Chapter 5

A Dynamic Model of Organizational Development

Investigating the Techniques for Improving the Creative Proficiency

Abstract: Japanese firms are typically known for continuous incremental innovation, and development of their traditional technological paths. American firms, in contrast, tend to evolve in a path-dependent fashion, until new organizational initiatives destroy the path and create a totally new technological network. Punctuated changes in the organizational paradigms yield increasing rents on the new investments, but have a significantly detrimental effect on the productivity of prior technological base. Further, the resources specialized to the older trajectories are usually non-tradable and non-transferable to the new paradigms. On account of their focus on incremental linkages, Japanese firms could still derive productivity benefits from the acquisition of these virtually worthless (for the American firms) market resources. The potential gains from trading older resources to the Japanese firms could motivate faster transition to new technological trajectories in the US. The growing diversity and speed of growth in the tradable older resources put strong pressures on the Japanese firms, and cause escalating costs of developing integrative links. An extension of organizational portfolio to the newly emergent markets might help Japanese firms reduce the institutional over-load, and flexibly realize their own creativity potential.

Introduction

Worldwide, the firms are seeking creative organizational learning for networking the emergent global opportunities. Pisano (1997: 1) observed, "the proposition that competitive advantage stems from firm-specific skills and capabilities has made learning a focal point of concern in fields such as competitive strategy, organizational behavior, and industrial organization economics. Without learning, it is difficult to imagine from where a firm's unique skills and competencies would come, and thus how it might create a competitive advantage." The learning has always been at the heart of organizational development. Marx (1867: 1245), for instance, noted, "The history of the colonial

administration of Holland – and Holland was the head capitalistic nation of the 17th century – is one of the most extraordinary relations of treachery, bribery, massacre, and meanness… By the beginning of the 18th century the Dutch manufacturers were far out-stripped. Holland had ceased to be the nation preponderant in commerce and industry. One of its main lines of business, therefore, from 1701-1776, is the lending out of enormous amounts of capital, especially to its great rival England. The same thing is going on today between England and the United States. A great deal of capital, which appears today in the United States without any certificate of birth, was yesterday in England, the capitalized blood of children." On a parallel note, in the late 19th century, Malthus (1798: 17) highlighted that, "From the accounts we have of China and Japan, it may be fairly doubted whether the best-directed efforts of human industry could double the produce of these countries even once in any number of years… The process of improving their minds and directing their industry would necessarily be slow; and during this time, as population would regularly keep pace with the increasing produce, it would rarely happen that a great degree of knowledge and industry would have to operate at once upon rich unappropriated soil."

Nobel Laureate North (1990: 32, 34, 138, 139) elucidated, "The problems of monitoring and metering the various attributes that constitute performance of agents mean that, in contrast to the standard neoclassical frictionless model of workers being paid the value of their marginal product, they are paid this cost minus the resource costs of monitoring and policing… Institutions provide the structure for exchange that (together with the technology employed) determines the cost of transacting and the cost of transformation… Effective traditions of hard work, honesty and integrity simply lower the cost of transacting and make possible complex, productive exchange… The security of property rights and the development of the public and private capital markets were instrumental factors not only in England's subsequent rapid economic development, but in its political hegemony and ultimate dominance of the world."

The decline in the England's global leadership position over the 20th century derived from a more effective organization of the non-dominant market opportunities. For instance, Woodward

(1958: 9-10) suggests, "A new approach lay in recognizing that firms differed not only in size, kind of industry and organization structure, but also in objectives... These differences in objectives controlled and limited the techniques of production that could be employed. A firm whose objective was to build prototypes of electronic equipment, for example, could not employ the technical methods of mass-production engineering." The potential value is well illustrated by the case of "management consulting business, which employs at least 100,000 people full-time around the world and has been growing twice as quickly as the rest of the world economy for the past decade. In 1994, according to the Gartner Group, it generated about $11.4 billion in fees." In this business, "books are just loss leaders for other, more profitable activities: public speaking, seminars, corporate advice, audiotapes, videotapes, diaries, and calendars… The money is good ($25,000 a seminar), the audience large and relatively uncritical, and you can bring back an Asian anecdote or two to spice up your performance at home." (Forbes, 1996: 206, 208) Japanese firms have been particularly prominent in taking cognizance of these emergent global opportunities:

> For Japan's companies, East Asia is now the most important region in the world... It is in East Asia that Japan's manufacturing companies enjoy profitability on their direct investments, and according to MITI analyses, only in East Asia. Since MITI's surveys began in 1985, North American profits on Japanese manufacturing investments have been nil. Europe was profitable for some time, until the economic recession in the early 1990's. Asian direct investment from Japan has been profitable throughout the period, and remain so. For Japan's companies then, East Asia is where the markets are, where the growth is, and where the profits are to be taken. No surprise then that under the current pressures of higher yen valuations and export price / cost rises, the discussion of off-shore investment focus on East Asia. (Abegglen, 1995: 37-46)

To summarize, two major alternative approaches could be used for exploiting the global opportunities: (1) learning from the developmental experiences of the prominent international leaders, and (2) assembly of the creative services of the emergent vendors, for furthering the development of international leaders. This report investigates the evidence on the first option based on the Japanese experiences, and recommends the second for further academic research.

Developmental Experiences of the Leading Japanese Firms

On the eve of the 20th century, Japanese organizations suffered from poor productivity and very limited internationally tradable manufactured products. The unfavorable tariff structure on trade,

and the domination of the international shipping by the England, impeded the Japanese access to the world markets. Under these conditions, Japanese people sought to focus their development on the interactions with the peripheral East Asian region, where the England or other politically dominant nations had shown only a limited interest in extra-territorial rights. The England inevitably found that it can 'free ride' on the Japanese services, instead of persisting with the traditional levels of hard work. This 'moral hazard' meant a reduced human power for bearing the risks of agency 'adverse selection,' and offered American firms unique opportunity to contest the global leadership.

1) Learning Power: During the first three decades of the 20th century, the American firms rapidly expanded the use of metal-based components in automobiles. At the time, Japan's autos were made totally of the wooden materials, and their production was limited by the extensive deforestation problem. Japanese government approved Ford's plans to assemble and sell metal-based vehicles in Japan. But in mid-1930s, the assembly of imported components was banned, causing Ford to exit the market. Honda Motors, which started as an auto repairs firm in 1928, began assembling the metal-based piston propeller rings as substitutes for the orthodox wooden-based ones. These metal rings were custom used in Japan's war bombers. Though the American military destroyed Honda's factory beyond use during the World War II, still the machinery scrap fetched Honda $600,000 from Toyota in 1945. Honda opened a technical research institute for analyzing the global racing bikes, and in 1951 designed an overhead valve that enhanced the fuel efficiency of road bikes. By 1952, Honda's 'cub' motorcycle was embraced by 13,000 of the Japanese bike dealers, and had captured 70% share of the emerging motorcycle market in Japan. Further innovations in the engine technology, based on the links with the vendors of erstwhile competitors, helped introduce a successor 'super-cub' model into the international markets. Overwhelmed with the lean look of Honda's super-cub compared to the sturdy British offerings, an American business undergraduate student coined the theme "You meet the nicest people on a Honda." Honda embraced this theme in its new mass advertising campaign beginning 1959, and immediately hit a jackpot. Honda moved to research the racing cars, and developed a variety of minicars, sports utilities, and light trucks during

the 1960s. Honda then secured low interest cost debt finance from the Mitsubishi Bank, for purchasing advanced machine tools from the Japanese electronic suppliers having preferential licensing links with the American suppliers. Honda Accord, launched in 1976, rapidly gained a lead in Japan's auto export market. Honda expatriated its older auto machinery to set up a 100% owned $1846 million auto plant in the US. It procured the list of top 100 American suppliers in diverse material processing operations, such as metal stamping, welding, painting and plastics. It selected a core group of suppliers on the criteria of demonstrated excellence in servicing the leading American manufacturers, and hired experienced American engineers for creative reengineering of its firm-specific equipment. The Ohio-assembled Honda Accord, launched in 1982, was a run away success, and allowed Honda to penetrate deep into the segments being targeted for development by Ford, Chrysler, and Volkswagen. General Motors, whose supplier base was pre-dominantly intra-firm, remained quite immune to Honda's expansion. During the 1980s, Honda rapidly moved upscale and contested the Japanese leadership of the US market. The principal firms, Nissan and Toyota, in the meantime, were struggling to fill their quotas from the voluntary export restraint agreement between the Japanese and the Western governments.

2) Agency Power: Honda's investments into the US relied on 6,500 US employees, and 350 Japanese expatriates. In contrast, Nissan's $775 million plant at Tennessee, commissioned in June 1983, hired 3,294 US employees, and used only 14 Japanese expatriates. The old stamping equipment and car body welding processes were imported from the Japanese factories. The equipment support for the assembly line and painting operations was mobilized locally in the US. In the late 1980s, Nissan commissioned a second assembly line, and dispatched another 6 Japanese expatriates for a short-term. The old truck engine machinery was exported from Japan to Mexico. A new engine plant was set up in the US for the passenger car engine manufacturing, which had earlier been concentrated in Mexico. Toyota expanded from its 50-50 joint venture with the General Motors, by setting up a new 100% plant at Kentucky in May 1988. It soon entered the pick-up truck market, originally dominated by the American auto assemblers. Its domestic share grew rapidly in value terms, and but

fell in volume terms from a peak of 43.2% in 1987 to 38.6% in 1996. The initial offerings were devoid of the V-8 engine and roomy cab found in Fords and Chevys. The "analysts speculated that the company purposely misread the market to avoid inflaming trade issues." Several billion dollars worth of parts and components designed and manufactured by the American suppliers were then identified for export to Japan. American suppliers were encouraged to set up model assembly lines featuring the latest 21st century processes. Using this learning, Toyota assembled 3.17 million units of vehicles in its domestic plants during 1995, though its domestic supplier and workforce base had been designed to manufacture just 3 million at the full employment level. Toyota then restored the dealer margins, that had been cut back during the early 1990s, and donated 10,000 new demonstration cars to the dealers for customer test-drives. All managers above the age of 50 were stripped of their titles, much before the retirement age of 60 years. Several employees were given two promotions at one go. Still Toyota's newly appointed President, Hiroshi Okuda (1996) noted, "It just takes five minutes for tiny Suzuki Motor Corp. to convey a top executive's decision to the whole company, while it takes weeks for Toyota… So far we have not been able to rejuvenate the workforce as I had hoped. The general impression is that Toyota is old and conservative."

3) Exchange Power Suzuki had over time expanded its horizons beyond the technical services of its key shareholder, General Motors. Suzuki formed partnership alliances with the government-backed entities in several Asian nations, gaining substantial tax holidays and import privileges. It extended these alliances to the suppliers of the most successful competing local auto assembler in each nation. The local managers and workers were ordained to pursue the art of continuous improvement, cost cutting, and quality enhancement. Suzuki's competitive position only strengthened when the local governments liberalized the import and licensing regimes. The government share of equity was acquired at deeply discounted value, compared to the investment levels being committed by the lead global assemblers. Thus, Suzuki contested largest Japanese market share in China, besides a largest total market share in India (76%) and Pakistan (66%). Suzuki transformed its Hungary venture into a majority owned one, and rapidly upgraded its share of the market to 16%.

Deeply appreciative of the Suzuki's approach, Toyota decided to strengthen links with the affiliates Hino and Daihatsu. Hino, the largest Japanese manufacturer of diesel trucks, had become a leader in the alternative fuel and engine technologies. Hino's buses had a unique reputation for low-exhaust emission. Hino was already in the process of finalizing an ASEAN joint venture with Nissan Diesel, and had acquired significant production networks in China and Taiwan. Daihatsu, the Japanese leader in electric vehicle technology, had a long-standing technical and licensing alliance with the leading Chinese auto firm – Tianjin Motors. Just recently, it had successfully contested the reputed global assemblers to bag a prestigious contract for assembling national cars in Malaysia. Toyota set a challenging target for its engineers to finalize new auto models within 18 months, instead of the conventional 27. Actually, it took less than 15 months to put Ipsum, designed to be a category killer in a popular segment dominated by Honda's Odyssey, into production. Ipsum, launched in September 1996, became the fourth-best selling car of Japan. Toyota rapidly contested back more than 40% share of the Japanese auto market in volume terms, and accumulated several billion dollars of the free cash reserves out of the booming profits.

Hypothesis Formulation

The creative assembly of the services of emergent vendor groups can help firms significantly broaden their marketing power. The institutional stakeholders might seek to further the returns by diffusing the resulting surplus for direct networking of the focal workforces. Table 1 reports the data on the number of vehicle units planned for overseas production and for exports from Japan in 1995. The percentage changes from the 1994 actual values are in brackets. In 1995, only Suzuki and Fuji Heavy maintained growth in exports as well as overseas production. Toyota, and its major full-line affiliate Daihatsu, considerably cut down domestic exports, and expanded overseas production.

Table 1: International Plans of Japanese assemblers for 1995
(percentage change from the 1994 actual is in brackets)

	Overseas Production	Exports
Toyota	12.50 (18.0%)	12.50 (-17.0%)
Nissan	11.20 (5.4%)	6.20 (- 2.0%)
Mitsubishi	7.00 (15.0%)	5.60 (1.0%)
Honda	8.99 (13.1%)	5.00 (- 3.0%)

Mazda	6.50 (0.0%)	5.90 (- 4.4%)
Suzuki	8.00 (13.5%)	2.00 (4.9%)
Daihatsu	2.30 (10.4%)	0.83 (- 8.1%)
Fuji Heavy	0.90 (54.9%)	1.27 (29.6%)
Total	57.39 (11.7%)	39.30 (- 6.1%)

Note: Data are in millions of assembled units. The data were obtained using the assistance of the staff at Research Institute of Long Term Credit Bank of Japan.

Japanese Multinational Enterprise Study Group (JMESG), coordinated by Tetsuo Abo at the University of Tokyo, interviewed the overseas plant managers of the Japanese firms. The data were gathered over 1989-95. The proficiency of three leading Japanese consumer electronics firms (Sanyo, Toshiba, and Sharp) are studied as potential networking option for augmenting the technological content of the traditional auto vehicles. The data are available for one plant each of the three firms, in Asia (Malaysia), Europe (UK/ Germany), and the US. The data evaluate the plant-level organizational practices on a scale of 1 to 5, where 5 = full application of the Japanese methods. The data are classified into 2 categories, each category comprising of 10 elements of Japanese methods. The first category contains the host-augmented elements, such as voluntary involvement of the workers in the small group activities. The second category contains the home-diffused elements, such as the percentage of machinery imported from the Japanese parent.

The option value of each know-how element used overseas is evaluated by averaging the application scores, for each of the three firms across the three regional plants. In Table 2(a), 30 host-motivated observations are regressed on two parameters, separately for each region: (1) **Regional-effect**, measured as the "application of an element averaged over the three plants in a region – application of the element for a firm in the region." (2) **Global-effect**, measured as the "application of an element averaged over the three firms across regions – application of the element for a firm in the region." The intercepts yield the constant **corporate-effect.** The t-values are in brackets.

Corporate factors were oriented towards the application of US know-how. Regional factors had a negative impact on the application of European know-how. The approach in Asia was guided by the changing corporate effectiveness. On the whole, Japanese firms deployed American methods for discovering fruitful applications of the local endowments. They adapted European methods for

exploiting these endowments. In Asia, the emphasis was on discovering further innovative applications, than on exploiting the local endowments in pre-planned domains. In other words, the American learning dominated the European learning in overseas investments.

Table 2(a): Application of the Host-Specific Elements of Japanese Methods

	America	Europe	Asia
Corporate-effect	3.106 (24.375)	2.989 (32.384)	3.075 (17.660)
Regional-effect	-0.155 (-0.815)	-0.680 (-2.482)	-0.317 (-0.937)
Global-effect	-0.269 (-1.720)	0.325 (1.285)	0.311 (1.004)
R sq.	0.403	0.325	0.036

In Table 2(b), the analysis is repeated using the 30 home-assimilated observations. Regional factors had a negative impact on the application of home-assimilated know-how into the Western landscape. Global factors had a negative impact on the application of home-assimilated know-how into the Asian landscape. Corporate factors adapted to the American and Asian resources, and applied assimilated home know-how into Europe. On the whole, the strong forces for adapting to the Asian know-how were catalyzed by the worldwide home-assimilated forces. In contrast, the strong forces for adapting to the American know-how were catalyzed by the local geography.

Table 2(b): Application of the Home-assimilated Elements of Japanese Methods

	America	Europe	Asia
Corporate-effect	2.650 (15.838)	3.079 (18.990)	2.663 (21.751)
Regional-effect	-0.796 (-2.866)	-1.122 (-2.818)	0.395 (1.225)
Global-effect	0.330 (1.602)	0.648 (1.806)	-0.694 (-3.038)
R sq.	0.246	0.285	0.288

To summarize, Japanese electronic firms showed a strong institutionalized behavior oriented towards the discovery of creative applications of the global know-how, as against the exploitation of the pre-programmed domestic knowledge endowments. All Japanese firms may be hypothesized to exploit the option value of global electronics experiences under the following condition:

Hypothesis: Organizational Development and Network Assembly

The greater the institutional activism, the greater the diffusion of Japanese investment networks overseas.

Operational Measures

In institutionally active systems, home-diffused forces usually exert a strong demonstration-effect. Table 3 gives comparative data for Toyota, and its group member Daihatsu, for the period 1975 to

1990. The data were obtained from NIKKEI NEEDS database, using the assistance of Takahiro Fujimoto at the University of Tokyo. All data are for the parent firm, excluding domestic as well as overseas affiliates. The data, originally in yen, were converted into the US dollar, to facilitate strategic appraisal of the globalization influences. The data were transformed from the varying accounting years to a common calendar year basis, using simple time averages. The data compare: (1) manpower, measured as manufacturing labor cost/ sales, (2) material power, measured as the cost of inputs bought from the outside vendors/ sales, (3) process overhead, measured as the (cost of goods sold – manpower – material power)/ sales, (4) product know-how, measured as the gross profit/ number of employees, (5) Global reputation, measured as sales/ total motor vehicle production of the US, Germany, and Japan, and (6) Export Intensity, measured as exports/sales.

Both Toyota as well as Daihatsu enjoyed a consistent growth in their global reputation over time. Toyota's reputation was several times stronger than that of Daihatsu. Throughout the period, Toyota used less manpower, than did Daihatsu. Except during the early 1980s, when Toyota used less material power, the normal material power usage was 71%. There was a continuous, and rapid, growth in the product know-how. Toyota had a stronger product know-how, but Daihatsu showed a substantially faster growth in its product know-how during the late 1980s. Toyota, and in particular Daihatsu, reduced the process overheads. There was a substantial reduction in their export intensity.

Table 4: Comparative Behavior of Toyota and Daihatsu

Toyota	Manpower	Material power	Process overheads	Product know-how	Global reputation	Export Intensity
1986-90	5.28%	70.64%	10.64%	100,710	8.60%	36.39%
1981-85	5.20%	67.96%	11.82%	57,271	6.61%	45.54%
1976-80	5.91%	71.63%	11.23%	29,264	4.72%	38.14%
Daihatsu						
1986-90	8.74%	70.92%	9.46%	51,915	0.78%	17.15%
1981-85	9.52%	70.67%	12.06%	18,400	0.56%	23.74%
1976-80	11.14%	71.64%	11.25%	11,157	0.42%	16.00%

On the whole, savings in manpower and an innovative application of material power helped further the product know-how, and thence global reputation. As the institutions generated increasing returns through diffusion of portfolio capital overseas during the late 1980s, the process

effectiveness suffered entropy, as did the export advantage. Therefore there is a need to correct the influence of global competition-effect, deriving from the diffusion of Japanese portfolio investments overseas, on the escalating domestic costs and diffusion of direct investment networks.

Test of the Hypothesis

The impact of institutional activism on the organizational cost-effectiveness involves three elements:

1) Growth in the Manpower Cost-effectiveness: Manpower cost-effectiveness is key to the ability of firms to develop differentiated products, and to gain global advantage. In Table 5(a), product know-how and global reputation are regressed on two variables: (1) Process cost escalation (**or research-effect**) measured as "firm's process overheads – firm's process overheads averaged over time." (2) Processes improving the effectiveness of manpower, (**or development-effect**) via exploitation of mechanized know-how from external networks. Development-effect is measured as "firm's process overheads – firm's manpower." The data are for two firms, Toyota and Daihatsu. The data are for the years 1976 to 1990. The intercept yields **institutional-effect**, under the traditional balance of overseas investment linkages. The t-values are in brackets.

The institutional forces added to the product value, but did not yield sustainable global reputation. The escalating process research costs were counter-productive to product know-how as well as global reputation. The processes developing the manpower effectiveness enhanced product know-how as well as global reputation. The improved manpower effectiveness especially added to the global reputation. The institutions tried to exploit this reputation by diffusing additional investment networks overseas, for promoting higher value-adding products indigenously.

Table 5(a): Growth in the Manpower Cost-effectiveness

	Product Know-how	Global Reputation
Institutional-effect	26,853 (4.26)	0.004 (0.91)
Research-effect	-1,403,378 (-4.86)	-1.024 (-5.40)
Development-effect	707,321 (4.76)	1.073 (11.02)
R sq.	0.566	0.823

2) Growth in the Material Cost-effectiveness: The purchase of creative material options from the emergent vendor groups can enhance the effectiveness of firms to generate value from the material

inputs. In Table 5(b), product know-how and global reputation are regressed on two variables: (1) Processes improving the effectiveness of networking rent-generating materials (or **discovery-effect**) measured as "firm's process overheads – firm's material power." (2) Processes focusing on the innovative assembly of the networked materials (or **assembly-effect**) measured as "firm's process overheads averaged over time – firm's material know-how." The data are for two firms: Toyota and Daihatsu. The data are for the years 1976 to 1990. The intercept yields the **globalization-effect**, of the balancing flows of human capital services. The t-values are in brackets.

Globalization of the human capital services networks used by the focal firms enhanced their product know-how as well as global reputation. The creative discovery of new rent-generating materials limited both product know-how as well as global reputation of the focal firms. But innovative assembly of material inputs enhanced both parameters. The network assembly of the services of the emergent vendor groups substantially added to the product know-how. Consequently, there were incentives to diffuse direct investment networks overseas for further globalization in the human capital services used by the firms. The enrichment in the overall quality of human capital services made a dominant contribution to the global reputation.

Table 5(b): Growth in the Material Cost-effectiveness

	Product Know-how	Global Reputation
Globalization-effect	574,527 (4.08)	0.589 (3.56)
Discovery-effect	-1,440,057 (-4.40)	-0.861 (-2.24)
Assembly-effect	2,314,555 (4.93)	1.780 (3.22)
R sq.	0.473	0.311

3) Growth in the Machine Cost-effectiveness: By purchasing the machinery endowments that support the operations of the human capital internationally, the firms can significantly boost the productivity of their domestic operations also. The sustained cost-effectiveness of machine is measured as the value of firm's total machinery base (**Machinery**). The improved productivity of domestic operations is measured as the value of manufacturing costs capitalized in a year (**Kaizen**). The resulting competitive advantage in the international market is measured as the value of exports (**Exports**). In Table 5(c), machinery, kaizen, and exports are regressed on (1) improved product quality deriving from a super-normal effectiveness of firm-specific manpower (or **manufacturing-**

effect), measured as the 'residual of the product know-how equation in Table 5(a) – residual of the product know-how equation in Table 5(b).' (2) Improved competitive advantage deriving from a super-normal effectiveness of firm-specific manpower (or **marketing-effect**), measured as the 'residual of the global reputation equation in Table 5(a) – residual of the global reputation equation in Table 5(b).' The intercept yields the **corporate-effect** of firm-specific resource linkages. The t-values are in brackets.

The resources networked by the corporations had a positive impact on the effectiveness of machinery, kaizen, as well as exports. The improved manufacturing quality, deriving from the invisible machinery links, furthered this organizational development. The improved market advantage made the invisible machinery links visible to the competitors, and exerted a neutralizing force. On the whole, invisible machinery links dominated the machine and exports. The visibility of the competing machinery links promoted kaizen of firm-specific infrastructure.

Table 5(c): Growth in the Machine Cost-effectiveness

	Machine	Kaizen	Exports
Corporate-effect	751.93 (6.417)	76.76 (9.482)	5576.44 (6.679)
Manufacturing-effect	0.0616 (2.655)	0.0034 (2.095)	0.6252 (3.780)
Marketing-effect	-60,339 (-3.738)	-2,876 (-2.579)	-575,886 (-5.008)
R sq.	0.451	0.227	0.564

4) Growth in the Method Cost-effectiveness: The diffusion of information, about various vendors that have capability specialized to the firm's machinery, can increase a firm's export revenues. At the same time, such diffusion can neutralize the need for kaizen costs, since the originators of the improved methods could themselves apply those methods to the resources specialized to the firm. In the following equation, **export-effect** from the diffusion of information on the machinery-specialized resources (**machinery-effect**), and the costs of specializing the kaizen to these resources (**kaizen-effect**) is evaluated. Kaizen-effect is measured as the residual of kaizen equation in Table 5(c), machinery-effect as the residual of machinery equation, and export-effect as the residual of export equation. The t-values are in brackets. The costs of specializing kaizen to the firm-specific resources tended to limit exports. The diffusion of information on machine-specialized resources, through intermediate or final products, had a dominant positive impact on exports.

Export-effect = 0.000 - 15.584 Kaizen-effect + 7.870 Machine-effect R sq.: 0.951
(0.000) (-1.715) (12.537)

The residual 4.9% comprised of an average $71.57 million of annual export advantage gained by Toyota, and of a similar advantage lost by Daihatsu. This is also consistent with Table 1, that Toyota had strong exports, and Daihatsu had super-normal level of overseas production.

Correction Factor for the Competition-effect

A firm can generate super-normal growth by investing in the discovery of new complementary resource options. For instance, Daihatsu's overseas production networks potentially worked as a source of discovering global opportunities, which could be fed to the export-oriented Toyota. To maximize the competitive advantage of their domestic firms, the international institutions might try to keep Japanese exchange rate at a low level so that Japanese learning is limited. Japanese institutions might retaliate to sustain returns by promoting super-normal diffusion of portfolio investment overseas, and thus help realize rapid appreciation of Japanese exchange rate.

Table 6(a) evaluates the impact of changing cost-effectiveness of manpower on Toyota's product know-how, averaged over 1970-72 (a period of constant exchange rate), 1973-75 (a period of yen appreciation, and export intensity), and 1991-93 (further yen appreciation and rising overseas production). The parameter estimates are based on the product know-how equation of Table 5(a). The residuals yield the super-normal growth in Toyota's **endowment-effect.** In brackets, each effect is measured as the percentage of total product know-how. As is evident, the institutional-effect from the traditional balance of investment linkages diminished remarkably between the early 1970s and the early 1990s. While Toyota had no incentive to research the process know-how during the early 1970s, such research became the dominating force by the early 1990s. The initiatives to develop the manpower effectiveness significantly diminished by the early 1990s. Toyota enjoyed a rapid growth in the value of its endowment, which made a positive contribution by the early 1990s.

Table 6(a): Significance of Institutional Activism in Toyota's Competitiveness

	1970-72	1973-75	1991-93
Institutional-effect	26853 (247%)	26853 (203%)	26853 (30%)
Research-effect	-45892 (-421%)	-43281 (-327%)	40641 (45%)

Development-effect	57757 (530%)	48830 (369%)	15903 (18%)
Endowment-effect	-27830 (-256%)	-19176 (-145%)	7369 (8%)
Total	10888 (100%)	13225 (100%)	90766 (100%)

With an increased awareness of the value of overseas learning, the firms could proactively diffuse their production networks overseas for strengthening their leadership position, and use the learning to augment the value-added on material resources. Table 6(b) evaluates the impact of changing material cost-effectiveness on Toyota's product know-how. The parameter estimates are based on the product know-how equation of Table 5(b). The residuals yield the super-normal growth in Toyota's **diffusion-effect**. The knowledge contribution of global manpower links significantly declined over time. The knowledge contribution of discovering new material links also declined. The significance of an innovative assembly of material resources significantly improved, but still had a detrimental impact on Toyota's product competitiveness. In these conditions, the diffusion-effect was the dominant force improving Toyota's product competitiveness.

Table 6(b): Significance of Organizational Development in Toyota's Competitiveness

	1970-72	1973-75	1991-93
Globalization-effect	574,527 (5277%)	574,527 (4344%)	574,527 (633%)
Discovery-effect	763,482 (7012%)	807,732 (6108%)	1017,784 (1121%)
Assembly-effect	-1302,808 (-11966%)	-1369,624 (-10356%)	-1568,821 (-1728%)
Diffusion-effect	-24,314 (-223%)	590 (4%)	67,276 (74%)
Total	10888 (100%)	13,225 (100%)	90,766 (100%)

Investigating the Techniques for Improving the Exchange Proficiency

At the time of Meiji Restoration in the late 19th century, Japan had a diverse portfolio of traditional intellectual properties. These intellectual properties had enriched through the interactions with East Asia, and most were not known to the England (except for the properties derived from the interactions with Portuguese and Dutch merchants during the 17th and 18th centuries). Japanese government took a Yen 11.71 million of pound sterling debt from the English bond market in 1873. The debt was taken by the England as a compensation for the historical attempts by the Japanese ships to exclude English ships from the East Asian route. The debt servicing rapidly exhausted the local precious stone reserves. Since any default was subject to a direct colonial administration from

the principal creditor, there were strong incentives for furthering the principal credit stake in the Japanese market. Under these conditions, the value of Japan's silver yen depreciated from 1.037 gold yen in 1874 to 1.297 in 1887. The exports of the gold currency nations, led by the UK, to Japan jumped from Gold Yen 14.04 million in 1874 to Gold Yen 29.79 million in 1887. The exports of the silver currency nations to Japan, which were coordinated by the British shipping and merchant firms, grew from Silver Yen 8.67 million in 1874 to Silver Yen 14.47 million in 1887. The exports of the other nations to Japan, which were coordinated by small Japanese shippers, to Japan fell from Silver Yen 0.75 million in 1874 to Silver Yen 0.04 million in 1887.

Japanese people anticipated an imminent entry into the British Commonwealth, and began mobilizing additional intellectual power from a very early stage. The government laid taxes on the official Japanese exports, comprising primarily of the raw silk and hand reeled silk, besides tea surpluses. These taxes were intended to limit the purchasing power of the major investors, who were being encouraged by the savvy British advertising to spend an increasing amount on the imported luxury combs and decorative items. The lead power was restored from the governors (daimyos) to the Emperor, who was a child, in 1868. The tax revenues were invested to purchase starred British military garments for the newly designated administrators and the Emperor. Japan's modernization was to be based on the slogan "Western learning and Japanese spirit." A breakthrough was achieved in 1873, when the US voluntarily returned Silver Yen 907,515 to the Japanese government. The amount had earlier been taken as compensation for the "mistaken" bombarding of an American ship at Shimonoseki in 1862. The government invested the windfall into the shipbuilding operations, but the UK refused Japanese entry into the international ship-service trade.

After many debates, Japanese administrators developed a consensus that the only option for salvaging their spirits is to focus on the East Asian route, which was still open to the Japanese shippers. In 1894, Japan invaded China, and acquired territorial and maritime rights in Korea, Taiwan, and other parts of East Asia. Substantial gold donations were received from China as war compensation. The UK immediately accepted Japan as a member of the elite gold currency group.

Japanese government was allowed to issue a low-interest debt on the British bond market. Japanese firms were allowed entry into the international shipping. The duties on the imports of Japanese products were cut, and Japanese government was able to do away with the export taxes.

Baba and Tatemoto (1968) estimated the relevant data on the balance of payments. Table 7(a) gives the average annual data on (a) **Learning Power:** military donations received by Japan, net of the payments, indicating Japan's proficiency in adapting to the orthodox European methods. (2) **Agency Power:** Inflows of capital net of the outflows (excluding donations), indicating Japan's proficiency in applying the innovative American methods for mobilizing European capital. (3) **Exchange Power:** Learning power + Agency Power – Trade Deficit, indicating Japan's proficiency in using the emerging market links for acquiring overseas assets, limiting the yen appreciation, and advance financing exports. (4) **Insurance Power:** Value of gold produced, indicating Japan's domestic endowment base for servicing the global obligations.

The data are in Silver Yen. As of 1870, the value of silver yen exceeded the value of US$. By 1878, the silver yen had depreciated by more than 10%. After remaining stable until 1883-1884, the value of each silver yen fell to about 0.75 US$ in 1886. In 1892, a fresh depreciation of silver yen ensued, and by 1895 the average annual value of silver yen had dropped to about 0.50 US$. This yen-dollar exchange rate remained stable for the next thirty years. Table 7(a) highlights that Japan enjoyed a revolutionary improvement in its learning power during 1871-1900. Japanese agency became increasingly attractive to the foreigners, except during the 1880s. At this time, Japan ingenuously tapped the insurance power for limiting the foreign debt. Still given the credible risks of insurance exhaustion, Japan consistently strengthened its exchange power.

Table 7(a): Development of Japanese Globalization (in silver yen)

	Learning Power	Agency Power	Exchange Power	Insurance Power
1871-80	-601,849	230,440	-17,506,490	371,941
1881-90	878,362	-731,529	-6,845,274	1,678,576
1891-1900	44,535,753	13,303,650	16,818,989	2,987,923

Table 7(b) gives average annual exchange data for manufacturing, servicing, and institutional domains. **Manufacturing Force**, measured as the trade surplus in manufactured goods, is valued in

free-on-board terms. **Servicing Force** is measured as the trade surplus in services including tourism, shipping, chartered vessels, tolls, direct extra-territorial investment income, insurance, and interest on government bonds. **Institutional Force** is measured as the trade surplus on government account including diplomatic services, and purchases of military equipment, machinery and railroads by the government agencies. The data are as percentage of the two-way trade. Japan enjoyed a strong manufacturing force, especially during the 1880s. Japan's servicing consistently improved over time. Japan's institutional force deteriorated, except for a brief improvement during the 1880s. Thus, the institutional forces derived their power from an over-stretched manufacturing, and deployed it for helping the Japanese firms acquire proficiency in servicing the international community.

Table 7(b): Development of Japanese Exports (as % of total trade)

	Manufacturing Force	Servicing Force	Institutional Force
1871-80	-13.62%	-82.87%	-59.77%
1881-90	0.73%	-47.48%	-36.53%
1891-1900	-6.04%	-20.52%	-78.59%

The overall impact of manufacturing, servicing, and institutional forces on the **learning power** is presented in Table 8(a). The impact is measured in terms of two variables: (1) **Quality-effect**, measured as 'value of exports - value of imports,' reflecting the super-normal quality of Japan's manufacturing, services, or institutions. (2) **Dynamism-effect**, measured as 'value of exports - value of exports averaged over 1871-1900,' reflecting the super-normal learning in manufacturing, services, or institutions, at specific times. Learning power is regressed separately on each force's quality-effect and dynamism-effect. The intercept reflects **Focus-effect**, or the constant learning from the application of a particular force. The t-values are in brackets. As is evident, a focused application of manufacturing force enhanced Japan's learning, while that of servicing force obviated it. The focused application of institutional force yielded little stable effects on learning. The poor initial quality of servicing force, and the strong dynamism of institutional force, were the dominating drivers of Japan's learning.

Table 8(a): Alternative Forces Contributing to Japan's Learning Power

	Manufacturing Force	Servicing Force	Institutional Force
Focus-effect	9,816,008 (2.019)	-42,358,268 (-2.569)	4,341,676 (0.792)

Quality-effect	-0.622 (-3.250)	-8.047 (-3.637)	-1.666 (-3.829)
Dynamism-effect	0.263 (3.071)	1.777 (2.182)	18.785 (2.447)
R sq.	0.537	0.483	0.510

The overall impact of manufacturing, servicing, and institutional forces on Japan's agency power is in Table 8(b). Japanese focus significantly weakened the ability of the overseas principals to exercise sustained agency rights in Japan. The diminishing quality, and sustained dynamism, of the Japanese institutional force was the dominant detrimental force. The improving dynamism of the servicing force enhanced the Japanese motivation for servicing as agents to the global principals.

Table 8(b): Alternative Forces Contributing to Japan's Agency Power

	Manufacturing Force	Servicing Force	Institutional Force
Focus-effect	4,943,928 (0.644)	23,065,011 (0.956)	-3,335,701 (-0.392)
Quality-effect	0.082 (0.272)	2.640 (0.815)	-1.196 (-1.770)
Dynamism-effect	0.258 (1.907)	1.776 (2.250)	-6.656 (-0.559)
R sq.	0.124	0.158	0.104

The overall impact of manufacturing, servicing, and institutional forces on Japan's exchange power is in Table 8(c). Japanese focus on servicing added to the exchange power, albeit with considerable risks. The improving quality, and sustained dynamism, of the manufacturing force was the essential pre-condition for exchange power. The institutions sought to create a level playing field by seeking a balancing principal status for Japan.

Table 8(c): Alternative Forces Contributing to Japan's Exchange Power

	Manufacturing Force	Servicing Force	Institutional Force
Focus-effect	4,121,048 (0.736)	32,107,756 (1.415)	-1,690,564 (-0.208)
Quality-effect	0.805 (3.656)	4.862 (1.597)	0.129 (0.200)
Dynamism-effect	0.429 (4.357)	1.450 (1.953)	15.871 (1.393)
R sq.	0.470	0.154	0.068

The international trade in intellectual services can help firms improve their manufacturing know-how. The institutions might seek to develop the servicing force for improving the local manufacturing operations. Such institutional activism is expected to put the nation into a higher-growth manufacturing trajectory, with a stronger servicing orientation. The incremental **learning-effect** of the enhanced manufacturing force is measured as the residual of the regression of learning power on the two parameters of manufacturing force in Table 8(a). Similarly, the incremental **agency-effect** is measured as the manufacturing force residuals in Table 8(b). The incremental

exchange-effect is measured as the manufacturing force residuals in Table 8(c). The incremental **servicing-effect** is measured as the corresponding servicing force residuals, in learning, agency or exchange power equations. The reduced **institutional-effect** is measured as the *negative* of the corresponding institutional force residuals, in learning, agency or exchange power equations.

In Table 9(a), each of the three elements of the manufacturing effectiveness is regressed on the corresponding servicing-effect and institutional-effect. The intercept yields **manufacturing-effect**, or endogenous changes in the manufacturing force. Cum R sq., including the manufacturing force R sq. from Tables 8(a)-8(c), reflects overall globalization-effects. The t-values are in brackets. The endogenous changes had no material impact on the manufacturing force over time. Enhanced servicing effectiveness had an especially significant impact on Japan's power to serve the principal players as an agent. The gains from further institutional activism, especially in relation to agency and learning, actually increased. The globalization played a dominant role in exchange effectiveness.

Table 9(a): Evaluating the Development of Manufacturing Effectiveness

	Learning-effect	Agency-effect	Exchange-effect
Manufacturing-effect	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Servicing-effect	0.603 (6.614)	0.823 (6.579)	0.569 (3.406)
Institutions-effect	-0.961 (-13.638)	-0.998 (-22.311)	-0.663 (-7.630)
R sq.	0.875	0.949	0.686
Cumulative R sq.	0.942	0.955	0.834

Once the manufacturing system has been reengineered, the prior servicing know-how yields little additional rents. The institutions might seek to sustain the value of human capital by targeting the reserve resource endowments in the emergent markets. Any organization that has a potential use for the reserve assets could participate in sharing the resulting surplus. In Table 9(b), Japan's production from gold reserves is regressed on each of the three elements of service-effect and institution-effect. The endogenous manufacturing effectiveness generated by these gold reserves had most significant impact on Japan being an agent of the global principals. The improving servicing effectiveness obviated the need for diffusing rents to the global principals. The reduced institutional activism re-created the risks of attracting the global principals.

Table 9(b): Evaluating the Development of Reserve Endowments

	Learning-effect	Agency-effect	Exchange-effect
Manufacturing-effect	1,679,480 (7.245)	1,679,480 (9.331)	1,679,480 (6.977)
Servicing-effect	0.015 (1.164)	-0.063 (-4.629)	0.010 (0.755)
Institutions-effect	-0.015 (-1.510)	0.010 (2.134)	-0.002 (-0.341)
R sq.	0.092	0.453	0.021

Once the incumbent agents develop their own servicing power, the principals suffer a loss in the size of their market. The global principals might seek emerging market opportunities for furthering their advantage in the institutional lending. **Opportunity-effect** on the incentives for diffusing capital is measured as the residual of the exchange-effect in Table 9(a). **Advantage-effect** on the incentives for diffusing capital is measured as the residual of the exchange-effect in Table 9(b). The **rents** are measured as the residual of learning-effect equations. The **reputation benefits** are measured as the residual of agency-effect equations.

In Table 10, opportunity-effect is regressed on the rents and reputation benefits computed from Table 9(a). Similarly, advantage-effect is regressed on the rents and reputation benefits computed from Table 9(b). The intercept yields the impact of insurance provided by the **diffused investment** networks. Cum R sq., including the R sq. from Table 9(a) or Table 9(b), reflects the impact of global institutional power. Diffused investments generated no material impact on exploitation of emergent opportunities or development of principal advantage. Learning rents were crucial to the advantage development. Agency reputation conditioned the opportunity exploitation. The organizational development made a dominant contribution to Japan's growing advantage. The super-normal impact of organizational development on the advantage growth (0.905), implied significant potential benefits from a deeper harnessing of the global manpower services.

Table 10: Impact of Institutional Development on Organizational Effectiveness

	Opportunity-effect	Advantage-effect	Test of Difference
Diffused investment	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Rents	0.135 (0.341)	1.004 (11.411)	-0.869 (-2.148)
Reputation Benefits	0.981 (2.518)	-0.032 (-0.279)	1.012 (2.496)
R sq.	0.250	0.903	
Cumulative R sq.	0.876	0.905	

Conclusions and the Recommendations for Further Research

In recent years, the governments in several nations have liberalized and deregulated the local economies. The emerging markets might use the foreign finance for the purchase of consumer goods or capital goods. The purchases of the foreign consumer goods improve the local living conditions, and enhance the worker productivity. The purchases of the foreign capital goods create new technological base. The lower cost of goods assembled in the emerging markets implies enhanced consumer welfare in the affluent nations. The consumer savings could be used for the research and development of innovative capital goods. Such a development model is predicated on the ability of more satisfied workers to discover new untapped domains. Else the costs of research could escalate, without yielding commensurate developmental benefits. For instance, Helfat (1994: 1731) analyzed five research and development (R&D) objectives in the US petroleum sector, over the period 1975-81 that led to the industry-wide consolidation shocks in 1982. The findings indicated "all five of the R&D activities have greater stability over time than another firm-level activity - that of investment - with which R&D expenditures are often thought to be associated."

One way to augment the scarcity of technical resources, which limited an earlier development of innovative ideas, is mobilizing the distinctive emerging market talent. Khanna and Palepu (1998) gathered data on the group-level intermediation activities for 9 major business groups each in Chile and India. The data were gathered primarily through interviews with the group chief executive officer, the group chief financial officer, and the group human resources manager, conducted during 1997. The data on 9 intermediation activities are available for 3 transport-based groups in Chile, namely Grupo Larrain, Grupo Claro, and Corp (Saieh) Group. Comparable data are available for 3 transport-based groups in India, namely Murugappa Chettiar Group, Mahindra & Mahindra Group, and Hero (Munjals) Group. The data are for the year when major deregulation began – 1987 for Chile and 1990 for India, and the most recent year – 1997. The data are available on a scale of 1 to 5, where 5 implies a high role of the group level intermediation.

The global excellence of a nation's group level skills is evaluated in terms of two parameters: (1) **activity-effect**, or the unique skills in an activity, measured as the 'intermediation of a group in an

activity – average intermediation of the group across 9 activities'. (2) **Group-effect**, or the unique skills of specific groups, measured as the 'intermediation of a group in an activity – average intermediation of three groups in the activity.' In Table 11(a), the intermediation of Chilean groups during 1987 and 1997 is separately regressed on the activity-effect and group-effect computed from 1987 data. The intercept yields the **nation-effect**, or the average intermediation in a nation. As is evident, activity-effect was the dominating factor for coordination in 1987. An activity coordinated at the group-level in 1987 continued to be coordinated at the group level even in 1997. Nearly half of the coordination was now impacted by the residual interaction between the group and the activity, deriving from national excellence. Thus, the Chilean groups excelled in a creative pooling of specific activity initiatives at the group level.

Table 11(a): Global Excellence of the Chilean Group Level Skills

	1987/1987	1997/87	Test of difference
Nation-effect	2.500 (89.016)	2.618 (13.229)	0.118 (0.589)
Activity-effect	0.983 (37.680)	0.710 (3.863)	-0.273 (-1.470)
Group-effect	0.035 (0.930)	-0.069 (-0.261)	-0.104 (-0.390)
R sq.	0.991	0.516	

In Table 11(b), a similar analysis is conducted for India. The groups in India tended to lower the coordination of activities to the best local practice level. Such strategic coordination helped them reach closer to the inter-national levels of higher overall coordination among the group companies.

Table 11(b): Global Excellence of the Indian Group Level Skills

	1990/1990	1997/90	Test of difference
Nation-effect	2.217 (98.714)	2.547 (13.673)	0.330 (1.759)
Activity-effect	0.990 (49.035)	0.770 (4.595)	-0.221 (-1.307)
Group-effect	0.035 (0.928)	-0.328 (-1.060)	-0.363 (-1.163)
R sq.	0.993	0.497	

In Table 12(a), the intermediation during 1997 is regressed on the activity-effect and group-effect, both computed from 1997 data. Indian groups select similar activities for a somewhat higher level of coordination. In Chile, the coordination level of an activity is contingent on the group-level strategy. On the whole, the Chilean groups have a slightly higher activity coordination level.

Table 12(a): Comparative Excellence of the Chilean and Indian Skills in 1997

	Chile	India	Test of difference
Nation-effect	2.618 (29.400)	2.547 (69.245)	-0.071 (-0.738)

Activity-effect	0.790 (9.509)	0.965 (25.841)	0.175 (1.921)
Group-effect	0.500 (4.901)	0.082 (1.466)	-0.418 (-3.590)
R sq.	0.902	0.980	

In Table 12(b), **present national excellence** is measured as the residual of 1997 equation, regressed on contemporaneous data. **Local-effect** is measured as the residual of 1987 (or 1990) equation, regressed on contemporaneous data. **Global-effect** is measured as the residual of 1997 equation, regressed on 1987 (or 1990) data. Present national excellence is regressed on the local-effect and global-effect, for Chile as well as India. The intercept yields the **corporate-effect**, i.e. group-varying development of each activity. As is evident, in both nations each group had a different approach to coordinate specific activities. The activities intensely coordinated by a Chilean group in 1987 were even more actively coordinated in 1997. In contrast, the activities intensely coordinated by an Indian group in 1990 became less coordinated in 1997.

Table 12(b): Analysis of the Interaction between Group and Activity in 1997

	Chile	India	Test of difference
Corporate-effect	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Local-effect	2.889 (5.671)	-0.821 (-2.832)	-3.710 (-6.329)
Global-effect	-0.087 (-1.197)	0.003 (0.076)	0.089 (1.111)
R sq.	0.640	0.253	

The above findings suggest significant potential of tapping the group-specific know-how in Chile, and the market-wide know-how in India. Innovative linkages among various distinctive organizations could help improve the market-wide effectiveness. Creative linkages among distinctive markets could help promote further technological growth internationally. Appreciating the potential opportunities, "Japan is close to lifting a ban on holding companies imposed five decades ago by the US occupation forces, in a step that advocates say could free Japanese corporations to form huge new alliances, cut their high labor costs and compete better against American rivals." (The Wall Street Journal, 1997: A 10) Japanese firms could translate the reduced costs of international monitoring into sustainable market growth. Alternatively, by seeking a dominant hold of the global market, they could neutralize the cost savings through entropy in the international reputation.

References

Abegglen James C.; "Japan's Asian Dilemma," pp. 37-46, A Global Economy Bound by Common Competitive Principles, The Yomiuri Shimbun, May 18-19 (1995).

Baba Masao, and Masahiro Tatemoto; "Foreign Trade and Economic Growth in Japan: 1858-1937," pp. 162-196, eds. Lawrence Klein and Kazushi Ohkawa, Economic Growth: The Japanese Experience since the Meiji Era, Illionois: Richard D. Irwin Inc. (1968).

Forbes; "Have you consulted a witch doctor lately?," by John Micklethwait and Adrian Wooldridge, November 18, pp. 204-212 (1996).

Helfat, Constance E., "Evolutionary trajectories in petroleum firm R&D", Management Science, 40(12), p. 1720-1747 (1994).

Khanna Tarun, and Krishna Palepu; "Policy Shocks, Market Intermediaries, and Corporate Strategy: Evolution of Business Groups in Chile and India," mimeo, Harvard Business School, Apr (1998).

Malthus Robert; An Essay on the Principle of Population, 1992 Cambridge U. Press ed. (1798).

Marx Karl; Capital: A Critique of the Political Economy, New York: International Publishers (1867)

North Douglass C.; Institutions, Institutional Change and Economic Performance, New York: Cambridge University Press (1990).

Okuda Hiroshi; quoted in Fortune, November 25, p. 122 (1996).

Pisano Gary P., "In Search of Dynamic Capabilities: The Origins of R&D Competence in Biopharmaceuticals," mimeo, Harvard Business School, July 31 (1997).

The Wall Street Journal; "Japan Set to Allow Holding Companies in Bid to Cut Costs," by Jaton Sapsford, p. A 10, February 21 (1997).

Woodward, Joan, Management and Technology, Ministry of Technology, London: Her Majesty's Stationery Office (1958).