structure group than in the other three structural groups (and this is certainly the relationship that is driving the third discriminant function), there is no reason for this relationship in our conceptual theory or model. Hypothesis 6 states that size of foreign manufacturing will be greatest in firms with structures that contain a GR dimension. This conceptual logic was supported by the bivariate analyses, and it discriminates the FDxPD structure (not the tensor structure) from the remaining three structures. The reason the discriminant model doesn't reflect the logic of Hypothesis 6 is undoubtedly because the first discriminant function already discriminates the FDxPD structure (which lacks a GR dimension) from the structures which possess a GR dimension. From a discriminant analysis perspective, Hypotheses 4, 5, and 6 are redundant. They all separate structures with a GR dimension from those without a GR dimension. Table 3 shows that while size of foreign manufacturing loads most heavily on the third discriminant function, it also loads more weakly on the first discriminant function (along with the size of foreign operations and number of foreign subsidiaries). So the third discriminant function, which is not statistically significant, is also not conceptually meaningful.

It is apparent from "Table 4 that the discriminant model cannot properly discriminate the tensor structure from the other three. When the discriminant analysis is run omitting the tensor structure group: (1) the valid logic and relationships associated with the first two discriminant functions are retained, (2) the percentage of correctly classified cases is 71% (against a chance probability of 31 %), and (3) the case classifications remain the same, except one more PDxGR structure case is correctly classified. Thus, the multivariate discrimiant model strongly supports the importance of size of foreign operations as the primary driver of a GR dimension in a matrix and to a lesser extent the influence of foreign product diversity as the driver of a PD dimension. Both strategic fits have been found to exist separately in elementary structure MNCs, where there is a single structural dimension in each firm (Stopford and Wells, 1977; Egelhoff, 1982). The present study has hypothesized that both types of fit would continue to exist when the structural dimensions are combined and overlaid in a matrix structure. These hypotheses were earlier supported by the bivariate analyses of our study. Now the multivariate analysis confirms that both types of fit tend to be achieved simultaneously by the matrix firms in the sample. Where the discriminant model fails is in specifying when a firm simultaneously uses all three dimensions in its structure (the tensor structure).

DISCUSSION

The present study makes several important contributions to strategy-structure theory, as it applies to international matrix structure firms. First, it conducted a large-sample test of the matrix part of the Stopford and Wells Model. Second, it introduced strategic orientation as a potentially important contingency variable for MNC structure. And third, it developed an information-processing model of strategy-structure fit for international matrix structures. Each will be discussed in turn.

Testing the Stopford and Wells Model

The present study provides the first comprehensive test of the matrix part of the Stopford and Wells Model. It indicates that this part of the Model is an underspecified and incomplete predictor of matrix structures in today's MNCs. It is probable that when the data was collected in the 1960s, the range of matrix and mixed structures in U.S. MNCs was relatively narrow. High levels of the two contingency variables in the Stopford and Wells Model (foreign product diversity and size of international operations) predict or fit just one type of matrix structure (the PDxGR structure). Given the wide variety of matrix structures in existence today, they need to be modeled and understood at the level of their component dimensions.

Strategic orientation as a new contingency variable

The study introduced strategic orientation as a new and potentially important contingency concept for structural fit. The logic is that different strategic orientations (multidomestic, international, global, transnational) create different interdependencies and, consequently, different information-processing requirements. There was empirical support for the argument that firms going abroad with an international strategy (where home-country products are moved with little alteration into international markets) can simply extend their existing functional division or product division structures to implement such a strategy. This makes the international strategy an easy, low-cost way of entering foreign markets, both from a business strategy perspective and an organizational perspective. The literature has often associated an international division structure with this type of strategy and entry into international markets (Stopford and Wells, 1972; Egelhoff, 1982). But this literature tends to be based on the experience of U.S. MNCs, and there was no systematic measurement of strategic orientation. German and other European MNCs seldom use an international division structure, even for the entry stage (Franko, 1976). Since the logic underlying Hypothesis 7 is as applicable to U.S. MNCs as it is to German MNCs, it would be interesting to further investigate whether it can also be generalized to U.S. MNCs.

The study found directional, not statistically significant support for the argument that a transnational strategic orientation will tend to require a GR dimension in a firm’s structure (Hypothesis 8). The logic is that an FD or PD dimension provides the information processing to implement the global efficiencies associated with a transnational strategy while the GR dimension provides the information processing required to reconcile these global requirements with the regional and local requirements that are also associated with a transnational strategy. We think the directional support for this argument is meaningful, even though the small sample size hindered statistical significance. There are only a few significant correlations between the strategic orientation variables and the existing contingency variables. Thus, strategic orientation largely dictates a set of interdependencies among the organizational subunits of an MNC that is not already captured by the existing contingency variables. Our investigation of this concept was limited and exploratory. It needs to be further pursued with (1) a more extensive, multi-item measurement of strategic orientation, and (2) a larger sample.

Developing an information-processing model of matrix strategy – structure fit

To develop a more specified model of the strategic domains of specific matrix structures, the present study borrows heavily from the framework begun by Egelhoff (1988a) and Wolf and Egelhoff (2002). For two of the contingency variables (foreign product diversity and size of foreign manufacturing) the study uses the same logic and hypotheses as Wolf and Egelhoff (2002). For two other variables (size of foreign operations and number of foreign subsidiaries), the present study develops new logic that uses the two variables to distinguish between the strategic domain that fits a geographical region dimension and the strategic domain that fits a global functional division or product division dimension. The earlier Wolf and Egelhoff (2002) conceptualization used these variables to specify the strategic domain of an international division structure (a structure not present in the current study). The empirical testing strongly supports the conceptualization borrowed from the earlier Wolf and Egelhoff (2002) study and the new conceptualization. It is important to recognize that empirical testing in the present study is based solely on comparisons among the different types of matrix structure. Previous testing in Wolf and Egelhoff (2002) only grouped elementary and matrix structure firms across a common functional, product, or geographical region dimension to test the hypotheses. In this respect, the present study is a much more direct and convincing test of the proposed matrix logic. This logic states that the information-processing capacity (coordination capability) of a matrix structure can be viewed as the sum of the information-processing capacities of its structural dimensions. With some limited qualifications, the information-processing capacity of a structural dimension remains the same when it is overlaid by a second or third structural dimension in a matrix.

In addition to providing more convincing empirical support for the proposed matrix logic, the study also provides new insight into the use of the GR dimension in matrix structures. The previous conceptualization of an elementary geographical region structure was that it requires relatively large international operations to justify the overhead costs of the regional HQs and that its primary purpose is to coordinate regional manufacturing and marketing. These are the two critical fits for the geographical region structure identified in the Egelhoff (1982) study. The new conceptualization of the GR dimension as a component of a matrix structure adds the following:

1. When international operations become very large, the GR dimension reduces the geographic scope and span of control of the HQ and prevents information-processing overload at the HQ level.

2. Adding a GR dimension to a matrix is the primary way of fitting a structure to a transnational strategy. It provides the bridge between globally managed functional and/or product activities and the demands of local environments.

Thus, the GR dimension plays a somewhat different role in matrix structures than it played in an elementary stand-alone geographical region structure. While the information-processing capacities of the dimension are similar in both cases, the purpose and utility of such information processing seems to change with the structural context. As a stand-alone elementary structure the GR dimension is primarily coordinating regional manufacturing and marketing strategies. As the second dimension in a matrix the GR dimension is buffering the global HQ of the other dimensions from information-processing overload (by managing most of the routine day-to-day operations in a region) and reconciling global goals and information processing with information-processing requirements stemming from the local environment. This new insight is an important addition to strategy-structure conceptualization, since today the GR dimension is just as likely to be used in matrix structures as in a stand-alone elementary structure.

The other significant issue raised by the empirical analysis is the failure of the discriminant model to distinguish the tensor or three-way matrix structure from the other two-way types of structure. This problem was not apparent from the bivariate analyses. The most useful way to state this problem is as follows: Given the presence of PD and GR dimensions in a matrix, what is the logic for adding an FD dimension, to create a tensor structure? The logic for the PD and GR dimensions in a matrix has already been discussed, and it is adequately represented by the four contingency variables (elements of strategy) used by the discriminant model. What is not represented by these variables is the logic for combining the FD and PD dimensions in the same structure. This combination occurs in the FDxPD and tensor structures. The discriminant model distinguished the FDxPD structure by its relatively smaller foreign operations (which fits the absence of a

GR dimension). It needs a different logic for distinguishing the tensor structure, and this logic must explain why FD and PD dimensions would be used in the same structure. This is still the missing part of an information-processing theory of strategy-structure fit.

As already discussed, the FD elementary structure fits low product diversity and the PD elementary structure fits high product diversity. On the surface, it would appear that these two dimensions should not be used together in the same structure. The reason an elementary FD structure requires low product diversity is because it can't handle high requirements for cross-functional information processing. Information processing in a FD structure largely occurs within functional channels. These functional channels only come together at the top of the structure, where cross-functional information-processing capacity is extremely limited. Since R&D, manufacturing, and marketing information must be integrated for each product line, increasing product diversity creates increasing requirements for cross-functional information processing. This would overload the limited information-processing capacity of the HQ in a FD structure.

The earlier Wolf and Egelhoff (2002) study concluded that when the FD and PD dimensions appear together in a matrix, the FD fit with product diversity will tend to dominate over the PD fit (there will be low product diversity). The data tended to support this view, and the logic provided was: "functional coordination across product divisions only makes sense when functions are sufficiently similar to make information sharing useful." The mean levels of product diversity in our sample are as follows: PD (4.7), PDxGR (4.2), FDxPD (3.4), and tensor (3.3). There is less difference here than in the Wolf and Egelhoff (2002) study. While the two structures containing a FD dimension do have lower product diversity, the difference is not that great. And there is still considerable product diversity in both structures (the elementary FD structure in the sample has mean product diversity of 2.2). As a result, we want to propose a somewhat different logic than the earlier study for specifying the strategic domain of the FD dimension in a matrix structure.

Given the levels of product diversity associated with the FDxPD and tensor structures, it is apparent that the cross-functional information processing required to coordinate such product diversity is being provided by the PD dimension in both matrix structures (not the FD dimension). The multiple product division HQs are providing cross-functional information processing for each product area, and this reduces the requirements for such information processing at the corporate HQ level where the separate functional channels come together. Thus, when a FD dimension is used in a matrix with the PD dimension, it only provides vertical information processing within functional channels, while the PD dimension provides the cross-functional information-processing capacity. This is why the presence of a FD dimension in a matrix does not necessarily require low product diversity.

What still needs to be explained is why an MNC would want to vertically process information within functional channels. The most obvious answer is some kind of functional interdependency that cuts across the product divisions (in the case of a FDxPD structure), or the geographical regions (in the case of a FDxGR structure), or both (in the case of a tensor structure). Our discussions with managers in manufacturing MNCs with matrix structures frequently uncovered significant technical or manufacturing similarities across product divisions, and often this was associated with a global technical or manufacturing division.[2] This suggests that interdependency within technical and manufacturing functions stems from technological similarities, which facilitates developing economies of scope and a common experience curve. Centralizing such information processing under a global technical or manufacturing dimension provides the information-processing capacity necessary to realize both of these.

None of the contingency variables associated with existing MNC strategy-structure theory adequately measures technological similarity and marketing similarity across product divisions and geographical regions. This is why existing theory (and the discriminant model) can't adequately specify the strategic domain that fits the tensor structure. While the broad concept of product diversity at the business strategy level is undoubtedly correlated with technological and marketing similarity, we argue that the latter need to be developed and measured as separate concepts. Adding these measures to the strategic contingency variables should contribute to a better understanding of when a FD dimension needs to be added to a matrix structure. This, in turn, will help to uniquely specify the strategic domain of the tensor structure. It is interesting that the multivariate analysis exposed this gap in existing theory, which heretofore has not been identified in the literature.

CONCLUSION

As international strategies become increasingly complex and diverse, managers need more specified theory and guidance for using matrix structures. This was lacking

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[2] Sometimes this global manufacturing or technical dimension is accompanied by a global marketing division, and there is a fully matrixed functional dimension. At other times there is no global marketing division, and only the manufacturing or technical activities are included in the matrix structure. We have not observed the opposite situation, where marketing is included in the matrix while the manufacturing and technical activities are not included.

when matrix structures previously failed in many MNCs. Our information-processing model is consistent with and further specifies the conceptual framework developed by Davis and Lawrence (1977). They suggested matrix structures should be used to address demands for a dual focus, high information-processing capacity, and shared resources. Our model develops many of the key strategy-structure fits required to do this.

It is important to realize that our study only addresses one of the two major problems facing matrix structures. It addresses the design of matrix structures so that they can provide the coordination needed to implement complex strategies. The other problem is the on-going management of matrix structure firms.. While bad design has undoubtedly aggravated this problem in the past, it remains a serious challenge even in well-designed matrix structures. This issue resides in the more behavioral concerns of Chi and Nystrom (1998), regarding the incentives, socialization, conflict, and overlapping responsibilities that occur in MNCs with matrix structures. To address these issues more micro-level research within matrix structure MNCs is required. The design and management of matrix structures should be viewed as complementary bodies of knowledge. Both are required if an organizational form as complex as the matrix structure is to succeed.

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Appendix: measurement of Variables

1. Organizational structure was measured by presenting respondents with descriptions and simplified organization charts of the various types of structure and asking them to select that which best described their organization. This variable represents the operating structure, which can be different from the legal structure of MNCs.

2. Foreign product diversity was measured by the number of 5-diget product classes associated with the company (taken from the Hoppenstedt classification system). This measure of total company product diversity was used, because there is no official data available on a firm's foreign product diversity. It is reasonable to believe that foreign product diversity and total company product diversity are highly correlated in most German firms with foreign sales.

3. Size of foreign operations was measured by the percentage of a company's sales occurring outside of the parent country.

4. Number of foreign subsidiaries was measured by the number of host countries in which the firm has foreign subsidiaries.

5. Size of foreign manufacturing was measured by the percentage of a company's manufacturing occurring outside of the parent country.

6. Strategic orientation was measured by the percentage of a company's sales estimated by the respondent to fall under each of the four types of strategy orientation.

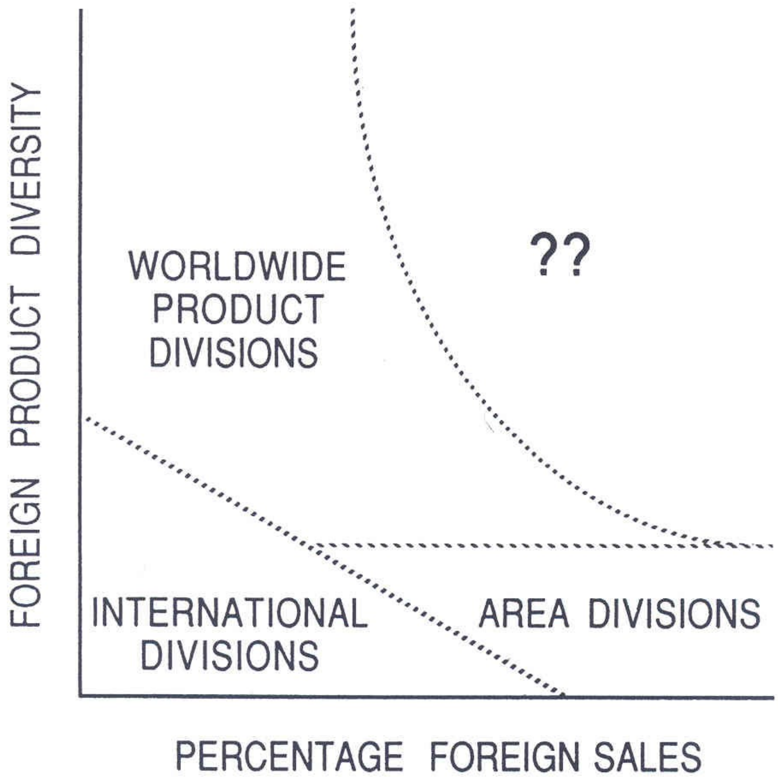

Figure 1. The Stopford and Wells Model showing the relationship between strategy and structure in multinational corporations

Table 1. Means, Standard Deviations and Correlations of Elements of Strategy

Variable	Means	SD	1	2	3	4	5	6	7
1. Product diversity	3.6	2.1							
2. Size of foreign operations	60.9	21.0	-.02						
3. Number of foreign subsidiaries	30.2	34.1	.25*	.44***					
4. Size of foreign manufacturing	43.6	23.2	-.10	.41***	.26*				
5. % international strategic orientation	23.8	33.2	-.07	-.46***	-.24*	-.16			
6. % multinational strategic orientation	12.1	21.3	.14	-.21	-.08	-.05	-.01		
7. % global strategic orientation	42.5	39.5	.03	.39***	.06	.05	-.57***	-.36***	
8. % transnational strategic orientation	21.7	31.5	-.05	.13	.24*	.14	-.32**	-.22*	-.41***

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.1$ (n = 70-112)

Table 2. Hypotheses and Results of T-tests and ANOVA Contrasts

		Mean Values of Elements of Strategy					
		Elementary structures	FDxPD	FDxGR	PDxGR	Tensor	
Number of firms		59	19	9	17	12	
Hypotheses	Measure						Differences
1. Product diversity greater in matrix structures than in elementary structures	# 5-digit classes	3.84		3.37			result is against expected direction p = .243
2. Size of foreign operations greater in matrix structures than in elementary structures	% foreign sales	58.9		62.8			p = .319
3a. Product diversity greatest in matrix structures with PD dimensions 3b. Product diversity lowest in matrix structures with FD dimension	# 5-digit classes		3.39	2.00*	4.20**	3.33	*Different from FDxPD at p<.001, PDxGR at p<.01, and Tensor at p<.05. **Different from FDxGR at p<.01, FDxPD at p=.14, and Tensor at p=.16.
4. Size of foreign operations greatest in matrix structures with GR dimensions	% foreign sales		47.7*	68.3	77.3	62.3	*Different from FDxGR at p<.01, PDxGR at p<.001, and Tensor at p<.05.
5. Number of foreign subsidiaries greatest in matrix structures with a GR dimension	# host countries		16.1*	48.1	60.1	42.5	*Different from FDxGR and PDxGR at p<.05, and Tensor at p<.01.
6. Size of foreign manufacturing greatest in matrix structures with GR dimension	% foreign manufacturing		34.1*	50.7	50.3	63.1	*Different from FDxGR and PDxGR at p<.01, and Tensor at p<.05.
7. International strategy orientation lowest in matrix structures with GR dimension	% international strategy orientation		27.5*	7.1	11.9	10.0	*Different from FDxGR at p<.05, PDxGR at p=.101, and Tensor at p=.096
8. Transnational strategy orientation greatest in matrix structures with a GR dimension	% transnational strategy orientation		13.2*	28.6	25.2	25.0	*Only different from the other structures at p=.15 to p=.20.

Note: FD = Functional divisions; GR = Geographical regions; PD = Product divisions; (n = 110-112 for t-tests, n = 42-57 for ANOVA contrasts)

Table 3. Multiple discriminant analysis of the elements of strategy on type of matrix structure

Independent variable	Discriminant function 1	2	3	F-value
Product diversity	-.15	.85	.78	2.5*
Size of foreign operations	.62	.46	-.38	4.3**
Number of foreign subsidiaries	.54	-.22	-.44	2.8*
Size of foreign manufacturing	.23	-.70	.83	3.2**
Canonical correlation	.56	.47	.27	
Wilks Lamda	.50**	.73*	.93	

* < .10, ** < .05, *** < .01, (n = 42)
Note: Type of matrix structure is the dependent variable.
All values under the three functions are standardized discriminant coefficients.

Table 4. Predicted type of matrix structure from coefficients of discriminant functions

Actual group membership	Predicted group membership FDxPD	FDxGR	PDxGR	Tensor
FDxPD matrix	14	0	1	1
FDxGR matrix	2	3	2	0
PDxGR matrix	3	1	7	1
Tensor structure	4	1	1	1

Note: Structures of MNCs correctly classified = 60%

Table 5. Centroids of the four structural groups measured along the discriminant functions

Group	Discriminant function 1	2	3
FDxPD matrix	-.78	.18	.01
FDxGR matrix	.22	-.72	-.44
PDxGR matrix	.72	.55	-.03
Tensor structure	.31	-.64	.47