

**BUILDING INTERNAL KNOWLEDGE NETWORKS IN THE  
MULTINATIONAL CORPORATION: A STUDY OF INTERNATIONAL  
RESEARCH AND DEVELOPMENT**

by

Robert W. Sommer

B. A. Psychology, Williams College  
(1984)

Submitted to the Alfred P. Sloan School of Management  
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Signature of Author \_\_\_\_\_  
Alfred P. Sloan School of Management  
May 14, 1992

Certified by \_\_\_\_\_  
D. Eleanor Westney  
Associate Professor of International Management  
Thesis Supervisor

Accepted by \_\_\_\_\_  
Jeffrey A. Barks  
Associate Dean, Master's and Bachelor's Programs

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**ABSTRACT**

There has been a recent surge in the geographical dispersion of research and development (R&D) in today's global companies. This thesis studies the managerial challenges surrounding the effective integration of offshore R&D efforts with other functions of the multinational corporation (MNC) both within and across country borders.

Specifically, this thesis explores the key factors that are involved in the management of internal knowledge networks in the Japanese MNC. The methodology of this study included interviews with ten different directors (from five different electronics companies) of Japanese R&D labs located in the U.S., as well as an interview with the General Manager of Corporate R&D for Sony Corporation. An analysis of the interviews has provided an understanding of the managerial challenges involved in transferring information between offshore R&D centers and the rest of the Japanese MNC. Management commitment, the encouragement of informal linkages, cross-functional standardized career paths, and R&D involvement in strategy formulation of the firm are the four principle areas that were found to offer the greatest managerial leverage in optimizing the internal knowledge networks within the MNC.

Thesis Supervisor: D. Eleanor Westney  
Title: Associate Professor of International Management

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## CHAPTER 1

### INTRODUCTION

As technological change accelerates and product life-cycles shorten, there is a greater emphasis placed on the speed in developing new technologies. This emphasis has led to an organizational shift away from the slow moving, bureaucratic corporate lab in favor of decentralized R&D facilities that are closer to the firm's markets. Decentralization of R&D has been dominated by the expansion of the role of business units in shaping R&D budgets and agendas, but it has also played a role in the proliferation of offshore R&D centers for today's multinational corporations (MNCs).<sup>1</sup>

At the same time, however, the increasing size and complexity of the MNC has created significant constraints for the effective implementation of global innovation. As Anglemar, Prahalad & Doz state;

To carry out complex, interrelated tasks, large firms develop formal structures which fragment these tasks into elements that can be performed by individuals, and integrate these elements through formal hierarchies and rules. The bureaucracy that results, the power plays that surround the rules, and the often fragile authority of key managers discourage innovation and risk-taking. This has been variously described as segmentalist behavior and bureaucratic resistance to change. The larger and more diversified firms become, the more their management systems evolve toward a logic of control and guidance, and away from a logic of entrepreneurship and variety creation; the more efficient management becomes, the more the on-going takes precedence over developing the new.<sup>2</sup>

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<sup>1</sup>De Meyer, "Global R&D Management", R&D Management, April, 1989, p.15

<sup>2</sup>Anglemar, Doz & Prahalad, "Technological Innovation and Interdependence", Technology in the Modern Corporation, Cambridge, Ma. 1986. p. 15

This paper will therefore analyze the management of information flows between researchers, the research team, and the operating units. The methodology for this study included extensive literature research and interviews with R&D management from several Japanese multinational corporations. The purpose of this thesis is to examine the internationalization of R&D, with respect to the Japanese MNCs studied, and determine the key variables that management can control to maximize the flow of information between the firm's operating units and the offshore R&D centers so that innovation can be effectively implemented. In particular, the management of internal knowledge networks from an organizational and human resources perspective will be addressed.

## CHAPTER 2

### ORGANIZATIONAL STRUCTURE

The organizational structure of the entire corporation is one of the key variables that will affect the quality of a firm's internal knowledge networks and the firm's responsiveness to innovation. There are three basic corporate structures that can help to define the overall organizational structures of the MNCs in this study; functional organizational structures, business or segment oriented structures, and geographical structures. A MNC may choose one or a combination (as described by a matrix organization) of these three structures to define its organizational structure. For example, older MNC firms have been functionally organized whereas newer transnational firms have been organized either geographically or by business segment ( i.e., global product organizations). In addition, some MNC firms have chosen a matrix structure, which combines at least two of the above organizational structures.

#### **2.1 Organizational Structure of MNC R&D**

The structure of the R&D organization typically follows that of the overall MNC organizational structure. For example, in a functional organizational structure, the R&D units report to a corporate R&D unit which will coordinate the center's activities and control its interaction with the operating units. Most of the firms in this study demonstrate a functional organizational structure. The divisionalized or business segment-oriented organization contains separate R&D centers reporting to each division. In such a setting, corporate R&D may have a coordinating and advising role. Sony Corporation's American labs follow this divisionalized strategy by reporting



to the corresponding development group in Japan which in turn reports to the administration group at the corporate laboratory (See exhibit 1). In a matrix organization, the offshore R&D manager reports to the local division or country head as well as the corporate R&D lab. Asea Brown Boveri's corporate structure represents the firm's use of the matrix organization (See exhibit 2) to be both a global and a local firm.<sup>3</sup> At ABB, the R&D center directors report to Craig Tedmon, Executive Vice President of R&D, as well as one of the 50 business area heads. ABB states that there is no significant duplication of R&D efforts with this matrix structure since most of the technologies are complementary. Further in-depth analysis is necessary to substantiate ABB's claim of little overlap of R&D efforts resulting from the firm's matrix structure.

### **2.1.1 Structure of Offshore R&D Center**

Behrman and Fischer's study (1980) defines four basic structures for offshore R&D activities. These are R&D organizations with; (1) absolute centralization, (2) participative centralization, (3) supervised freedom, and (4) total freedom. Participative centralization and supervised freedom are the predominant forms found in Behrman and Fischer's study and in this study as well.

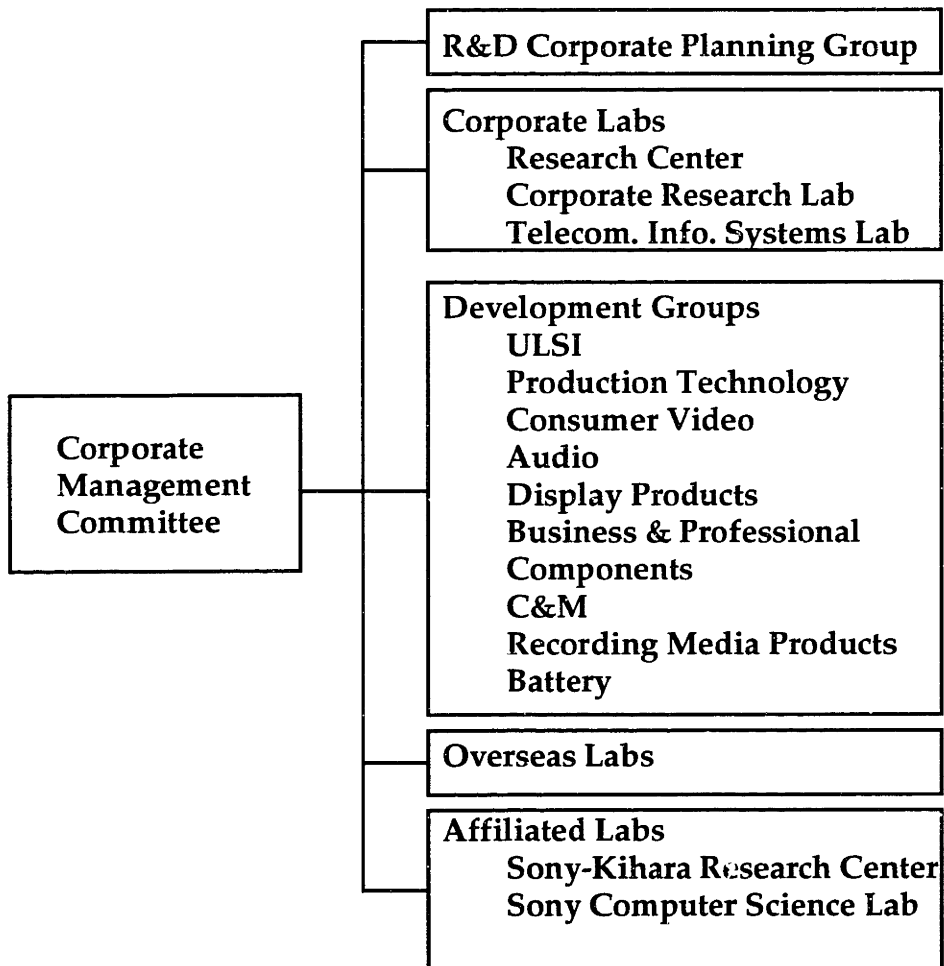
Participative centralization is characterized by centralized funding and a strong central influence over project decisions for the offshore center. These centers, however, participate in the day-to-day management of the projects and have some influence on the strategic direction of the center. This structure is quite

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<sup>3</sup>Presentation by Gerhard Schulmeyer, April 2, 1992.

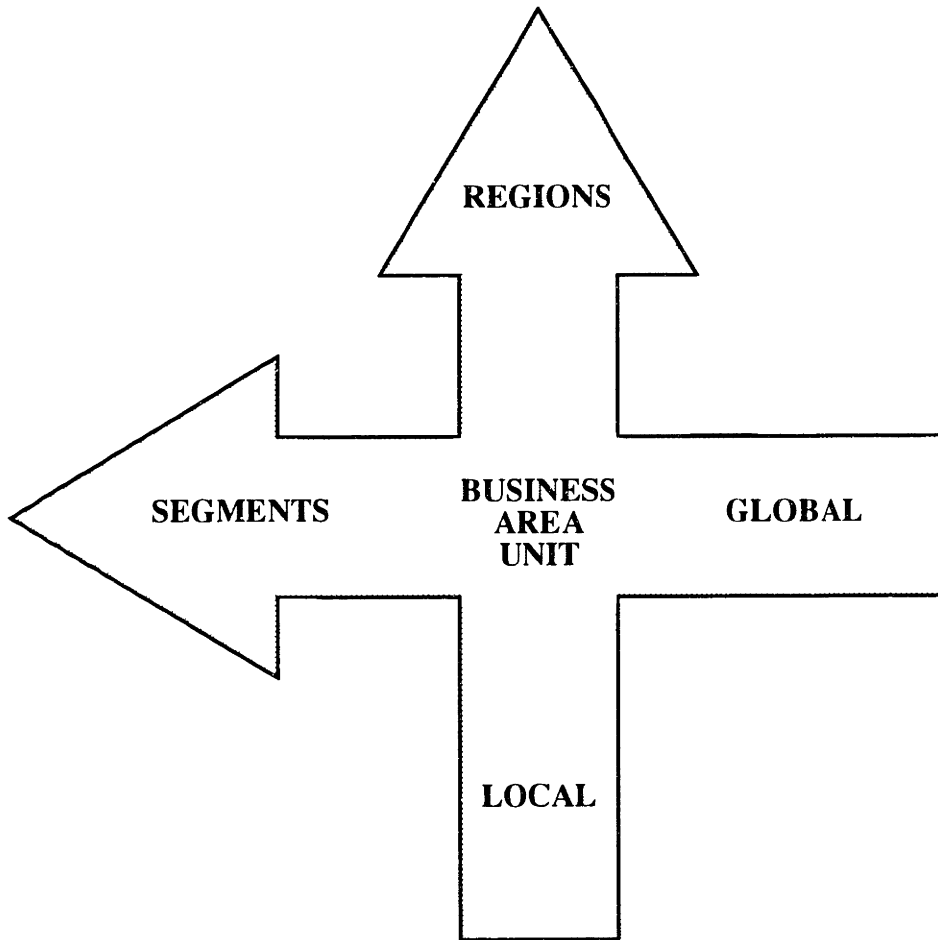
Exhibit 1

Sony Corporation R&D Organization



**Exhibit 2**

**Asea Brown Boveri Matrix Organization**



similar to "supervised freedom" firms where primary responsibility for the operational decisions rests in the hands of the offshore center's management. In both of these structures, coordination with the home organization is informal, relying on personal contacts through frequent travel and telephone conversation.

Most of the facilities that were analyzed in this study were "greenfield" sites with relatively short histories. Each of the structures of these offshore R&D centers can also be reflected by at least one of Robert Ronstadt's four strategic types of offshore R&D centers:

- **Corporate Technology Units**, established for generating basic technologies for the parent organization;
- **Global Technology Units**, designed to develop new products and processes for world markets;
- **Indigenous Technology Units**, designed to develop new products for local markets by drawing on local technology;
- **Technology Transfer Units**, designed to facilitate technology transfer from the corporate parent to the local subsidiary.<sup>4</sup>

Sony and Fujitsu exemplify the complexity of strategic intent in their offshore R&D centers. For instance, there are two purposes for U.S.-based R&D at Fujitsu. Firstly, Fujitsu would like to develop global applications for semiconductors and, secondly, the firm is developing new products and tailoring existing ones for the U.S. market. Local market-related R&D strategy is decided jointly between the U.S. R&D center and the corporate lab

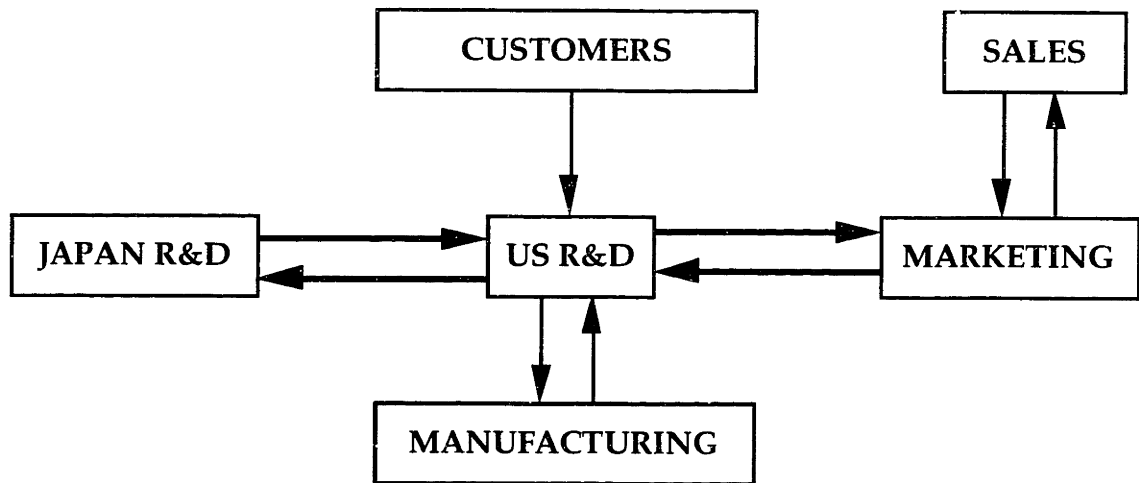
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<sup>4</sup>Westney, "Internal and External Linkages in the MNC: The Case of R&D Subsidiaries in Japan", MIT, 1988. p. 6.

in Kawasaki, whereas the U.S. center exercises complete control over the global application process (see exhibit 3).<sup>5</sup>

### Exhibit 3

#### Fujitsu Internal Network Links



At Sony, the divisional labs in the U.S. develop the initial stage of the product with the local customer requirements in mind. The project is then transferred to the business development group and the divisional lab in Tokyo. The divisional lab in Tokyo then makes the final decision as to where the product will be manufactured with global application being one of the primary factors in its decision.<sup>6</sup>

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<sup>5</sup> Westney, pp. 1-7.

<sup>6</sup> Interview at Sony's U.S.-based R&D headquarters, NJ.

### 2.1.2 Impact of Geographic Dispersion on Organizational Structure

The spreading web of the MNC has led to an increased pressure for the organizational structures of the "home" office and those of the off-shore facilities to converge. This pressure can be attributed in part to the increase in the globalization of technology in products and processes and therefore an increase in the need for greater similarity in organizational structures and processes to establish common ground. Therefore, the greater the similarity between the organizational structures and processes of two entities, the easier the interaction. However, achieving similarity in organizational structures between the offshore and home organizations carries a cost. As Westney explains,

The MNC dilemma of reconciling the benefits of local tailoring with those of global standardization in products and in strategies has been joined by the organizational dilemma of local vs. standardized organizational patterns. And in this dilemma, finding ways of combining variation and standardization is even more complex than in the arenas of products and strategies.<sup>7</sup>

By homogenizing the local R&D facilities, a firm will diminish the effectiveness of developing localized technologies. On the other hand, if the offshore R&D center's structure is too different from the other organizations of the MNC with which the center interacts, little transfer of knowledge will take place.

Westney further states that emulation of the corporate lab's organizational patterns will foster the offshore R&D facility's development. The enhanced development of the offshore center may very well result from stronger internal knowledge networks with the corporate lab through similar

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<sup>7</sup>Westney, p. 2.

organizational structures. In similar structures, more equal peer relationships develop, thereby enhancing the degree of informal communications. Furthermore, information gathering between the two organizations will be enhanced with better understanding of the different organizational structures.

### **2.1.3 Other Factors Affecting Organizational Structure (Technology, Time Frame, Size of Center)**

Technology is one of the key drivers of organizational structure. Therefore the make-up of the technology can help to shape the type of organizational structure and the corresponding knowledge networks in an organization. For instance, Behrman and Fischer's study found that firms with a high degree of science-orientation preferred a "participatively centralized" style of management. This is to say that there is a greater degree of corporate control and guidance in managing more science-oriented R&D activities than those that related more to product development.<sup>8</sup>

De Meyer (1991) states that the higher the time pressure for the projects of the R&D center, the greater the tendency of the center's structure to become more centralized. Furthermore, the smaller the size of the offshore facility, the greater amount of corporate control over the center's activities. Both of these factors will result in more formal interaction with the corporate organization which, as will be explained later in this paper, is not as effective as informal communication in facilitating knowledge transfer within the MNC.

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<sup>8</sup>De Meyer, p. 141.

## **2.2 Offshore Lab Composition**

### **2.2.1 Teamwork**

Almost every facility studied stressed the importance of teamwork in the lab's research and technology transfer efforts. Although technical skills are very important, an executive at Fujitsu's lab in Raleigh, NC feels that the scientists and engineers that he hires should have proven abilities to work with other people. Another example of a team-oriented approach is that of the Mitsubishi Electric Research Laboratory (MERL) which in the words of the facility's director, "will focus on basic research, emphasize collaboration and interdisciplinary teams."<sup>9</sup> Similar comments to those of Fujitsu and Mitsubishi were made by almost all of the R&D directors interviewed in this study. Their comments relating to the importance of teamwork have been corroborated in other studies of Japanese firms. For example, at Toyota, there is an awareness that future major technical advances will require interdisciplinary efforts. Toyota's emphasis on teamwork-oriented research and job rotation demonstrates the company's commitment to interdisciplinary and teamwork-based R&D.<sup>10</sup>

### **2.2.2 Small Group Size**

Most successful companies that rely on innovation for growth emphasize small teams that work in a relatively autonomous atmosphere. Quinn (1986) states that the optimum number of key individuals per team varies from five to seven. Quinn attributes this number to a study performed by Victor McGee who calculated the total number of one-way channels of

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<sup>9</sup>Interview at Mitsubishi Electric Research Lab, Cambridge, MA.

<sup>10</sup> Rubinger, "Technology Policy in Japanese Firms", Technology in the Modern Corporation, Cambridge, MA. 1986. p. 191.



communications in a group as  $n[2^{(n-1)}-1]$ , which shows an increase in channels from 75 to 1016 as the group increases from five to eight persons.<sup>11</sup> With an increase in group number over eight, communication channels decrease. Quinn cites the "skunkworks" at Lockheed as the model for these small project teams. At Lockheed, small teams of engineers, technicians and designers were grouped together to develop new products or processes from concept to commercial prototype. Quinn believes that the "skunkworks" eliminate bureaucratic delays and facilitate important communication between team members. The optimal group size of five to seven people alludes to entrepreneurial behavior as a key success factor in technological innovation. Quinn's point of view is supported by the fact that small, newer firms have been very successful in the exploitation of technological progress. Their entrepreneurial nature stems from the group's ability to adopt a focused, small-team approach towards projects with a charismatic, technical leader who may possess a willingness to take risks.<sup>12</sup> One of the challenges of any R&D organization is to mirror this entrepreneurial atmosphere and maintain the controls that are necessary to integrate its efforts into the relevant areas of the company.

### **2.2.3 External Orientation**

When establishing strategic visions for the firm or for the business unit, management must base its vision on the "practical realities of the marketplace." There are two things which enhance this customer-oriented perspective: (1) a strong market orientation at the highest level of the

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<sup>11</sup>Quinn, "Innovation and Corporate Strategy: Managed Chaos", Technology in the Modern Corporation, Cambridge, MA. p. 175.

<sup>12</sup>Angelmar, Doz and Prahalad, p. 15.

company, and (2) well-defined mechanisms to facilitate the market and technical interactions at the lower levels of the firm. Quinn (1987) cites Sony as an example of this technical-market interaction:

Sony's Chairman Morita, who has personally started several of its most innovative ventures, purposely seeks informal settings where he can meet with and understand the lifestyles of trend-setting younger people. Soon after technical people are hired, Sony cycles them through weeks of retail selling. Sony engineers become sensitive to the ways retail sales practices, displays, and non-quantifiable customer preferences affect success.<sup>13</sup>

This focus on customer orientation is more than a well-polished sales tactic. Sony's customer emphasis has enabled the firm to capture significant technological innovations from its consumers and has forced other firms within the electronics industry to follow its lead. Von Hippel's study in January of 1978 found that over 50% of all innovation in the electronics industry is performed by customers. For instance, Quinn noted that Hewlett Packard, 3M, Sony, and Raychem have developed complex new markets through highly interactive relationships with their customers. Quinn (1987) states, "They frequently introduce radical new products through small teams closely participating with lead customers, learning from them, and rapidly modifying designs and entry strategies around this information." In other industries, such as textiles and paper manufacturing, equipment suppliers are the important sources of innovation. Universities are sources of innovation in biotechnology. With these significant innovation sources outside of the multinational firm, it is imperative that the MNC scan technologies and then effectively transfer these technologies throughout the rest of the firm through its internal knowledge networks.

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<sup>13</sup>Quinn, p. 177.

### **2.3 Implications of Organizational Structure on Internal Knowledge Networks**

R&D plays an important role in the scanning and transfer of technologies in the MNC but its positive impact will be minimized without the appropriate organizational structure to interact with other units within the MNC. As presented in this paper, similar organizational structures may enhance communication between two entities. This is especially true under a corporate goal of technology integration which necessitates frequent interaction between the offshore lab and other units within the MNC. It should be noted, however, that differentiation between the organizational structures of the offshore lab and the "home" organization may be required when involvement with the local technical and scientific community requires a unique organizational structure and substantial interaction.

In addition, offshore R&D centers consisting of small groups and emphasizing teamwork will communicate more effectively with other organizations within the MNC. To optimize the interaction, however, the offshore center should possess an external orientation to make the R&D activities more valuable to other areas within the MNC. Communication between different parties will increase when there is a perceived need to communicate. By being externally oriented, the offshore R&D center will be more valuable to sales and marketing, manufacturing, and the corporate R&D lab.

## CHAPTER 3

### SYSTEMIC APPROACH TO MNC R&D

By increasing the researcher's understanding of all aspects of the MNC's related business units, the firm will increase the effectiveness of its R&D efforts.

For example at Fujitsu's lab in Raleigh, N.C., not only is there a strong desire to recruit people who have expertise in a particular area but there is also a push to hire researchers who possess the ability to work in related areas. The official at this lab states that in the U.S. most researchers are too specialized to think systemically.

In Japan, in contrast, most people are trained throughout their corporate career, so I think it is easier for engineers there to understand the whole corporate structure... In Japanese companies, they expect the people to have wider views, so that there may be overlapping strategies and software people think about hardware and hardware people think about software. <sup>14</sup>

Understanding how one's work relates to the overall goals of the organization will enable a researcher to engage in more meaningful and robust work for the rest of the MNC.

#### **3.1 Cross-Functional Job Rotation**

One strategy which will enhance systemic thinking is the use of cross-functional career tracks. In R&D organizations, this means developing tracks that will improve the application of an R&D employee's skills and knowledge to production or other departments within the firm. Toyota employs a job rotation program where most of the R&D employees will eventually be assigned to positions that are outside of the technology-related divisions. Toyota

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<sup>14</sup>Interview at Fujitsu Lab in Raleigh, NC.

demonstrates its commitment to shop-floor experience by posting, at any particular point in time, about 35% of the R&D staff in the company's production facilities. Approximately 70% of these engineers who started in R&D will eventually return to their R&D jobs.<sup>15</sup> These cross-trained R&D engineers will bring a more holistic perspective to the R&D lab which will translate into more effective technology transfer with other organizations within the MNC.

### **3.2 Reconciling Semantic Differences: Strategic Technical Areas**





Differences in semantics create a broader gap between the R&D organization and the operating units of the company. As Graham Mitchell (1987) states, the technologist's terminology deals with input, which means the skills needed to produce the product or service, and the general manager's vocabulary emphasizes the product or service. Mitchell solves this conflict by deriving an analysis that caters to the R&D and operating units' needs called a "Strategic Technical Area"(STA). The STA has four components: (1) The skills or disciplines, (2) which are applied to (3) a particular product or service, (4) which addresses a specific market need. By using the STA, the R&D operations are forced to define their activities in the business units' terms (and, thereby, the customers' terms). This then enables a further breakdown in the R&D tasks between those that focus on operational issues and those that focus on strategic issues. Typically, the breakdown has been that the R&D centers emphasize operational issues and the technical support of product development, and the corporate labs focus on the longer term strategic issues (see exhibit 4).

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<sup>15</sup>Rubinger, p. 191.

## Exhibit 4

### STA Perspective at Different Organizational Levels

Organization Level	Time Horizon	Focus
Corporate		<ul style="list-style-type: none"> <li>• Long-term; integration, technical strength and human resource / education needs, direction, positioning, creation of new options</li> <li>• Medium-term; synergy, resource optimization</li> <li>• Short-term; technical programs to implement business goals</li> </ul>
Group		
Division		
Business Unit		
	0      5      10	

Mitchell states that the value of the STA is in its ability to link a wide range of employees between different organizations within the MNC.

The underlying situation which gives particular value to the STA is that, in many large industrial corporations, similar technical skills and expertise are widely applicable to product or service areas in different parts of the organization. In many corporations, there is a de facto network of technical expertise, which often cuts across to the formal management and organization structure. While this linkage and synergy may be understood by the technical specialists, it is unlikely to be widely recognized at all management levels. This network provides insight and power to drive the businesses in new technical directions, some of which may challenge the conventional wisdom as articulated by the formal business plans.<sup>16</sup>

<sup>16</sup>Mitchell, "New Approaches for the Strategic Management of Technology", Technology in the Modern Corporation, Cambridge, MA. p.136.

By defining the STA at the operating unit level, the technical people (R&D staff) are challenged to develop the critical skills that the business units need (in the business units' terms) to effectively compete. The complexity of the firm's products or services will determine the number of STAs per product or service. Mitchell states that three or four technical areas are sufficient to account for the most critical skills.

### **3.3 Implications of Systemic Approach to MNC R&D on Internal Knowledge Networks**

By defining technologies in terms that are meaningful to the broadest range of organizations within the MNC, the MNC R&D organization may enhance its value to these organizations. An increased awareness and understanding of the R&D organization's efforts will result, thereby fostering increased communication throughout the firm. Furthermore, the cross-functional job rotation of R&D engineers will help to minimize the perceived but often unsubstantiated differences between operating units and will encourage a more systemic approach to R&D, resulting in greater cross-functional communication.

## **CHAPTER 4**

### **HUMAN RESOURCE MANAGEMENT**

For the purpose of this study, there are five key areas in human resource management that may offer leverage points in the effective management of learning between the offshore R&D center and the rest of the MNC organization. These five areas are management style, performance evaluation, incentive structure, career management, and training and development.

#### **4.1 Management Style**

Management style is a term that generally states the managerial practices of a particular organization or type of organization. For example, an executive at Fujitsu's Richardson, Texas facility states that "typical Japanese management is very flexible. In Japanese management, we can communicate with any person, but in the U.S., each engineer staff has only one boss. They want to report to their own boss. But in Japan, we can communicate with any related persons." This particular executive explained that communication flows much easier under Japanese management because of the flexibility of reporting and communication networks.

In the Canon Palo Alto facility, run by Drs. Harland and Mellon, there is a self-described "American" management style. Speaking specifically, one of the executives at this facility stated that the employees were evaluated twice a year in formal reviews which measure their progress against mutually agreed upon goals. Metrics such as patents and accurate and timely reporting of



results are discussed during the reviews. These reviews provide feedback to employees and help to determine the employee's remuneration from the center's bonus pool, which is not duplicated anywhere else in Canon. In accordance with "typical American R&D management" style, there are no career ladders developed at this facility. Under such an American management style where workers must narrow their efforts on those objectives to which they will be measured, informal interactions are minimized, thereby constraining the flow of communications between R&D staff and between R&D employees and other organizations within the MNC.

#### **4.2 Performance Evaluation**

This facet of human resource management is concerned with the metrics and feedback to the employee of his or her performance. Most of the facilities studied in the U.S. demonstrated American management's common practices. For example, employees were evaluated against a relatively objective set of measures at least once a year. This evaluation process typically included a formal review with the employees direct supervisor. For example, at NEC labs in Princeton, NJ, employees performance metrics include objective measures such as the number of patents a researcher has produced or the number of articles published.<sup>17</sup> At Fujitsu's center in Raleigh, NC the most important performance criteria are new product developments and how they are applied to domestic sales and global sales.<sup>18</sup>

At Fujitsu's lab in San Jose, performance measurements indirectly include patents. The lab director at this location states that Fujitsu has a set of

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<sup>17</sup> Interview at NEC Research Institute in Princeton, NJ.

<sup>18</sup> Interview at Fujitsu lab in Raleigh, NC.

objectives for this facility which focus on applied research and product development. These objectives are directed towards the design requirements of the projects, and patents are an outcome of solving these design requirements.<sup>19</sup>

At domestic Japanese R&D labs, for comparison purposes, initial performance evaluation takes place at the end of the training program when the researcher receives an initial assignment that is based primarily on performance during the training program. After this point, there is little or no formal evaluation, with most performance assessment coming informally from the frequent and intense interactions between superiors and subordinates. This contrasts significantly with American R&D performance evaluation where there are more formalized annual feedback interviews and performance appraisals.<sup>20</sup>

#### **4.3 Incentive Structure**

In analyzing the incentive structures of offshore R&D labs, one should pay particular attention to the behavior that is most likely to result from the facility's incentive and compensation structure. For example, labs which focus on different types of research may want to establish different incentive structures that reflect the types of research and results desired. According to one official at NEC, basic research activities should be performed on a more individualized basis than applied activities and should have incentive structures that encourage more individualized work. Conversely, more product development-oriented R&D work requires less individualized

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<sup>19</sup>Interview at Fujitsu lab in San Jose, CA.

<sup>20</sup>Westney, p. 14.

performance metrics in order to encourage greater cooperation among group workers and to enlist greater cross-functional interaction.

There have been well-noted differences between the incentive structures of U.S. R&D facilities and Japanese R&D facilities. Japanese firms tend to standardize their pay and promotion schedules based on seniority with uniform salaries across functions whereas American firms tend to compensate and promote their R&D employees on performance. An official at Fujitsu's Anaheim lab, states that pay is in accordance with the U.S. system of pay-by-performance as determined by the achievement of objectives. In the Anaheim lab, salary is completely individual and thereby very different from Japan.

Some Japanese firms, however, have engaged in some innovative compensation and reward systems. As Quinn (1987) notes,

Sony gives a small but significant percentage of a new product's sales to its innovating teams. Pilkington, IBM and 3M's top executives have often been chosen from those who earlier headed new product entries. Intel let its Magnetic Memory Group operate like a small company with special performance rewards and simulated stock options. GE, Syntex and UTC have actively helped internal champions of "non-related" product innovations establish new companies and have taken equity positions in their enterprises.<sup>21</sup>

In the Japanese R&D organization, promotion (and personnel transfer) appear to be the key methods for technology transfer. In this case, the researcher is transferred to a divisional lab or manufacturing facility to assure that the project that he or she has been working on will be properly implemented.

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<sup>21</sup>Quinn, p. 177.

Such a move is part of a career track or career ladder that will eventually lead to a position in line management. This career track therefore emphasizes the transfer of technology as one of the purposes in promoting the employee.

#### **4.4 Career Management**

Similar to what has just been previously discussed, career management issues of offshore R&D centers are dramatically influenced by the local country's career management practices. R&D facilities in the U.S. therefore follow the local career management practices of placing the responsibility for one's career management on the shoulders of the employee. Conversely, R&D management in Japan takes a more active role in the employee's career management by establishing career ladders. For example, in Fujitsu's San Jose facility, there are no established career ladders for the researchers. In comparison to the career ladder system found in most Japanese labs, the lack of such an approach towards career management is due to the lack of a rigid seniority system in the American lab. Most of a researcher's personal growth in an American lab comes from his or her growth in technical capability. Therefore the recruitment strategy of the Japanese R&D center located in America is to hire people who are experts in their field and then provide them with the opportunity to optimize their skills.

Since there is a tendency for specialization at this facility, it is unclear how the focus on specific tasks can be successfully mixed with interaction in other activities at the center or with other organizations within the MNC. One possible solution could be the establishment of complementary tasks at different R&D organizations. Designed complementarity will create an incentive for the different specialists to interact. Therefore, different but

related activities will foster a greater flow of information across the MNC organization.

There is a broader approach to career management for the Japanese researcher due to the career ladder system. An executive at Fujitsu's Raleigh, N.C. facility notes that in Japan there is a path from research to line management so that scientists and engineers will develop a broader perspective. This career ladder track has a positive effect on internal knowledge networks by establishing personal and professional linkages across R&D and line management (including manufacturing and sales/marketing) functions.

#### **4.5 Training and Development**

With training and development policies, there also seems to be a difference between Japanese R&D organizations and their U.S. based centers, thereby demonstrating local management practices. For example, at NEC's Princeton facility, training depends upon the individual's needs and initiative. At this facility, in particular, researchers are provided travel budgets that they can use to attend conferences and other training activities. Training is mostly informal with the most formal training coming in the way of study groups. These groups meet to discuss the limits of certain technologies in order to keep the researchers focused on the practical aspects of these technologies.

From the onset, domestic Japanese R&D organizations take a much more active role in the training and development of their employees. This is represented not just in the amount of attention that they give to employee development, but also in the holistic content of their training. Most Japanese

firms have historically put their recent hires through a formal entry-level training program. The firms mix their general management recruits with their R&D recruits in this several month long rotational program which also includes intensive education about the firm. As Westney states, "in Oki Electric Company, for example, both managerial and technical recruits even spend some time in a retail store selling Oki products, to provide them with direct exposure to customers."<sup>22</sup> Japanese firms also widely practice the sending of researchers to other firms and external research organizations to round out the researchers skill base and, perhaps, to benchmark new technologies. In addition, Japanese firms engage in extensive research with their suppliers and with their customers. These practices affect internal networks by making these researchers sources of market intelligence for the rest of the firm.

#### **4.6 Implications of HRM on Internal Knowledge Networks**

The difference in HRM practices between the "home" country and the "local" country pose challenges for the management of the MNC's internal knowledge networks. Differences in management style, performance evaluation and reward, career management, and training and development will significantly affect the creation and effectiveness of the firm's communication and learning networks. Through this study, it appears that career management in the manner of cross-functional job promotion will enhance the firm's knowledge networks by facilitating the transfer of technology as well as by increasing the likelihood of informal cross-functional linkages. The positive effect on the MNC's internal networks will increase with a greater degree of standardization of career paths across different

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<sup>22</sup>Westney, p. 12.

organizations within the MNC. Standardization, however, may be difficult to obtain due to labor market differences between countries.

## CHAPTER 5

### CULTURAL BARRIERS

#### 5.1 Cultural Bias to Established Technology

Some of the most significant obstacles to the effective management/transfer of technologies come from the cultural barriers to adopting new technologies within the corporation. By recognizing that a company's product and production technologies may be a key component of the firm's corporate culture, when a technology changes, the company's culture may have to go through a painful rebirth to effectively adopt this technology. As Foster (1983) states,

Sometimes a cultural preference for established technology is explicitly built into the management system; several major corporations still give top R&D priority to the defense of their existing product lines. The more doggedly they champion a policy of unyielding technology defense, the more vulnerable to new technology they become. Many R&D vice presidents, having earned their titles by successfully guiding their companies into new technologies, are not disposed to abandon their favorites easily. Indeed, they often inadvertently block the investigation of new and threatening technologies in the name of defending existing product lines.<sup>23</sup>

#### 5.2 Cross-Cultural Barriers

It has been acknowledged that the greater the similarity between the organizational structures and processes of two entities, the greater the interaction. Furthermore, researchers who share common values and goals can work independently, with minimal diminishing returns with geographic distance, self-coordinating their activities without detailed controls.<sup>24</sup> This

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<sup>23</sup>Foster, "Timing Technological Transitions", Technology in the Modern Corporation, Cambridge, MA. p. 43.

<sup>24</sup>Quinn, p. 171



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similarity in values and goals, however, is very difficult to obtain on a cultural level in a MNC. Paradoxically, different local social and political environments dictate that the MNC have a high level of internal organizational variety in comparison to domestic companies. This cultural balancing act may be the major bottleneck in the internal knowledge network of the MNC.

Most of the firms included in this study have only begun to address the issue of cross-cultural barriers. Fujitsu tried to mitigate the cultural differences between Japanese researchers and American researchers through weekly meetings between the R&D organization in Japan and the OSSI R&D center in Emeryville via the parent company's video teleconferencing center. As one Fujitsu official stated in an interview, the biggest problem in the cross-border management was poor communication due to the distance and cross-cultural misunderstanding. The official noted that this problem of poor communication was clearly noticeable at the lower levels of the organization where there were little or no cross-border relationships.<sup>25</sup> This is especially problematic in that lower-level communication appears to be the greatest source of internal knowledge transfer in Japanese MNCs.

### **5.3 Language Barriers**

These communication problems are critical factors in sub-optimal technology transfer. For instance, at Fujitsu's San Jose facility, all of the researchers are American, thereby causing communication problems with the Kawasaki lab. One official at the San Jose lab stated that relocating Americans to Japan is not a likely solution due to the lifestyle implications for the Americans. This

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<sup>25</sup>Interview at Fujitsu lab in Emeryville, CA.

obstacle may present an opportunity for training the "home" organization as well as the offshore facilities. One attempt at trying to cross-culturally train the home organization is Fujitsu's establishment of a cross-cultural design environment. An executive at Fujitsu's Richardson, Texas Transmission Development Division stated that all of the design standards were translated from Japanese to English to further common understanding between the home organization and the offshore R&D centers.

Technology is making cross-border communication easier, more effective, and more frequent. For instance, Fujitsu's Richardson, Texas lab communicates everyday with Japan through a dedicated line that was developed by Fujitsu. This line also has Fax, video conferencing, and electronic mail capabilities. Thus technology could be a major factor in helping to break down these communication barriers, but it can only help if there is continued personal contact between the workers at the different facilities. Personal contact is critical in establishing informal relationships which are the key contributors to enhanced communication within the MNC.

It is important to note that most of the offshore R&D centers included in this study engaged in little or no cross-cultural training of their U.S.-based employees. Even in the instance of expatriate Japanese workers, there was only cursory language and cultural training. Sony for example will train their U.S.-based Japanese researchers for one and a half months and the firm will train the employee's family for one week.<sup>26</sup>

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<sup>26</sup>Interview at Sony Corporate headquarters in Tokyo, Japan.

## 5.4 Value Incongruence

In addressing the difficulties in offshore R&D for the MNC, Westney and Sakakibara state,

They may also encounter problems when it is necessary to develop a cooperative working arrangement between a project group working in the United States and one working in the Japanese facility. The US researchers may quickly develop a contempt for someone who is a very effective project leader in Japan, but who lacks the technical superiority they value; the Japanese engineers may find it hard to work with an American project leader who commands the respect of his own subordinates by his technical expertise, rather than his management skills. An awareness of the different criteria of excellence in the two settings may go far in anticipating and dealing with such problems.<sup>27</sup>

Thus, a strong case develops for the effective cross-cultural training of the "home" organization as well as the offshore organization. If cross-cultural managerial differences exist between the offshore center and the home organization, the international information flow will not be maximized.

## 5.5 Implications of Cross-Cultural Barriers on Internal Knowledge Networks

By recognizing the cultural and language barriers that can arise between the offshore center and the home organization, the MNC may be able to avert any discontinuities between the two organizations. By training key "home" employees in local (those of the offshore facilities) languages and cultures, and by training key "local" employees in the "home" country's languages and culture, greater understanding and communication will result. In addition, frequent interaction, both personal and non-personal (phone, fax, video), will

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<sup>27</sup>Westney and Sakakibara, "The Role of Japan-Based R&D in Global Technology Strategy", Technology in the Modern Corporation, Cambridge, MA. p. 229.

facilitate informal interaction and lead to a more effective internal knowledge network.

## CHAPTER 6

### INTERACTION BETWEEN OFFSHORE R&D AND THE MNC

To optimize the activities and results performed by the offshore R&D groups within the MNC, the organizations with which these groups are linked should be flat in order to decrease the organizational layers between the R&D staff and those at the top of the reporting organization. Quinn (1987) therefore feels that total division sizes should be kept below 400 in order to create a flow of information through only two intervening layers (the R&D team would go through two layers of management to get to the division's ultimate decision-maker). As Quinn states, "Since it takes a chain of 'yesses' to approve a project as it moves to the top and only one 'no' to kill it, jeopardy multiplies as management layers increase."<sup>28</sup>

#### 6.1 Interaction with Corporate Lab

Increasing the interaction between the corporate lab and the offshore R&D center will improve the offshore lab's research agenda and enhance the center's chances of attracting top talent. Westney states that the corporate lab can have a beneficial effect by; exchanging researchers for short-term joint projects; dispatching researchers from the corporate lab to work in the Japanese lab; and sending a senior, professionally established scientist from the corporate lab to raise the facility's visibility and increase the MNC's commitment to the local market. Westney also mentions that emulation of the corporate lab's organizational patterns will foster the offshore R&D facility's development. By mirroring the corporate lab's organizational patterns, less confusion will result from cross-lab contact. The local facility

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<sup>28</sup>Quinn, p. 175.

will also be aided if strong external networks are developed, thereby making the corporate lab more interested in increasing its interaction with the offshore lab.

One of the significant findings of this study is the degree to which the levels of interaction affect the technology transfer process. An executive at Fujitsu's lab in Anaheim states that there are many different levels of interaction with the corporate lab in Kawasaki. Managers interact, engineers interact, and senior executives interact in a very parallel manner. In the Japanese firms, it appears that most of these interactions are driven through personal relationships. DeMeyer mentions that personal contacts and lateral information flows are critical in the transfer of technology. The creation of trust and the building of personal networks are significant factors in establishing these information exchanges. For example, in Fujitsu's San Jose lab the main communication to the corporate lab is through a key personal contact. As an official at this facility states, "M. (a Japanese researcher) is a key element of our communication with Japan. He was a major player there for many years and so he has the contacts with Kawasaki."

Another element in the offshore R&D center's relationship with the corporate lab entails technology transfer from the corporate lab to the offshore center. This technology transfer primarily relates to educating the offshore facility on how a basic technology applies to a locally oriented product or process and usually involves the transfer of a researcher from the corporate lab who has been working on the particular technology. This process poses a problem to Fujitsu and other Japanese firms with offshore R&D centers that would like to limit the number of Japanese employees in the local country. One Japanese

manager at Fujitsu would like to limit Japanese researchers to less than 10% of the U.S. center's workforce, but he is concerned about not having enough Japanese engineers to manage the knowledge transfer from the basic research facility in Tokyo. As this manager states, "We need these people to make a bridge, but it should not be too many. So we should carefully pick the people from Tokyo to smoothly give the know-how and conduct the technology transfer."<sup>29</sup>

## 6.2 Interaction with Operating Units

In Westney and Sakakibara's comparison of the management of Japanese and American R&D, there was a significant difference in the R&D organizations' links to manufacturing at all levels. In fact, Japanese firms may have closer ties to manufacturing because of the R&D organizations multiple linkages with manufacturing.<sup>30</sup> One contributing factor to these multiple linkages could be the standardization of the Japanese engineers' ( which include research and manufacturing personnel) career paths. As Westney and Sakakibara state,

The standardization of Japanese career paths is accentuated by the fact that the organizational structure of the R&D groups is the same as that of manufacturing or sales: the hierarchy of sections (*ka*) and departments (*bu*) is identical, and the titles of section chief and department head carry the same status in every function. They also carry much the same salary across functions.<sup>31</sup>

The Japanese firm's standardized approach to career paths thereby enables a greater flow of information to travel between R&D and manufacturing and

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<sup>29</sup>Interview at Fujitsu Lab in Raleigh, NC.

<sup>30</sup>Westney and Sakakibara, p. 227.

<sup>31</sup>Westney and Sakakibara, p. 226.



other operating units as well. Information flowing between two equals is more effective than through two unequal entities. In Japan, this system is especially important due to the extent to which informal contacts dominate the internal networks of the firm.

### **6.2.1 Budgeting**

The budgeting process provides the MNC with the opportunity to enhance the internal communication flow between the offshore center and the operating divisions by establishing the operating division as an "internal customer" of the R&D center. With a greater vested interest in the content and frequency of knowledge transfer, more effective communication could result.<sup>32</sup>

At this point in time, the budgeting and funding process has little to do with the strategic orientation or the day-to-day operation of the offshore R&D centers. For example, in spite of Canon corporate funding 100% of CRC America's (Canon Research Center, America in Palo Alto, CA) activities, there is no corporate influence in the day-to-day decision making at the center. The three vice presidents of the center report to the president of Canon USA. There is one key Japanese contact, the individual who hired Dr. Garland and Dr. Mellon to run the lab, who serves as the interface between the lab and Japan. Fujitsu's switching lab in Raleigh, NC is another example of the autonomy of the local center in spite of corporate funding. This center's primary mission is to incorporate customer requirements into system specifications so that the back-end development teams in Tokyo are driven accurately by the market. Because of the importance of representing the

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<sup>32</sup>Westney and Sakakibara, p. 228.

customer's voice, the local office has a very strong say in the allocation of the center's budget. An official at the center estimates that the local center's influence is approximately 60% in respect to the corporate lab's 40%, even though the local facility is funded 100% by corporate.

### **6.2.2 Linkages with U.S.-Based Subsidiaries**

Another significant finding of this study is that there appears to be little or no interaction (either formal or informal) between the offshore R&D centers and the local business units. Sony, for example interacts with its U.S.-based business units through the development groups in Japan (see exhibit 5). Similarly, at NEC there is no link between the Princeton R&D center and the US manufacturing and marketing organization. Short term ( i.e., a two-year time horizon) development work is undertaken at the manufacturing sites. A manager at this center states that having applied research at the Princeton Research Institute enables NEC to have access to the basic research scientists and keeps the institute focused on the customer. One could argue the contrary point, that a lack of interaction with local marketing and manufacturing would direct one's view away from the customer.

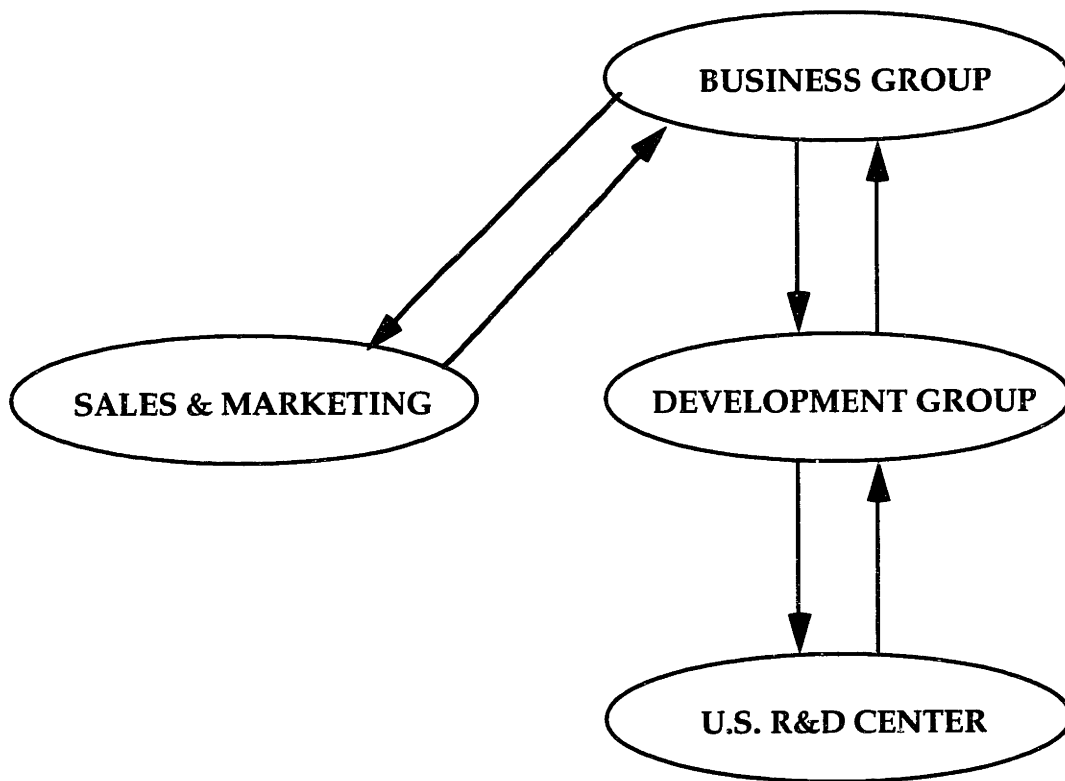
Similar results were found at all Japanese R&D facilities located in the U.S.. For example, Fujitsu's Anaheim and San Jose facilities' communications with other U.S. based business units are managed through Tokyo. There are no direct local communications. One Fujitsu official says, however, that communication links will be developing soon with the local computing division.

### **6.2.3 Involvement with Strategic Planning**

One of the most difficult issues to resolve in the management of MNC R&D is that of assessing the goal of the R&D organization. For some organizations, the purpose of their R&D centers, regardless of where they are located is to support the strategies of the existing business. For others, the purpose of their R&D organizations is to generate new opportunities for change. It is therefore important for a firm to structure its R&D organization in a manner

**Exhibit 5**

**SONY Internal Communication Network**



that appropriately balances the needs of the firm's existing business units with those of the future. This balancing act for the R&D organization requires management to incorporate an important role for the technologist in the business strategy planning process and it requires the R&D organization to place a greater emphasis on the strategic management of technology versus the management of technological projects.

As Mitchell (1983) stated, technical trends are changing the rules of business. Shorter product life cycles and the blurring of market segment boundaries are results from the influence of technology. Therefore, the R&D manager is increasingly being asked by others throughout the corporation about the relevance of his or her technical projects to the business units' strategy as well as that of the corporation. Moreover, the R&D manager will most likely be requested to take an active role in the formulation of the business units strategy by providing information on technical trends and the technical strengths of competitors.<sup>33</sup>

By fulfilling a valuable role in the strategy formulation process of the different operating units, the R&D manager will have a more interactive link with those units. This ideal is far from the reality of the the isolated offshore R&D centers depicted in this study. These Japanese offshore centers, however, maintain indirect contact with the manufacturing, marketing, and strategic planning groups through either the corporate lab in Japan or through some form of administrative group (i.e., the development groups at Sony). Thus there appears to be an opportunity for improving the internal knowledge

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<sup>33</sup>Mitchell, p. 135.

networks in the Japanese MNC's by creating closer ties with local marketing and manufacturing organizations within the MNC.

## CHAPTER 7

### CONCLUSION

This paper has studied the key factors that are involved in the management of internal knowledge networks in the MNC. Specifically, an analysis was undertaken to understand the managerial challenges in transferring information between offshore R&D centers and the rest of the Japanese MNC. Management commitment, the encouragement of informal linkages, cross-functional standardized career paths, and R&D involvement in strategy formulation of the firm are the four principle areas that offer the greatest managerial leverage in optimizing the internal knowledge networks within the MNC.

#### **7.1 Top Management Commitment**

For effective information flow to occur between the offshore R&D center and other organizations within the MNC, there must be a clear commitment from top level management to highly value the work and knowledge that is being generated at the offshore R&D center. Similarly, there must be a need for the offshore center to interact with the other organizations (i.e., the corporate lab, manufacturing, and marketing/sales) within the MNC. As Westney and Sakakibara state about U.S. firms with research centers in Japan, "Without a strong high-level recognition of the forces that make such a strategic mandate desirable, and a long-term commitment at the US firm, it is unlikely that the time and resources necessary to meet organizational challenges of developing effective management and liaison systems will be available."<sup>34</sup>

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<sup>34</sup>Westney and Sakakibara, p. 230.

## **7.2 Encouragement of Informal Interaction**

It has been identified that the more effective R&D structures display an organization that is greatly dependent on informal communication networks with many lateral contacts, numerous peer committees (both formal and informal), and a clearly communicated common corporate goal. As DeMeyer states, personal contacts and lateral information flows are critical in several stages of the innovation cycle. The creation of trust and the building of personal networks are significant factors in establishing information exchange. DeMeyer lists several methods to build informal relationships and stimulate the flow of information within the MNC:

- Create a policy to stimulate travel and frequent telephone contacts between Offshore R&D center managers and between the technological specialists.
- Hold regular formal meetings or seminars;
- Create a company culture which encourages an open exchange of information;
- Organize international working groups that will foster significant personal interaction between researchers of different countries;
- Actively rotate scientists and managers between different countries;
- Offer language training.<sup>35</sup>

## **7.3 Cross-Functional Standardized Career Paths**

In the Japanese R&D organization, promotion and personnel transfer appear to be the key methods for technology transfer. By adhering to a seniority based promotion and salary structure, Japanese firms are able to easily transfer people across divisions due to the similarity in the engineers' relative positions in both divisions. This personnel transfer is based on the concept of

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<sup>35</sup>De Meyer, p.142.



"parallel hierarchies" where, "people who entered each bureaucracy can be expected to have contemporaries who entered the others in the same year and who are at approximately the same levels of responsibility and discretion."<sup>36</sup>

#### **7.4 R&D Involvement in Business Planning Process**

By emphasizing the strategic importance of the offshore R&D center, management will encourage interaction between the center and the rest of the MNC. This is especially true in the strategic planning process where the offshore center can provide technological information that may significantly impact the business operations of the firm. As the technologies with which the center is working become more integrated with the firm's current operations, the greater the need for the center's involvement in the short-term strategic decisions of the firm. On the other hand, as the centers' technologies become more differentiated from the firm's current operations, there evolves a greater need for the center to become more involved in the firm's long-term strategy formulation. Regardless of the level of integration/differentiation of the technologies with which an R&D organization is working, more significant involvement with the strategic planning process of the firm will result in stronger internal knowledge networks between the R&D organization and the rest of the MNC.

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<sup>36</sup>Westney, p. 17.

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Mr. Matsuhiko Kono  
Sr. VP, Operations  
Fujitsu Business Communications, Inc.  
Anaheim, CA  
March 25, 1992  
(Interviewer: Chris Voisey)

Mr. Hiroaki Takechi  
Vice President, Technical Operations  
Switching Division  
Fujitsu Network Switching of America, Inc.  
Raleigh, NC  
March 23, 1992  
(Interviewer: Chris Voisey)

Mr. Mitsumasa Ashida  
President  
Fujitsu Microelectronics, Inc.  
San Jose, CA  
March 27, 1992  
(Interviewer: Chris Voisey)

Mr. Jeffrey A. Schriebman  
Chief Operating Officer  
Open Systems Solutions, Inc. ( purchased by Fujitsu in 1991 )  
Emeryville, CA  
March 26, 1992  
(Interviewer: Chris Voisey)

Mr. Larry Moresco  
Director  
Fujitsu Computer Packaging Technologies  
San Jose, CA  
March 26, 1992  
(Interviewer: Chris Voisey)

Mr. Tatsuo Kudo  
Senior Vice President, Transmission Development Division  
and Mr. Charles Huffman  
Vice President, Transmission Development Division  
Fujitsu Network Transmission Systems, Inc.  
Richardson, TX  
(Interviewer: Chris Voisey)

Dr. Harry Garland  
Vice President  
Canon Research Center America, Inc.  
Palo Alto, CA  
(Interviewer: John Jordan)

Mr. Laszlo Belady  
Chairman, Director of Laboratory  
and Dr. Tohei Nitta  
President  
Mitsubishi Electric Research Laboratories, Inc.  
Cambridge, MA  
(Interviewers: Eduardo Horowitz & Jon Otterstatter)

Dr. Kahng  
NEC Research Institute  
Princeton, NJ  
February 20, 1992  
(Interviewers: Bart Wojciehowski & Rick Shyrock)

Interview with Michio Arai  
General Manager  
R&D Administration Department  
R&D Corporate Planning Group  
Sony Corporation  
February 19, 1992  
(Interviewer: Rob Sommer)