

**"DISTRIBUTED INNOVATION IN THE  
'DIFFERENTIATED NETWORK' MULTINATIONAL"**

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### **ABSTRACT**

We offer a reconceptualization of the structure of the Multinational Enterprise as a differentiated network of three different types of relations: (i) task relations that define the local structure of each national subsidiary, (ii) governance relations that link the headquarters and the subsidiaries, and (iii) exchange relations that link the subsidiaries to each other. Using this framework we develop a series of propositions about how the structure of these relations influences the innovativeness of the different subsidiaries in a multinational organization. Analyses of data collected from 261 managers in 22 different national subsidiaries of two multinational companies show that all three of these structural effects are important in explaining the extent of innovative initiative and the number and scale of innovations generated by each subsidiary,

## DISTRIBUTED INNOVATION IN THE "DIFFERENTIATED NETWORK" MULTINATIONAL

Ever since Vernon (1966) proposed the product cycle model, the ability to innovate has been seen as the *raison d'être* for multinational enterprises (MNEs). Over the last two decades, many new theories have been proposed to explain why MNEs exist, and now they survive and grow, but innovations have continued to occupy the center stage in all these explanations (Calvet, 1981; Dunning, 1988). The basic argument in these theories is that what allows a firm to operate in many different countries is its ability to create new knowledge -- to innovate -- and to appropriate the benefits of these innovations in multiple locations through its own internal organization more effectively than it could through market-mediated mechanisms such as selling or licensing the knowledge (Buckley and Casson, 1976; Rugman, 1981; Caves, 1982).

In all these traditional theories of the MNE the parent organization has been viewed as the provider of the innovations which are then exploited abroad through the foreign subsidiaries. In recent years, however, some observers of large MNEs have proposed a rather different model (see, for example, Hedlund, 1986; Prahalad and Doz, 1987; Bartlett and Ghoshal, 1989). In their view, the growing parity among industrial nations in overall economic and technological capacity has resulted in technological expertise and lead users for specific products and services being increasingly dispersed among different countries (Vernon, 1979; Westney, *in press*). As a result, MNEs must now create distributed innovations, with different national units using their local resources to create innovative products, processes and administrative practices which can be used locally as well as in other national markets in which the MNE operates. Instead of relying only on the parent or headquarters (HQ) for innovations, the MNE must maximize its innovative potential by facilitating innovations in all its constituent parts.

This need for and shift towards distributed innovations requires, according to these observers, a reconceptualization of the MNE as a heterarchy (Hedlund, 1986), a multi-focal company (Prahalad and Doz, 1987), or a transnational organization (Bartlett and Ghoshal, 1989). While these authors differ in the terminology and detail in which the structural characteristics of the new form of MNE is specified, there is a broad consensus on the key attributes of the "ideal type" of the new MNE they describe and advocate. Perhaps the most recent and

formalized expression of this ideal type depicts the MNE as a differentiated network (Ghoshal and Bartlett, 1991). This differentiated network model of the MNE differs significantly from the multidivisional or M-form organization which has so far served as the most commonly used ideal-type for large, complex, multi-unit firms such as MNEs (Chandler, 1962; 1990). In essence, this new research tradition -- if we can so describe this body of work -- has made the case that MNEs have evolved from the M-form to the differentiated network primarily (though not exclusively) to create the internal organizational context necessary for facilitating distributed innovations. So far, however, there has been relatively little formal theorizing or systematic empirical work to explicate the differentiated network model of the MNE and examine the factors that influence the innovativeness of its subsidiaries.

Our objectives in this paper are threefold. First, in the following section, we compare the traditional M-form with the differentiated network model of the MNE, and identify some of the key structural attributes that differentiate the latter from the former. One of the key conclusions we derive from this comparison is that structural effects in the differentiated network model of the MNE emanate from three different levels of analysis, viz., the level of each subsidiary itself; the level of the relationship between the headquarters and each subsidiary; and, finally, the level of the network of relationships among the various subsidiaries.

Existing literature on the new MNE provides some implicit ideas on how structural attributes at each of these levels can influence a particular subsidiary's innovativeness, and, thereby, affect the MNE's overall ability to facilitate distributed innovation. In the next section of the paper we derive from these implicit ideas a set of testable propositions. Subsequent sections describe the data and measures used to test these propositions, the results of these tests, and the overall conclusions that can be drawn from these results.

### **From the M-form to the Differentiated Network**

As described by Chandler (1962), the Multidivisional or M-form firm fashioned by du Pont and Sloan involved the creation of more or less self contained, semi-autonomous divisions -- grouped according to some criteria such as product lines, technologies, distribution channels, geography, or some combination of these -- under a corporate administrative structure. Figure 1 graphically depicts this structure and some of its key assumptions and attributes are discussed below.

[Insert Figure 1 about here]

First, at least in its idealized form, each subsidiary or division of the M-form faces a distinct local environment which is independent of the environments faced by other divisions. This independence of sub-unit environments is, indeed, the main criteria for grouping activities into subunits. In the strategy literature this criteria is explicit in the normative suggestions on how strategic business units should be defined (Lorange and Vancil, 1977; Hax and Majluf, 1984). This assumption is also manifest in the empirical studies that have focused on the corporate/division relationship in the M-form organization (Govindrajana, 1988; Ghoshal and Nohria, 1989).

Second, the responsibility for all operating tasks are assigned to the divisions. This delegation of operating responsibilities to the divisional level is the fundamental distinction between the functional or U-form organization and the M-form (Ouchi, 1980) and is the key element in increasing the overall organization's ability to cope with diversity and complexity. By delegating operating responsibility, corporate management in the M-form is freed up to deal with key strategic issues for a broader scope of activities. At the same time, operating decisions are improved by moving these tasks to divisional managers who have superior knowledge of the specific environments of their own businesses. Lack of any operational interdependencies among the divisions (as a result of the assumption regarding lack of any linkages or interdependencies across their local environments) is a key premise that supports this delegation of operating tasks.

Third, consequent upon such delegation of operational responsibilities to the divisions, the corporate administrative structure including the top management of the company and the elite staff attached to them, are left with three key responsibilities (Lorange and Vancil, 1977; Vancil, 1979). First, they control divisional performance by influencing the process by which the divisions set their goals and by monitoring their performance to achieve these goals. Second, they allocate resources among the divisions to allow them to pursue their operational goals. Finally, interdependencies across the divisions that are related to the generation and consumption of resources such as cash are coordinated by the corporate office with a view to optimize the corporate portfolio.

While this is a somewhat stylized representation of the M-form that ignores some subtle variations both within and among such firms highlighted by more process-oriented scholars such as Bower (1970), Frederickson (1983), and others,

the new differentiated network model of the MNE represents a radical departure. This model is graphically depicted in Figure 2, and its key assumptions and characteristics are contrasted below with those of the M-form.

**[Insert Figure 2 about here]**

First, the local environments of the different national subsidiaries in the differentiated network model are both different and interdependent. On the one hand, the local environment of each national subsidiary is different because of a variety of factors including differences in regulations and government imposed restrictions on cross-national flows of people, products and information (Prahalad and Doz, 1987), differences in institutional structures and socially defined criteria for legitimacy (Westney, in press), differences in the levels of economic and technological development (Stopford and Turner, 1985), and differences in competitive structures and general business infrastructures (Prahalad and Doz, 1987). On the other hand, in an environment of increasing transnational linkages between people and firms triggered by increasing technological and economic parity, rapidly improving transportation and communication facilities and the increasing spread of multinational companies and alliances, these different national environments are also increasingly interlinked, similar and interdependent. Thus, in contrast to the assumption of mutually independent local environments faced by the divisions of the M-form organization, the subsidiaries of the differentiated network organization face environments that are simultaneously differentiated through some unique attributes and integrated through similarities and interdependencies (Nohria and Ghoshal, 1991; Rosenzweig and Singh, 1991).

Second, the interdependencies across the subsidiary environments lead to interdependencies among the subsidiaries with regard to their operational tasks (see Ghoshal and Bartlett, 1991 for illustrations). Because of these operational interdependencies, any particular subsidiary can no longer be allowed complete operational autonomy. Rather, the operating responsibilities become more diffused, both among the subsidiaries themselves and between the subsidiary and the corporate head office.

Finally, just as operating tasks and responsibilities are diffused and interdependent in the differentiated network, so are strategic responsibilities. With diffusion of technologies and lead users, and with progressive accumulation of resources and skills by different subsidiaries, a particular subsidiary or a group of subsidiaries are often better positioned, both in terms of environmental stimuli and

internal capabilities, to carry out the key strategic tasks that, in the M-form, are seen to be corporate responsibilities (Bartlett and Ghoshal, 1989). With such multiple strategic centers (Hedlund, 1986), the task of monitoring, control and of resource allocation become similarly diffused and shared.

Such differentiation and interdependence across the subsidiary environments and the diffusion and sharing of operational, strategic and control responsibilities lead to the two distinguishing characteristics of such organizations that the label differentiated network highlights. First, structurally, such organizations are not uniform or homogeneous internally, but are systematically differentiated to match the environmental and task requirements of each unit. Each subsidiary can therefore be structured internally in different ways. The relationships between the headquarters and each subsidiary can also be differentiated, to match the nature and extent of dependence, independence, and interdependence in each of these links (Egelhoff, 1988; Ghoshal and Nohria, 1989; Gupta and Govindrajana, 1991).

Second, the interdependencies across the various subsidiaries lead to extensive linkages among the subsidiaries themselves since dealing with such interdependencies requires close communication and coordinated action among them. Thus, the hierarchical structure of the M-form is replaced with a network structure in which extensive flows of information, product and people link the constituent units of the company in more or less tightly coupled exchange relationships (Ghoshal and Bartlett, 1991).

#### Structural effects in the differentiated network.

Because of these attributes, analyzing structural effects (Blau, 1960) on any aspect of organizational behavior or action (such as the innovativeness of the various national subsidiaries) in the differentiated network model must deal with a complex levels of analysis issue (Freeman, 1978) that the M-form model ignores because of the assumptions it makes regarding internal symmetry and lack of subsidiary level interlinkages and interdependencies. These assumptions and the resulting simplicity in the analysis of structural effects in complex organizations have been criticized even by earlier theorists. Scott (1987:226), for example, concludes his review of the literature on organization structure with the recommendation that "researchers must exhibit greater sensitivities to the complexities of organizational systems rather than treating the wider organizational structure as some kind of average of the characteristics of its work activities and

work units. It would seem more appropriate to treat it as an overarching framework of relations linking subunits of considerable diversity, and to develop measures that capture the distinctive characteristics of this superstructure." As our preceding description of the differentiated network model of the MNE has shown, the need for such an approach is especially crucial in this context since structural effects, in such an organization, can arise from relational patterns at three different levels of the firm.

First, each subsidiary, as a more or less independent organizational unit can have a different internal structure in terms of the pattern of linkages and relationships across its departments or functions. These relations define how work gets done within the subsidiary and these may therefore be regarded as task relations. The nature of such task relations, which can differ across subsidiaries, can clearly influence the behavior and actions of each subsidiary.

A second type of relation is the headquarters-subsidiary relationship. This relationship can be thought of as primarily being a governance relation. Hence, it can be analyzed in terms of the coordination and control mechanisms that the corporate headquarters employs to govern the subsidiary. Based on the work of Child (1973), Ouchi (1980), and Eisenhardt (1985), there are three primary control mechanisms that the headquarters may use singly or in combination to govern its subsidiaries. The first is control over the locus of decision making, i.e., the extent to which different decisions are centralized or decentralized. The second is the extent to which formal control mechanisms such as job specifications, rules and procedures are used to govern the division. The third control mechanism is the extent to which the division is governed through shared goals and values, or normative control (Edstrom and Galbraith, 1977; Baliga and Jaeger, 1984; Ghoshal and Nohria, 1991). As proposed by Ghoshal and Nohria (1989), because of the differences in the context of each subsidiary and the nature and extent of interdependence in the headquarter-subsidiary relations, such governance mechanisms are internally differentiated to fit the context of each subsidiary. The nature of this relation, thus, is a second source of structural effects in the differentiated network organization.

Finally, the third type of structural effect arises from the relational networks among the various subsidiaries. The position of a particular subsidiary within the network of such exchange relations, as argued by Cook (1977), influences its behaviors and actions, independent of the attributes of its own internal structure of task relationships or the structure of its governance relationship with the

head office. Thus, network position in the sense of centrality or structural equivalence (Burt, 1982) can be another source of structural effects in the differentiated network model of the MNE.

### **Distributed Innovation in the Differentiated Network**

Equipped with this differentiated network model of the MNE, we return to the question of what promotes distributed innovation in the MNE. We examine below how structural attributes at each of these three different levels can affect a subsidiary's innovativeness. The previous literature on the "new" multinational provides us with some implicit ideas, but mostly with regard to the influence of the structure of the headquarters-subsidary governance relation (Ghoshal and Bartlett, 1988). A larger body of literature on innovations in general (see reviews by Kanter, 1988; Delbecq and Mills, 1985; Daft, 1982; Kimberly and Evanisko, 1981; Kimberly, 1980; Kelly and Kransberg, 1978; Downs and Mohr, 1976; Baldrige and Burnham, 1975; Zaltman, Duncan, and Holbek, 1973), and on innovation in social networks (Rogers, 1983, Burt, 1987) provides both a complimentary perspective and also more specific propositions at the remaining two structural levels.

We start by clarifying what we mean by a subsidiary's innovativeness. There is little consensus on how to define and measure an organization's innovativeness (Van de Ven, 1986; Kelly and Kransberg, 1978). There are several reasons for this lack of consensus. Innovations are, by definition, unique. One innovation is rarely commensurable with another. So, if two organizations both innovate, it is hard to conclude which one is more innovative because the innovations may be of different types (e.g. product, process or administrative innovations), of disparate significance (e.g. incremental or radical) and of different scale (e.g. large versus small). Also, one organization may be better at generating new ideas and the other at implementing them.

Keeping these difficulties in mind, we define innovative accomplishments very broadly to include any policy, structure, method or process, product or market opportunity, that is perceived to be new by the relevant unit of adoption. This definition was first advanced by Schumpeter (1919) and has subsequently been employed in several studies including the empirical work of Zaltman et al. (1973) and Kanter (1983). We adopt this very broad definition of innovation because our aim is to try and capture the extent to which each subsidiary of the MNE is responsible for generating any form of new knowledge that can benefit the MNE.

While Daft (1982) and others have emphasized keeping technical and administrative innovations distinct, we join with Van de Ven (1986) and others who have argued that making such distinctions results in an unnecessary fragmented classification of the innovation process. However, we restrict the scope of innovative accomplishments to only include those that have been implemented because we are interested in demonstrated innovative ability and not just the generation of new ideas. This definition also captures the spirit in which this term has been used by Hedlund (1986) and is inclusive of the specific illustrations cited by Ghoshal and Bartlett (1988) in their discussions of innovation in the "new" MNE.

It is not enough to define what accomplishments are considered innovative to determine what makes one organization more innovative than another. We suggest that there are three dimensions along which organizations may vary in terms of their innovativeness. The first is the extent to which innovative accomplishments are widespread in the organization, i.e. what fraction of the total population of the organization is involved in creating innovations. The second is the degree of innovativeness, i.e. the total number of innovative accomplishments by the organization's members. And the third dimension is the scale of innovative accomplishments, i.e. magnitude of economic impact derived from the organization's innovations. The units of the first dimension are innovative people, the second innovations themselves, and the third the economic impact of the innovation. Taken together, these dimensions provide for a more multi-faceted analysis of an organization's innovativeness than has been previously conducted in the literature.

With these three dimensions of a subsidiary's innovativeness as our dependent variables, we now offer a series of propositions on how they are influenced by structural attributes at each of the three levels of the differentiated network model of the MNE.

The structure of task relations in the subsidiary. At the level of the effects that the structure of task relations within each national subsidiary have on innovation, we can expect the results of the traditional literature on innovation in single unit organizations to apply. Starting with the seminal work of Burns and Stalker (1961), what this literature has repeatedly concluded is that the rigid bureaucratic or "mechanistic" form is inimical to innovation (see Daft, 1982 for a more recent survey). Instead, an "organic" form of organization characterized by dense lateral flows of communication across functional and departmental boundaries is considered most conducive to innovation (Burns and Stalker, 1961; Lawrence

and Lorsch, 1967; Aiken and Hage, 1971). These lateral linkages are a valuable source of diverse inputs that stimulate idea generation. They also prevent "segmentalism" or factional conflicts across functions, thereby creating an atmosphere that supports innovation and facilitates the implementation of innovative ideas (Kanter, 1983, 1988).

We can therefore expect that increasing the density of lateral linkages in the subsidiary will have a positive impact on its innovativeness along all dimensions. However, relatively speaking, we would expect increasing density to have the greatest impact on the number of innovations. This is because the main effect of dense inter-functional linkages is on the process of innovation itself (Kanter, 1988). By creating channels for diverse inputs, such linkages facilitate the recognition of opportunities or needs and make it easier to implement innovative ideas, thereby increasing the number of innovations that are possible. Thus we hypothesize:

H1: Increasing density of interlinkages among a subsidiary's managers will enhance its innovativeness along all dimensions, particularly in terms of the number of innovations produced.

The structure of HQ-subsidiary relations. As mentioned earlier, the structure of the HQ-subsidiary relation can be analyzed in terms of three control mechanisms that the HQ can use to govern the subsidiary. Each of these control mechanisms has different implications for the innovativeness of the subsidiary.

The effect that control based on the centralization of decision making has on innovation has received extensive research attention (see Zaltman et. al., 1973 for a review). Empirical findings, though not always consistent, generally show a negative correlation: greater centralization impedes an organization's ability to generate innovations (Downs and Mohr, 1976). The research on centralization in MNEs shows similar results with regards to the innovativeness of subsidiaries (Picard, 1977; Gates and Egelhoff, 1984).

These findings support Thompson's (1967) and Amabile's (1988) view that having personal responsibility for action and outcomes is conducive to innovation. By denying authority, centralization can lead to the abrogation of responsibility and diminished initiative. This suggests that while centralization negatively affects all dimensions of innovativeness, it is particularly damaging to individual initiative and hence most seriously impacts the extent to which innovation is widespread in the organization. Thus:

H2: Centralization of decision making as a form of control in the HQ-subsiidiary relation inhibits the innovativeness of the subsidiary along all dimensions, particularly in terms of the extent to which innovative initiative is widespread.

Traditionally, control based on formalization in terms of highly specific role definitions, rules, and procedures has been considered to strongly inhibit innovation (Aiken and Hage, 1971). As Mohr (1969, 1980) states, even intuitively it is obvious that a certain amount of freedom to experiment and do things outside a formal role or procedure is necessary for innovation. There is considerable empirical research that supports this intuitive belief (see Kanter, 1988 for a review), though none of it has been done in the context of the MNE.

While formalization is certainly inimical to individual initiative and to experimentation, thereby having a negative impact on the extent and number of innovative efforts in an organization, research done by Burgelman and Sayles (1986) suggests that it can play a different role depending on the scale of innovation. According to them, innovation in organizations can be thought of as being of two types. One type which is based on individual initiative and is outside the strategic and structural context established by the corporation is primarily organized through informal structures such as skunkworks, off-line projects, etc. The other type, which is more programmatic and consistent with the firm's defined strategy is usually supported by a more formal structural context including well defined roles, procedures, and controls. The latter initiatives are often larger than the former. Indeed, when it appears that autonomous initiatives are likely to have a big pay-off, their further development may require that they be managed by a more formal approach. This leads us to hypothesize:

H3: Formalization as a form of control in the HQ-subsiidiary relation inhibits the innovativeness of the subsidiary in terms of both the extent and number of innovative accomplishments, but facilitates large scale innovation.

Finally, received theory suggests that innovation requires the mobilization of support in the form of endorsement, backing, approval, and legitimacy (Kanter, 1983). Thus, control mechanisms that lead to common bonds between the headquarters and subsidiary and to shared goals and values can facilitate innovation. In the context of the MNE, these mechanisms include the initial training and socialization of subsidiary managers as well as their ongoing socialization achieved through mentoring, rotating subsidiary managers, and managing the time they spend at the headquarters (Jaeger, 1983; Edstrom and Galbraith, 1977). These mechanisms create social capital and common understandings which can help to mobilize support for innovative initiatives. As Rogers (1983) found,

communication and the exchange of ideas is more effective when individuals are homophilous (i.e. when they share common meanings, goals and values). Since control through socialization attempts to minimize the divergence of preferences and values between the headquarters and the subsidiary, it can be expected to have a positive impact on the innovativeness of the subsidiary.

We would expect this effect to hold for the subsidiary's innovativeness along all dimensions since the supportive context that is created through shared goals and values helps individuals take risks, increases the chances that innovative efforts will not be killed, and makes it easier to find the resources and approvals necessary for larger scale innovations. This leads us to hypothesize:

4: Socialization and normative integration as a form of control in the HQ-subsidiary relation enhances the innovativeness of the subsidiary along all dimensions.

The structure of relations among subsidiaries. The position of an actor in various relational networks has important implications for the actor's power, access to resources, autonomy, and attitudes (Burt, 1982). In the context of innovation, the location of actors in communication networks is of particular importance (Rogers, 1983). Early research on communication networks found that actors at the center were better at solving problems and completing ambiguous tasks (Bavelas, 1950; Guetzkow and Simon, 1955). Centrality in communication networks, in the sense of "betweenness" or being in the middle (directly or indirectly) of chains linking other actors (Freeman, 1979) can be a source of both a diverse set of inputs as well as power (Krackhardt, 1990). By being central in the inter-subsidiary networks of communication flows, a subsidiary can learn about interesting developments in other national locations and also use the network to more efficiently search for the resources required for innovation.

The benefits of being central are likely to be greatest for the number of innovations generated by the subsidiary since centrality provides gateways for information flows that are most helpful for the generation of new ideas. At the same time, being in a central location in the subsidiary network also facilitates individual initiative and creates the power and support necessary for larger scale innovations. Thus:

H5: Centrality in the communication networks across subsidiaries enhances the innovativeness of the subsidiary along all dimensions, particularly in the number and scale of innovations generated.

In addition to these structural effects on the innovativeness of the different national subsidiaries of the MNE, it is important to account for other contextual factors that can affect an organization's innovativeness (Baldrige and Burnham, 1975; Kimberly and Evanisko, 1981). Two contextual factors particularly pertinent to the MNE are: (i) the slack resources available to the subsidiary; and (ii) the type of environment in which the subsidiary is located.

By slack we mean "uncommitted and unspecified resources of appropriate personnel, finance, material, and motivation; or if such resources have been committed and specified, it has been done in a way that they are recoverable." (Thompson 1967, p.42) Slack has been hypothesized to be positively related to organizational innovativeness: "Slack provides a source of funds for innovation that would not be approved in the face of scarcity." (Cyert and March, 1963, pp. 278-279). Usually, though not necessarily, slack is related to the size of the subsidiary. While this suggests that the size of the subsidiary is another factor that must be considered in explaining its innovativeness, we believe that the effect of size is mediated by slack.

Slack can be expected to have a positive impact on all dimensions of innovativeness, but particularly so for the scale and number of innovations, since slack permits both a greater number of initiatives and also larger scale initiatives. This leads to our sixth hypothesis:

H6: The slack resources available to a subsidiary can enhance its innovativeness along all dimensions, particularly in terms of the number and scale of innovative initiatives.

Even though one of the factors driving the shift towards the differentiated network model of the MNE is the increasing parity of various national environments in terms of their ability to stimulate innovation, differences in the relative conduciveness of various national environments to innovation do persist. These differences may arise out of institutional factors such as rules and regulations, the nature and quality of local technical talent and their networks, and the extent of competition in the local economy (Westney, in press). Thus, the local environment in which the subsidiary is embedded may affect its innovativeness. This leads to our final hypothesis:

H7: The degree of economic development of the local environment in which the subsidiary is located can enhance its innovativeness along all dimensions.

## Data And Measurement

The data to test these hypotheses were obtained through a self-report questionnaire mailed to department managers at the national subsidiaries of two major MNCs - Philips of Holland and Matsushita of Japan. While both are among the largest and most diversified MNCs in the world, we focused our study on the consumer electronics business in which the two companies competed directly on a worldwide basis and were broadly comparable in terms of size, geographic scope and competitive position. By focusing on the same business in both companies, we hoped to achieve some level of comparability in terms of overall environmental and task characteristics. Yet, by carrying out the analysis in one Western and one Japanese company, we could test our hypotheses in two very different organizational contexts. These data were collected as part of a larger study on the organization of multinationals that is described in detail elsewhere (Bartlett and Ghoshal, 1989). The responses of 182 subsidiary managers from 14 national subsidiaries in Matsushita and 79 subsidiary managers from 8 national subsidiaries in Philips were complete and usable.

The limitations of these data need to be noted at the outset. First, these data are incomplete in some respects. We do not have data on all the subsidiaries of these MNCs, nor do we have data from each and every department manager in every subsidiary. Second, our data are based on the perceptions of the respondents. Without getting mired in the intractable debate on this issue, we acknowledge the limitations of such perceptual measures as outlined by Downey and Ireland (1985). We chose this approach because of the practical difficulty of obtaining objective data in such far flung locations and the absence of any published data on most of the issues of interest to us. Moreover, our use of multiple indicators and multiple respondents reduces, to some extent, the problem of individual perceptual biases. Finally, our data may have limited generalizability since it was collected from only two MNCs that were chosen from a purely practical standpoint -- they were willing to commit the significant amount of executive time that participation in our study required. Despite these limitations, we believe our data are interesting because they are unusual (it is hard to find data at these multiple levels of analysis in multinationals) and they shed light on an interesting research problem.

### **Measures**

In any multi-level analytical model, such as the one we have advocated, it is important to ensure that all the measures are at the same level of analysis

(Rousseau, 1985). While our raw data were obtained from the managers of different departments within each subsidiary, the level of measurement that we are going to adopt throughout this paper is that of the overall subsidiary, because it is the innovativeness of the subsidiary that is our focal dependent variable.

Innovation. We asked all the department managers in each subsidiary to tell us how many innovative accomplishments they were responsible for over the preceding one year and to describe and estimate the dollar benefit of their three most valuable innovative accomplishments. As operationalized by Kanter (1983), innovative accomplishments included new policies, new structures, new methods or processes, and new products or market opportunities. Using these data, we computed three measures that captured the different dimensions of the innovativeness of each subsidiary: INNOVEXT -- the extent to which innovation was widespread in the subsidiary -- was computed as the fraction of respondents in each subsidiary who reported any innovative accomplishment at all. INNOVNUM -- the number of innovative accomplishments generated in the subsidiary -- was computed as the average of the total number of innovations reported by the respondents in each subsidiary; and INNOVSIZ -- the scale of innovations generated by the subsidiary -- was computed as the average of the self-estimated dollar benefit (revenues and/or savings) of the top three innovations reported by the respondents.

Structure of work relations in the subsidiary. This was operationalized as the extent to which the managers in the subsidiary communicated on task or work related matters across functional and departmental boundaries (DENSITY). Respondents were asked to report the frequency with which they communicated with managers in 11 other pre-specified departments within their subsidiary. The extent of each manager's cross-functional communication was then calculated as the fraction of the total number of other departmental managers with whom they communicated on a weekly basis or more often. Finally, the scores of the respondents were averaged to measure the density of task interlinkages within each subsidiary.

Structure of the HQ-subsidiary relation. As per our theoretical analysis, three different aspects of the governance structure of the headquarters-subsidiary relation were measured: the extent of (i) centralized control, (ii) formalized control, and (iii) normative control.

The extent to which decision making was centralized was measured by asking respondents to estimate on scales of 1 (low) to 5 (high), the relative influence of the subsidiary in making five types of decisions: (i) the modification of an existing product, (ii) the modification of a production process, (iii) the restructuring of the subsidiary organization involving the creation or abolition of departments, (iv) the recruitment and promotion of managers to positions below that of subsidiary general manager, and (v) the career development plans for department managers. These decision situations were adopted from an instrument developed and used by De Bodinat (1975) to measure the extent to which headquarters-subsidiary relations are centralized. An additive scale (Cronbach's  $\alpha = 0.73$ ) of these five indicators (reverse scored) was used as our final measure of centralization (CENTRAL).

The extent of formalized control of the HQ-subsidiary relation was measured by asking respondents to indicate on a scale of 1 (definitely true) to 4 (definitely false) the extent to which the following 5 conditions applied: (i) for most tasks there are well developed rules and policies set by HQ, (ii) HQ keeps a close watch to ensure that rules and policies are followed, (iii) for most situations, there are manuals that define the course of action to be taken, (iv) for most jobs, there are written job descriptions, and (v) everyone has a well-defined and specific job to do. These indicators are in accord with the Aston measures of the extent to which activities and jobs are structured or formalized: "the degree of employee behavior that is defined by specialist jobs, routines, procedures, and formal written records." (Pugh et. al., 1968). Accordingly, FORMAL, an additive scale (Cronbach's  $\alpha = 0.80$ ) of all 5 indicators (reverse scored), was used to measure the formalization of the HQ-subsidiary relation.

As an alternative to purely perceptual and subjective measures of goal congruence and common values as indicators of normative control, we attempted to get measures of various initial and ongoing socialization mechanisms that both theory (Van Maanen, 1976; Feldman, 1976; Van Maanen and Schein, 1979) and previous empirical research (Edstrom and Galbraith, 1977; Jaeger, 1983) suggested were important in achieving and maintaining normative control. Three indicators were combined in an additive scale SOCIAL (Cronbach's  $\alpha = 0.73$ ) to measure the extent of socialization. These were (i) "training" which was scored as 1 if the manager reported receiving at least one month of initial training upon joining the company and 0 otherwise; (ii) "mentoring" which was scored as 1 if the manager reported having an active mentor at the headquarters and 0 otherwise; (iii) "rotation through headquarters" which was scored as 1 if the manager had, over the last year,

spent at least 2 weeks at or made at least 3 trips to the headquarters, and 0 otherwise.

In each case, the final measures of the structure of the headquarters-subsidary relation were obtained by averaging the scores of all the managers in each subsidiary.

Structure of the relations among subsidiaries. Each respondent was asked to indicate the frequency with which they communicated with managers in the other national subsidiaries of their firm. These responses were dichotomized based on whether the frequency of communication was at least monthly (scored as 1) or less frequent (scored as 0). Two subsidiaries were considered linked by a communication tie if any manager at either subsidiary had a communication link with another manager at the other subsidiary. We took such a wide latitude in defining the existence of a communication link between subsidiaries because in our case research as well as in previous empirical work (Allen, 1977; Tushman, 1977), it has been observed that communication across organizational boundaries is often channelled through a key individual who plays the role of a "gatekeeper" or "liaison." Our operationalization was intended to be robust to the existence of such a gatekeeper between any pair of subsidiaries. For each MNE, a binary symmetric matrix of communication ties among the subsidiaries resulted from this procedure. This matrix was used as an input to compute Freeman's (1979) "betweenness" measure of centrality (BETWEEN). Betweenness measures the extent to which the subsidiary lies in the path of different information chains. As Krackhardt (1990) argues, this measure is indicative of the extent to which the subsidiary has access to different, non-redundant sources of information, or, put differently, the variety of information at the subsidiary's disposal. It is also a measure of power since a subsidiary in a central position in terms of betweenness can influence other members by withholding or distorting information in transmission.

Slack. Following Bourgeois (1981), the slack resources available to the subsidiary was operationalized by asking respondents to estimate, on a scale of 1 (no effect on activities) to 5 (major disruption of activities), the consequence of (i) a 10% reduction in their annual operating budget and (ii) a 10% increase in the time the people in their department had to spend on tasks and activities unconnected with the department. These two indicators were reverse scored and combined in an additive scale called SLACK (Cronbach's alpha= 0.73). SLACK for the subsidiary as a whole was computed as the average slack reported by all the respondents in the subsidiary.

**Environmental Context.** As an indicator of the degree of development of the subsidiary's national environment, we used the classification of the country in the World Development Report, 1986. The year 1986 was chosen to correspond with the timing of the survey. Advanced countries were scored as 3, newly industrializing countries as 2, and developing countries as 1. The overall degree of economic development (DEV) was considered a good proxy for the dynamism and innovative potential of the local environment.

**Company Context.** Since the data we collected were from two different MNEs, one European and the other Japanese, in order to control for any company level effects, a dummy variable PHILIPS scored as 1 for subsidiaries belonging to Philips and 0 for those belonging to Matsushita was also included in the model.

### **Findings**

The means and standard deviations of all the variables discussed above are presented in Table 1 and the Pearson correlation coefficients in Table 2.

**[Insert Tables 1 & 2 about here]**

One of the first inferences one can draw from the correlation matrix is that despite being comparable in terms of size, geographic dispersion, and industry, the two companies we studied are organized quite differently. Philips makes significantly greater use of all three control mechanisms to govern its subsidiaries than Matsushita. Not surprisingly, the managers in Philips' subsidiaries report having significantly less slack and fewer interactions among themselves than their counterparts in Matsushita. Interestingly, there is no significant difference in the pattern of inter-subsidiary linkages. These results are somewhat counter-intuitive because the general view is that Japanese MNEs operate as a centralized hub, controlling their subsidiaries more tightly and allowing only a few subsidiaries to play a central role (Bartlett and Ghoshal, 1989). Our data would suggest that this widely held belief may not be universally true.

Our results, however, provide support for another popular view that innovative initiative is more widespread and numerous in Japanese MNEs relative to their Western counterparts. More subsidiary managers in Matsushita reported a larger number of innovative accomplishments than their counterparts in Philips. However, the managers at Philips reported innovative accomplishments that had a larger pay-off than those reported by Matsushita managers although the difference

was not statistically significant. These results can be interpreted in two ways. On the one hand, it may be the case that more managers in Matsushita's subsidiaries are involved in a larger number of smaller innovations. This would be consistent with other studies that have reported that Japanese firms value employee suggestions for continuous improvement more highly and as a result receive and implement a much greater number of small innovative ideas. On the other hand, these results could also be due to the different standards that the managers in these two firms employed to define an innovative accomplishment -- with managers in Matsushita taking a wider latitude than those in Philips. In either case, it is true that more Matsushita subsidiary managers perceive themselves as being responsible for innovative accomplishments than is the case at Philips.

In terms of the contextual variables, it would appear that subsidiaries in more developed nations are more tightly governed by the headquarters, particularly in terms of normative control. This makes sense because these are the subsidiaries that are typically more critical to the economic performance of the company and given the power they possess as a result, are governed most effectively using mechanisms of normative control (Ghoshal and Nohria, 1989). Also, not surprisingly, managers in subsidiaries in more developed countries report a relatively larger number of innovative accomplishments that have a significantly higher payoff. This is to be expected because of the greater potential of these environments in terms of both the inputs to innovation and the benefits of innovation.

The slack resources possessed by subsidiary managers is, as we had expected, positively correlated with more widespread as well as a larger number of innovative accomplishments. However, contrary to our prediction, it bears no relationship to the scale of innovative accomplishments. This is an interesting finding that suggests that the slack resources that subsidiary managers possess enables them to undertake small innovative projects, but these resources do not suffice for larger innovative projects. Larger projects may require formal approvals and additional resources that only the headquarters can provide.

Turning to the structural variables, it is interesting to note that the density of linkages among the managers within each subsidiary is negatively correlated with the degree of control that the headquarters exercises over the subsidiary's managers, particularly the degree of centralization and normative control. At the same time, subsidiaries in which the managers are more densely interlinked with each other also tend to be more central in the communication network among the subsidiaries.

What this suggests is that their interaction with headquarters dominates the behavior of MNE managers in national subsidiaries. If this interaction is intense, they pay little attention to building relationships in their own subsidiary or with managers in other subsidiaries; otherwise they invest more time and energy in building these local and lateral relationships. In terms of its effect on innovation, consistent with our theoretical predictions, dense interlinkages among a subsidiary's managers has a positive effect on all facets of innovation, but significantly so for the number of innovative accomplishments.

Looking at the structure of headquarters-subsidiary relations and their effect on the innovativeness of subsidiaries, we notice that the three governance mechanisms -- centralization, formalization, and socialization -- are not highly correlated with each other, with the exception of formalization and socialization which are positively correlated. There is also considerable variance in the degree to which these mechanisms are employed across subsidiaries, lending support to our view that the governance of headquarters-subsidiary relations is differentiated (using different combinations of these three governance mechanisms) according to the subsidiary context.

In terms of the effect of the structure of the headquarters-subsidiary relation, as we had hypothesized, centralization is negatively correlated with all facets of subsidiary innovativeness, having a most significant impact on the number of innovative accomplishments. Also in keeping with our hypotheses, formalization is negatively correlated with the extent of innovative initiative (significantly) and the number of innovative accomplishments (not significantly), but is positively correlated with the scale of innovations (significantly). However, the effects of socialization, contrary to our hypothesis, are insignificant.

The centrality of the subsidiary in the inter-subsidiary communication network has the expected association with the number of innovative accomplishments reported by the subsidiary's managers supporting our view that these channels provide crucial sources of input that can stimulate innovative ideas. Centrality does not, however, have a significant association with other facets of a subsidiary's innovativeness.

Finally, the weak inter-correlations among the dependent variables supports our contention that the extent of innovative initiative, the number of innovations and the scale of innovations are three different facets of the innovativeness of subsidiaries that together afford a richer picture of this complex construct.

The preceding analysis focused on univariate relationships. To investigate the varying importance of different contextual and structural effects we conducted a hierarchical regression analysis with the three measures of subsidiary innovativeness as the dependent variables and the other structural and contextual variables as independent variables. A hierarchical multiple regression model was used because this technique uniquely partitions the variance associated with different sets of independent variables (Cohen and Cohen, 1983). It therefore allows one to test hypotheses about the variance attributable to particular variables after others have been accounted for.

In keeping with our intuition regarding the causal ordering of the independent variables, they were introduced in five blocks. The dummy variable PHILIPS was introduced first to account for any variations across the two companies. The contextual variables (SLACK and DEV) were entered second. Variables pertaining to the various structural effects were entered next starting with the structure of task relations in the subsidiary, followed by the variables pertaining to the structure of the HQ-subsidiary governance structure, and finally the variables pertaining to the position of the subsidiary in the structure of inter-subsidiary relations. Our logic was to first account for the immediate contextual effects and then progressively add in effects at increasingly higher levels of structural analysis.

Given the small number of cases ( $N=22$ ), the residuals were plotted to check for outliers, assumptions of normality, and multi-collinearity. No outliers were found, and the model did not suffer from problems of violation of normality or from multi-collinearity. The results of the regression models are reported in Table 3.

**[Insert Table 3 about here]**

It is readily apparent from Table 3 that the three aspects of the innovativeness of subsidiaries that we have studied are influenced by different factors. The extent to which innovation is widespread in each subsidiary is most significantly affected by the structure of the headquarters-subsidiary governance relation. What encourages subsidiary managers to innovate is lack of central control, few formal rules and procedures, and frequent contact with managers at the headquarters. The number of innovations generated within a subsidiary, on the other hand, is much more a function of the slack resources it has, the density of inter-linkages among its managers and its centrality in the inter-subsidiary communication network. The structure of the headquarters-subsidiary relation

explains an insignificant amount of the variance in the number of innovations across subsidiaries. Finally, the most important factors for large scale innovations are dense inter-linkages among subsidiary managers and a headquarters-subsidary governance structure that has few centralized controls but yet has a high degree of formalization.

This pattern of results leads us to draw the following inferences. At the level of the individual, i.e., what makes subsidiary managers innovate or not, what is most important is that they have considerable autonomy and some corporate support. This finding is consistent with the literature on the social psychology of innovation that has identified *freedom and psychological security* as being two of the essential conditions for individual creativity and innovation (Thompson, 1967; Amabile, 1988).

If innovations are taken as the focus of analysis, i.e. what facilitates more or less innovation, our findings support Kanter's (1988: 186) conclusion that successful innovation requires access to "three basic commodities that can be invested in action: information (data, technical knowledge, political intelligence, expertise); resources (funds, materials, space, time); and support (endorsement, backing, approval, legitimacy)." Slack provides access to resources, centrality in the inter-subsidary communication network access to non-redundant information, and a high density of intra-subsidary linkages not only provides information but also makes it easier to mobilize the support necessary to successfully implement local innovative proposals.

Finally, if we focus on the scale of innovations, our findings are consistent with the previous research on "programmed innovation" that has suggested that inter-functional support and formal direction are necessary to successfully implement large scale innovation (Burgelman and Sayles, 1986; Dewar and Dutton, 1986). It is worth noting that formal direction, one of the conditions conducive to large scale innovation, is at odds with the conditions for stimulating widespread individual initiative. This observed contradiction lends credence to the normative proposal that firms must be ambidextrous and set up parallel and/or sequential structural mechanisms to deal with these two facets of innovation (Duncan, 1972; Burgelman and Sayles, 1986). As Holbek (1988) has suggested, this can be accomplished if formal control is differentiated by type so that large scale innovative initiatives are managed by formal HQ direction whereas smaller scale innovative initiative are left to direction of the subsidiary manager. Alternatively, differentiation can be managed by timing, so that formal HQ direction takes over

once an innovative initiative reaches the stage when the scale of its impact warrants corporate oversight.

### **Conclusion**

Our main objective in this paper was to propose a reconceptualization of the MNE as a differentiated network of three different types of relations: task relations internal to each subsidiary, governance relations linking the headquarters with each subsidiary, and exchange relations linking the subsidiaries to each other. This model of the MNE, we argued, would provide richer insights into the structural conditions that can facilitate distributed innovation in the MNE which, according to several observers, is a strategic imperative for the modern MNE. Our model is more complex than the traditional M-form model of the MNE. Since *ceteris paribus* one would always prefer a simpler model, the value of our model can only be established if it provides explanatory insights that would otherwise be lost. Our empirical results, in our view, underscore the value of our model. The structure of each of the three types of relations that the differentiated network model of the MNE directs attention to played a significant role in explaining one or the other facet of innovation at the level of the subsidiary. It is easy to see how an exclusive focus on the structure of the headquarters-subsidiary relation or any other structural feature would have led to a partial and incomplete understanding of what affects the innovativeness of subsidiaries. We hope the results of this study encourages other researchers to adopt this analytical framework for studying structural effects on other issues like the distribution of subunit power in MNEs and other multidivisional firms.

From a substantive standpoint, we were able to make some progress in answering a question of considerable practical significance -- what are the structural conditions that facilitate distributed innovation in MNEs? To summarize the results of our analysis, the extent of innovative initiative in subsidiaries can be enhanced by granting the subsidiary considerable autonomy, encumbering it with few formal procedures, and socializing the subsidiary managers through regular interaction with headquarters managers. The number of innovative accomplishments that are generated by a subsidiary can be enhanced if the subsidiary has slack resources, dense interlinkages among its managers and a central position in the inter-subsidiary communication network. Finally, for larger scale innovative accomplishments, the subsidiary requires dense interlinkages among its managers as well as formal support and direction by the headquarters. In order to simultaneously facilitate the extent and scale of innovativeness of subsidiaries, the MNE may need to set up

either parallel structural mechanisms so that suitable conditions exist for large and smaller scale innovations, or switching rules so that when innovative projects appear to be of a large scale, they are subject to more formal control by the headquarters.

It is important to note that these structural conditions do not address all aspects of distributed innovation in MNEs. For the MNE to take full advantage of its potential for distributed innovation, innovations generated by its various subsidiaries must be, when appropriate, diffused and adopted by the remaining subsidiaries. This is by no means automatic because of such well known problems as the not-invented-here syndrome (Allen, 1977). Also, the structural conditions that facilitate inter-unit diffusion might not be the same as those that facilitate the generation and local adoption of innovation which was our focus in this paper (Ghoshal and Bartlett, 1988). It may take greater headquarters coordination, for example, to manage these aspects of innovation. Further theoretical and empirical work is required to develop a more complete model of distributed innovation in MNEs.

Finally, we wish to reiterate the empirical limitations of our study. Our study is based on data from only 22 subsidiaries drawn from two multinationals, both in the same industry. This no doubt raises questions about the validity and generalizability of our findings. By using multiple indicators and respondents and by employing relatively simple analytic techniques we have tried to be as rigorous and as robust as possible given these limitations. Clearly, however, a much larger scale study is necessary to evaluate our findings in a broader context. What we hope is that this paper might motivate such a study.

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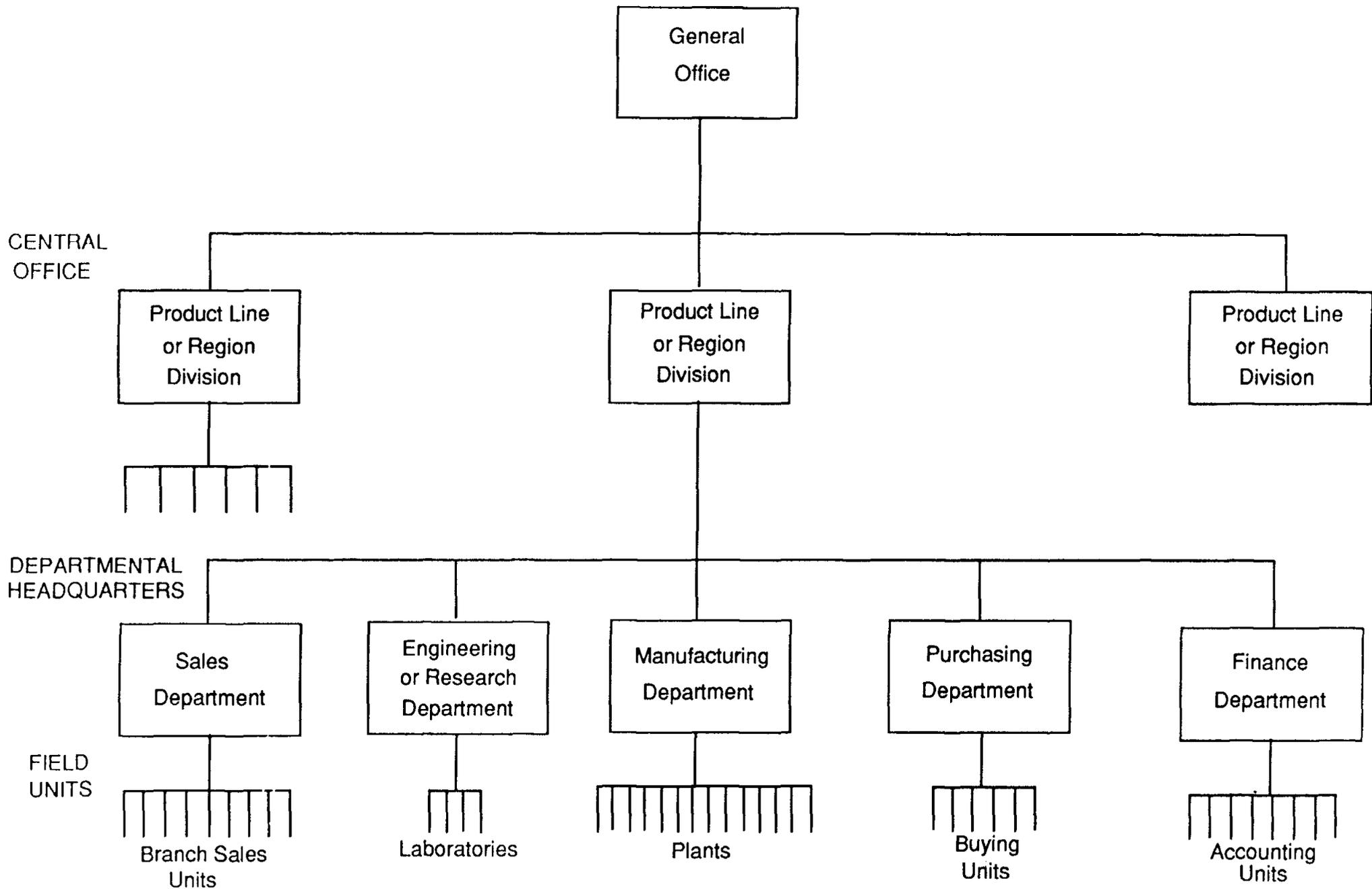


FIGURE 1 : The M-Form Organization (source: Chandler, 1962, p. 10)

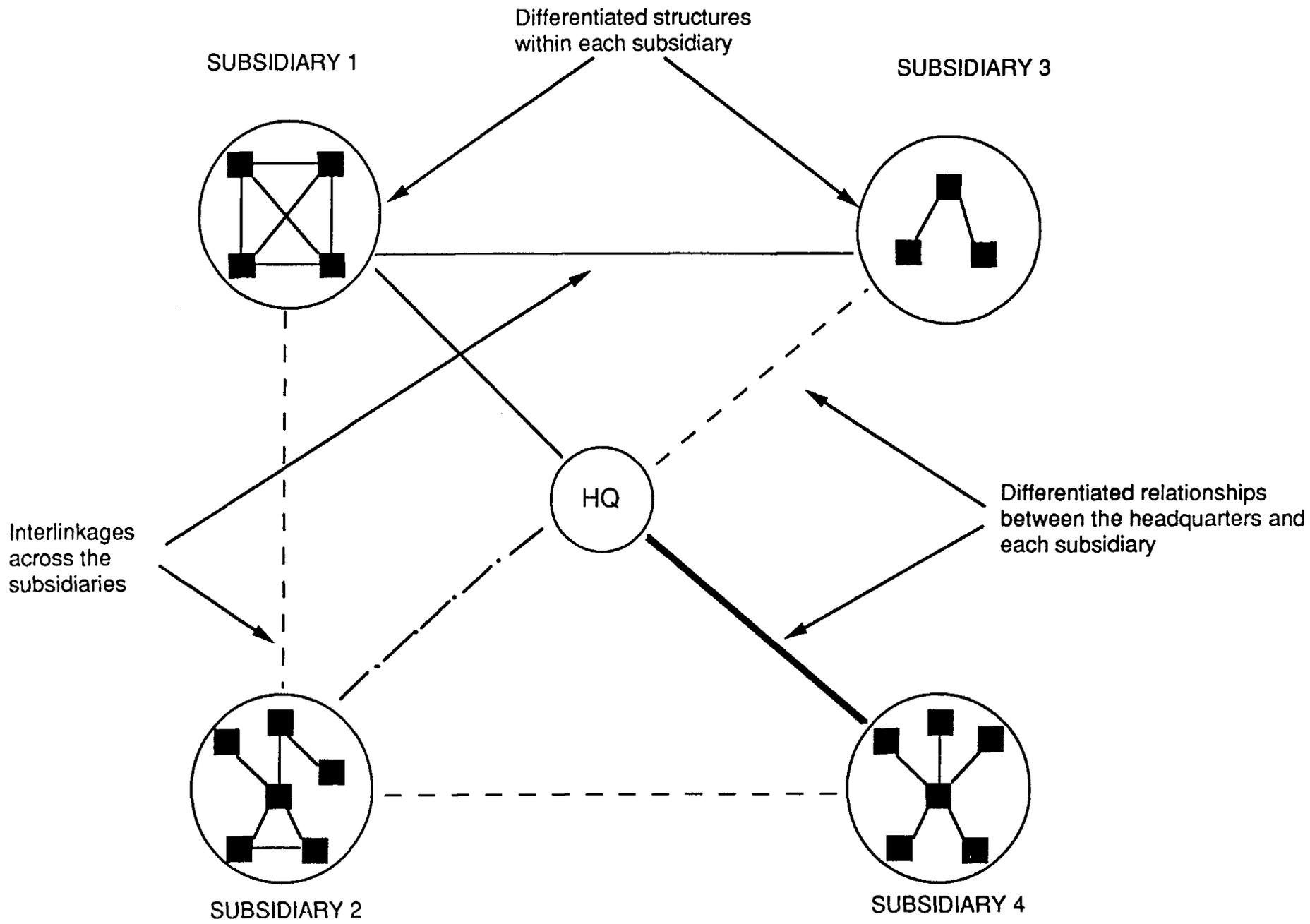


FIGURE 2

A Reconceptualization of the Structure of M-Form Organizations in Terms of a Network of Differentiated Relations

**Table 1 Means, Standard Deviations, and Descriptions of Variables**

	<b>Variable</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Description</b>
1.	PHILIPS	.364	.492	Dummy for company (Philips)
2.	DEV	2.182	.853	Degree of economic development of local environment
3.	SLACK	7.089	.922	Slack resources available to subsidiary
4.	DENSITY	5.722	1.182	Density of interlinkages among managers within subsidiary
5.	CENTRAL	17.655	2.485	Centralization of HQ-subsiidiary relation
6.	FORMAL	6.231	1.705	Formalization of HQ-subsiidiary relation
7.	SOCIAL	.556	.464	Socialization in HQ-subsiidiary relation
8.	BETWEEN	.052	.079	Relative betweenness of subsidiary in inter-subsiidiary network
9.	INNOV. EXT	.603	.126	Extent to which innovation is widespread in subsidiary
10.	INNOV. NUM.	3.239	.853	Average number of innovative accomplishments in subsidiary
11.	INNOV. SIZ	13.117	4.933	Scale of innovative accomplishments by subsidiary

**Table 2 Correlation Matrix Among Variables**

Variables	1	2	3	4	5	6	7	8	9	10	11
1. PHILIPS	1.00										
2. DEV	.289	1.00									
3. SLACK	-.516 <sup>c</sup>	-.093	1.00								
4. DENSITY	-.517 <sup>c</sup>	.023	.107	1.00							
5. CENTRAL	.523 <sup>c</sup>	.126	-.257	-.657 <sup>c</sup>	1.00						
6. FORMAL	.375 <sup>b</sup>	.387 <sup>b</sup>	-.162	-.253	-.183	1.00					
7. SOCIAL	.459 <sup>b</sup>	.419 <sup>b</sup>	-.109	-.418 <sup>b</sup>	.235	.476 <sup>b</sup>	1.00				
8. BETWEEN	-.030	.279	.057	.495 <sup>c</sup>	-.343 <sup>a</sup>	-.098	-.067	1.00			
9. INNOV. EXT.	-.328 <sup>a</sup>	-.190	.378 <sup>b</sup>	.112	-.438 <sup>b</sup>	-.340 <sup>a</sup>	.140	-.057	1.00		
10. INNOV. NUM.	-.341 <sup>a</sup>	.291	.379 <sup>b</sup>	.670 <sup>c</sup>	-.534 <sup>c</sup>	-.155	-.023	.682 <sup>c</sup>	.210	1.00	
11. INNOV. SIZ	.226	.359 <sup>b</sup>	-.081	.285	-.330 <sup>a</sup>	.438 <sup>b</sup>	.182	.108	.033	.119	1.00

Note: <sup>a</sup>Significant at p=.10  
<sup>b</sup>Significant at p=.05  
<sup>c</sup>Significant at p=.01

**Table 3 Results of Hierarchical Regression Analysis**

Independent Variables	DEPENDENT VARIABLE								
	Extent of Innovation			Number of Innovations			Scale of Innovation		
	$\beta$	R <sup>2</sup>	$\Delta R^2$	$\beta$	R <sup>2</sup>	$\Delta R^2$	$\beta$	R <sup>2</sup>	$\Delta R^2$
<b>Company</b>									
Phillips	-.021	.108	.108	.002	.117	.117	.647*	.051	.051
<b>Context</b>									
Slack	-.080			.312*			.163		
Development	.232	.181	.073	.159	.326	.209*	.215	.146	.095
<b>Subsidiary Task Structure</b>									
Density	-.050	.181	.000	.478*	.649	.323*	.510*	.332	.186*
<b>Headquarter-Subsidiary Governance Structure</b>									
Centralization	-.498*			-.072			-.484*		
Formalization	-.444*			-.110			.351*		
Socialization	.501*	.530	.349*	.237	.703	.054	-.047	.562	.230*
<b>Structure of Intersubsidiary Relations</b>									
Betweenness	.204	.555	.025	.364*	.782	.079*	-.330	.624	.062

Standardized coefficients are reported to normalize for the different scales

\* indicates significance at 95% confidence level.

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90/54 EP	Damien NEVEN and Colin MEYER	"European Financial Regulation: A Framework for Policy Analysis", (Revised May 1990).	90/66 TM/SE/FIN	Soumitra DUTTA and Piero BONISSONE	"Computer Support for Strategic and Tactical Planning in Mergers and Acquisitions", September 1990
90/55 EP	Michael BURDA and Stefan GERLACH	"Intertemporal Prices and the US Trade Balance", (Revised July 1990).	90/67 TM/SE/FIN	Soumitra DUTTA and Piero BONISSONE	"Integrating Prior Cases and Expert Knowledge In a Mergers and Acquisitions Reasoning System", September 1990
90/56 EP	Damien NEVEN and Lars-Hendrik RÖLLER	"The Structure and Determinants of East-West Trade: A Preliminary Analysis of the Manufacturing Sector", July 1990	90/68 TM/SE	Soumitra DUTTA	"A Framework and Methodology for Enhancing the Business Impact of Artificial Intelligence Applications", September 1990
90/57 FIN/EP/ TM	Lars Tyge NIELSEN	Common Knowledge of a Multivariate Aggregate Statistic", July 1990	90/69 TM	Soumitra DUTTA	"A Model for Temporal Reasoning in Medical Expert Systems", September 1990
90/58 FIN/EP/TM	Lars Tyge NIELSEN	"Common Knowledge of Price and Expected Cost in an Oligopolistic Market", August 1990	90/70 TM	Albert ANGEHRN	"Triple C': A Visual Interactive MCDSS", September 1990
90/59 FIN	Jean DERMINE and Lars-Hendrik RÖLLER	"Economies of Scale and Scope in the French Mutual Funds (SICAV) Industry", August 1990	90/71 MKT	Philip PARKER and Hubert GATIGNON	"Competitive Effects in Diffusion Models: An Empirical Analysis", September 1990
90/60 TM	Peri IZ and Tawfik JELASSI	"An Interactive Group Decision Aid for Multiobjective Problems: An Empirical Assessment", September 1990	90/72 TM	Enver YÜCESAN	"Analysis of Markov Chains Using Simulation Graph Models", October 1990
90/61 TM	Pankaj CHANDRA and Mihkel TOMBAK	"Models for the Evaluation of Manufacturing Flexibility", August 1990	90/73 TM	Arnoud DE MEYER and Kaara FERDOWS	"Removing the Barriers in Manufacturing", October 1990
90/62 EP	Damien NEVEN and Menno VAN DUJ	"Public Policy Towards TV Broadcasting in the Netherlands", August 1990	90/74 SM	Sumantra GHOSHAL and Nitin NOHRIA	"Requisite Complexity: Organising Headquarters- Subsidiary Relations in MNCs", October 1990

90/75 MKT	Roger BETANCOURT and David GAUTSCHI	"The Outputs of Retail Activities: Concepts, Measurement and Evidence", October 1990	90/87 FIN/EP	Lars Tyge NIELSEN	"Existence of Equilibrium in CAPM: Further Results", December 1990
90/76 MKT	Wilfried VANHONACKER	"Managerial Decision Behaviour and the Estimation of Dynamic Sales Response Models", Revised October 1990	90/88 OB/MKT	Susan C. SCHNEIDER and Reinhard ANGELMAR	"Cognition in Organisational Analysis: Who's Minding the Store?" Revised, December 1990
90/77 MKT	Wilfried VANHONACKER	"Testing the Koyck Scheme of Sales Response to Advertising: An Aggregation-Independent Autocorrelation Test", October 1990	90/89 OB	Manfred F.R. KETS DE VRIES	"The CEO Who Couldn't Talk Straight and Other Tales from the Board Room," December 1990
90/78 EP	Michael BURDA and Stefan GERLACH	"Exchange Rate Dynamics and Currency Unification: The Ostmark - DM Rate", October 1990	90/90 MKT	Philip PARKER	"Price Elasticity Dynamics over the Adoption Lifecycle: An Empirical Study," December 1990
90/79 TM	Anil GABA	"Inferences with an Unknown Noise Level in a Bernoulli Process", October 1990			
90/80 TM	Anil GABA and Robert WINKLER	"Using Survey Data in Inferences about Purchase Behaviour", October 1990	<u>1991</u>		
90/81 TM	Tawfik JELASSI	"Du Présent au Futur: Bilan et Orientations des Systèmes Interactifs d'Aide à la Décision," October 1990	91/01 TM/SM	Luk VAN WASSENHOVE, Leonard FORTUIN and Paul VAN BEEK	"Operational Research Can Do More for Managers Than They Think!," January 1991
90/82 EP	Charles WYPLOSZ	"Monetary Union and Fiscal Policy Discipline," November 1990	91/02 TM/SM	Luk VAN WASSENHOVE, Leonard FORTUIN and Paul VAN BEEK	"Operational Research and Environment," January 1991
90/83 FIN/TM	Nathalie DIERKENS and Bernard SINCLAIR-DESGAGNE	"Information Asymmetry and Corporate Communication: Results of a Pilot Study", November 1990	91/03 FIN	Pekka HIETALA and Timo LÖYTTYNIEMI	"An Implicit Dividend Increase in Rights Issues: Theory and Evidence," January 1991
90/84 MKT	Philip M. PARKER	"The Effect of Advertising on Price and Quality: The Optometric Industry Revisited," December 1990	91/04 FIN	Lars Tyge NIELSEN	"Two-Fund Separation, Factor Structure and Robustness," January 1991
90/85 MKT	Avijit GHOSH and Vikas TIBREWALA	"Optimal Timing and Location in Competitive Markets," November 1990	91/05 OB	Susan SCHNEIDER	"Managing Boundaries in Organisations," January 1991
90/86 EP/TM	Olivier CADOT and Bernard SINCLAIR-DESGAGNE	"Prudence and Success in Politics," November 1990	91/06 OB	Manfred KETS DE VRIES, Danny MILLER and Alain NOEL	"Understanding the Leader-Strategy Interface: Application of the Strategic Relationship Interview Method," January 1990 (89/11, revised April 1990)

91/07 EP	Olivier CADOT	"Leading to Insolvent Countries: A Paradoxical Story," January 1991	91/19 MKT	Vikas TIBREWALA and Bruce BUCHANAN	"An Aggregate Test of Purchase Regularity", March 1991
91/08 EP	Charles WYPLOSZ	"Post-Reform East and West: Capital Accumulation and the Labour Mobility Constraint," January 1991	91/20 MKT	Darius SABAVALA and Vikas TIBREWALA	"Monitoring Short-Run Changes in Purchasing Behaviour", March 1991
91/09 TM	Spyros MAKRIDAKIS	"What can we Learn from Failure?", February 1991	91/21 SM	Sumantra GHOSHAL, Harry KORINE and Gabriel SZULANSKI	"Interunit Communication within MNCs: The Influence of Formal Structure Versus Integrative Processes", April 1991
91/10 TM	Luc Van WASSENHOVE and C. N. POTTS	"Integrating Scheduling with Batching and Lot-Sizing: A Review of Algorithms and Complexity", February 1991	91/22 EP	David GOOD, Lars-Hendrik RÖLLER and Robin SICKLES	"EC Integration and the Structure of the Franco-American Airline Industries: Implications for Efficiency and Welfare", April 1991
91/11 TM	Luc VAN WASSENHOVE et al.	"Multi-Item Lotsizing in Capacitated Multi-Stage Serial Systems", February 1991	91/23 TM	Spyros MAKRIDAKIS and Michèle HIBON	"Exponential Smoothing: The Effect of Initial Values and Loss Functions on Post-Sample Forecasting Accuracy", April 1991 (Revision of 90/46)
91/12 TM	Albert ANGEHRN	"Interpretative Computer Intelligence: A Link between Users, Models and Methods in DSS", February 1991	91/24 TM	Louis LE BLANC and Tawfik JELASSI	"An Empirical Assessment of Choice Models for Software Evaluation and Selection", May 1991
91/13 EP	Michael BURDA	"Labor and Product Markets in Czechoslovakia and the Ex-GDR: A Twin Study", February 1991	91/25 SM/TM	Luk N. VAN WASSENHOVE and Charles J. CORBETT	"Trade-Offs? What Trade-Offs?" April 1991
91/14 MKT	Roger BETANCOURT and David GAUTSCHI	"The Output of Retail Activities: French Evidence", February 1991	91/26 TM	Luk N. VAN WASSENHOVE and C.N. POTTS	"Single Machine Scheduling to Minimize Total Late Work", April 1991
91/15 OB	Manfred F.R. KETS DE VRIES	"Exploding the Myth about Rational Organisations and Executives", March 1991	91/27 FIN	Nathalie DIERKENS	"A Discussion of Correct Measures of Information Asymmetry: The Example of Myers and Majluf's Model or the Importance of the Asset Structure of the Firm", May 1991
91/16 TM	Arnoud DE MEYER and Kasra FERDOWS et.al.	"Factories of the Future: Executive Summary of the 1990 International Manufacturing Futures Survey", March 1991	91/28 MKT	Philip M. PARKER	"A Note on: 'Advertising and the Price and Quality of Optometric Services', June 1991
91/17 TM	Dirk CATTRYSSE, Roelof KUIK, Marc SALOMON and Luk VAN WASSENHOVE	"Heuristics for the Discrete Lotsizing and Scheduling Problem with Setup Times", March 1991	91/29 TM	Tawfik JELASSI and Abbas FOROUGHJI	"An Empirical Study of an Interactive, Session-Oriented Computerised Negotiation Support System (NSS)", June 1991
91/18 TM	C.N. POTTS and Luk VAN WASSENHOVE	"Approximation Algorithms for Scheduling a Single Machine to Minimize Total Late Work", March 1991			

91/30 MKT	Wilfried R. VANHONACKER and Lydia J. PRICE	"Using Meta-Analysis Results in Bayesian Updating: The Empty Cell Problem", June 1991	91/43 SM	Sumantra GHOSHAL and Christopher BARTLETT	"Building Transnational Capabilities: The Management Challenge", September 1991
91/31 FIN	Rezaul KABIR and Theo VERMAELEN	"Insider Trading Restrictions and the Stock Market", June 1991			
91/32 OB	Susan C. SCHNEIDER	"Organisational Sensemaking: 1992", June 1991			
91/33 EP	Michael C. BURDA and Michael FUNKE	"German Trade Unions after Unification - Third Degree Wage Discriminating Monopolists?", June 1991			
91/34 FIN	Jean DERMINE	"The BIS Proposal for the Measurement of Interest Rate Risk, Some Pitfalls", June 1991			
91/35 FIN	Jean DERMINE	"The Regulation of Financial Services in the EC, Centralization or National Autonomy?" June 1991			
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91/37 EP	Ingo WALTER and Hugh THOMAS	"The Introduction of Universal Banking in Canada: An Event Study", August 1991			
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91/42 TM	Rob R. WEITZ and Tawfik JELASSI	"Solving A Multi-Criteria Allocation Problem: A Decision Support System Approach", August 1991			