

Chapter 9

A Dynamic Model of Technological Servicing

Why Do the Firms Value the Potential of Emerging Networks?

Abstract: Over the recent years, there has been an increased involvement of the traditionally minority workforces, such as women, in the operations of the firms in the affluent economies. The minority workforces offer their services at lower than normal costs. The research of the firms in the affluent economies has traditionally focused on the know-how and creative imagination of their dominant workforces. The development of the unique know-how of the emerging workforces could augment the productivity of corporate services, and further enhance the value-added by the maturing manufacturing sector. The dynamic impact of these propositions on the leadership position is modeled using the comparative Japanese and American organizational approaches.

Introduction

Recent studies highlight a critical need for appreciating the broad-based nature of the valuable technological skills, not limited just to the affluent and educated sections. In its seminal report, "Our Creative Diversity," World Commission on Culture and Development (1995: 46, 79, 86, 135, 139) noted, "The ethos of universal human rights proclaims that all human beings are born equal and that they enjoy these rights irrespective of class, gender, race, community, or generation." "Special attention must therefore be paid to the knowledge that each culture has contributed to the world's intellectual legacy. Such knowledge comprises valuable information on botany, agronomy, and other areas of the natural environment, as well as specific technological solutions to problems. Priority has to be given to the collection, systematization and dissemination of such knowledge, as well as to combining it with modern technological knowledge." "Especially in the area of rural development, we have become increasingly

sensitized to the value of local knowledge and to the fact that, in many communities, women are crucial actors in the preservation and dissemination of such knowledge.” In the emerging Asian markets, “industrialization is as much ‘female-led’ as it is ‘export-led.’... The workforce in many export processing zones in the textile, optics, electronics industries include large numbers of women, many of them young, unskilled and unmarried.” “Many tribal communities in India have age-old technologies and practices in such diverse areas as hill-top agriculture, medicine, health care, community education, and socialization.” Lazonick (1994: 89) observes, “Central to the managerial revolution in American business was the creation of incentive systems and accounting systems that sought to transform individualistic Americans into ‘organization men.’ The inhabitants of the managerial structure were in fact (until the 1960s) almost exclusively men. More than that, they tended to be white, Anglo-Saxon, Protestant men who, within the corporate structure, were ‘members of the club.’... Left out of the ‘club’ were women, who were often required to give up their employment upon marriage, and shop-floor workers, who increasingly came from a variety of non- ‘Wasp’ backgrounds. These were the ‘hourly’ workers who, in theory at least, could be hired and fired at will. In practice, those blue-collar workers who tended expensive machinery that had to be operated continuously and at high speeds to generate returns had to be motivated to maintain the pace of work.”

Chang and Singh (1995: 2) highlighted, "Assuming bounded rationality, managers cannot be certain about the success of their ventures into new areas. Consequently, the creation of a new line of business by the firm can be represented as a sequential process of initial exploration followed by feedback in terms of performance of the venture and the fit between its key success factors and the capabilities of the firm. An outcome of the feedback process can be either scale up or exit..." They studied the effectiveness of internal development versus external acquisition modes for exploring new business opportunities, using the data on the US manufacturing firms during the 1980s. The external acquisitions were less constrained by the existing operations, and

were more cost-effective. Those businesses, as belonged to a firm's existing business lines, had greatest probability of success. As such, by the early 1990s, there was an increased emphasis on focusing to develop the related business lines, primarily through the acquisitions of high quality vendors of the relevant technologies. However such acquisitions could limit the flexibility of the firms to develop new business areas, and lock them out of alternative emergent technologies.

The case of the top auto assembler, General Motors, is instructive. In its early years, General Motors used to make the open body vehicles, each of which were constructed individually out of the wood. In 1919, it entered into a 10-year contract with the Fisher Body, for an exclusive purchase of the patented closed body made out of the steel metal. The contract had a most-favored customer clause, guaranteeing the best prices offered by the Fisher Body to any of its customers worldwide. The initial price of the metal body was set at 17.6 percent above the Fisher Body's variable cost. The metal body vehicles were a roaring hit with the customers, and constituted more than 65% of the total sales of the General Motors by 1924. General Motors wished to adopt the metal body in its other vehicles also, but such applications called for an expensive retooling of the Fisher Body's plant. Also, for an improved servicing, General Motors asked the Fisher Body to set up a plant near its own assembly operations. Fisher Body was not very keen on these new investments, and was experiencing a capacity shortage in meeting even the existing demand of the General Motors. It therefore agreed to be acquired by the General Motors, who was then free to use the technology of Fisher Body in a way that best serviced the consumer demand. With similar acquisitions of the other vendors and distributors, General Motors easily contested the market leadership from the Ford Motors by the late 1920s.

To sustain its leadership, General Motors encouraged each of its divisional units to explore fresh purchase options. Montverde and Teece (1982: 207) investigated the make-versus-buy decisions of General Motors and Ford on 133 automotive components. The "application engineering effort associated with the development of any given automobile component" had a

positive effect on the decision to vertically integrate. The firm-specificity of any given component, captured by a dummy variable, also favored the make decision. In addition, the General Motors-effect, captured by a dummy variable reflecting manufacturing scale economies, positively catalyzed the vertical integration. As of 1989, for instance, General Motors operated nearly ten different North American purchasing units for the vehicle paint. Each purchasing unit bought a different formula for the first two paint coats, phosphate and electrically bonded primer, of an auto body. PPG Industries alone serviced three of these purchasing units through its three different business units, each of which had its own distinct research lab and the marketing set-up. General Motors commissioned an in-house team to research the best-practice specifications of each paint coat, and soon accrued annual savings of \$20 million in the paint purchase costs. It also discovered an environmentally friendlier water-based final coating alternative to the traditional more hazardous solvent-based final coating used in its paint shops. Through the 1990s, it invested an average of \$250 million to construct 11 high-volume new final paint shops, and had replaced all but 18 of the old paint shops by 1997 (Automotive News, 1997: 1, 24). Further as of 1989, each of the body shops of General Motors had a different type of robot and computer systems. The sharing of common components, across even the models of same size and price category, was nearly impossible. General Motors had to modify its manufacturing processes to have common links, and to use common parts across all the mid-sized cars as well as the minivans. On the whole, the time and costs involved in the reengineering of the existing operations considerably limited the growth in the General Motors' competitive advantage.

With experience in hindsight, General Motors is now motivating its acquired vendor operations to service external assemblers for added returns. Delphi Automotive Systems, the auto parts unit of the General Motors, is currently the world's largest auto parts supplier. Mercedes-Benz, pursuant to a revolutionary decision to initiate assembly operations in the US, selected Delphi to be the lead vendor for the cockpit of new generation sports utility vehicles. These

vehicles were expected to offer premier recreational services, and cost just \$30,000 in contrast to the normal \$70,000 cost of the conventional German-made vehicles. Delphi set up a dedicated service center, three miles from the Tuscaloosa, Alabama transplant of the Mercedes in the US. The cockpit was delivered complete with all the latest comforts, including airbags, heating and air-conditioning system, instrument clusters, steering column walks, and wiring harnesses. Mercedes radioed a new cockpit specification to Delphi every 3.6 minutes. Delphi assembled the cockpit in 40 minutes, and transported it over the special conveyor system installed on a truck to the Mercedes plant. Mercedes loaded the cockpit on to the next vehicle, 169 minutes after the initial signal. The attraction of Delphi lay more than just in servicing flexibility. Given Delphi's global leadership contacts, 140 of the components used in the cockpit were procured from 35 suppliers across 6 nations. Mercedes identified some additional contacts, including the North American transplant of a Japanese firm, Denso. Denso offered energy conserving heater/ air-conditioner system, which carried little space for tube to pass through the firewall. Delphi helped Denso create more space for the worker's hands, by integrating system components more compactly. The result was a dramatic improvement in system performance and reliability, and reduced material as well as manufacturing costs.

Thus, the strategic emphasis on the technological servicing is being led by two major forces: (1) Escalating costs of the organizational skills make vendor services more valuable, (2) Enhanced use of vendor services generate pressures for upgrading the servicing potential of the firm-specific resources, or else spinning them off to the skilled vendors. This chapter investigates the evidence on the first force, and recommends the second for further academic research.

Cost of Organizational Skills and Value of Vendor Services

Until the World War II, Japanese firms were organized on a dualistic relationship with the shop-floor workers, and the outside vendors. At the end of World War II, the US reform authorities in Japan experienced a frequent breakdown in the communication due to the telephone system

outages. Japanese residents made several petitions to the US reform authorities for helping to solve the problem of high downtime in their personal communications also. Juran (1995: 524) reports, "Following an investigation, the most significant cause of breakdowns was identified as the poor quality of vacuum tubes used in repeater stations along long distance lines. In response, MacArthur requested Secretary of War Patterson to contact the president of AT&T asking for civilian personnel skilled in telephone communication and equipment manufacture to be sent to Japan to assist in rebuilding the telephone network. As a result, about half of the CCS [Civil Communications Section] staff was actually AT&T employees... From 1946 through 1950, Civil Communications Section (CCS) staff visited the factories of a large number of manufacturers all over the country, from representative large electric equipment makers to small companies with as few as six employees. In reports of their observations, they pointed out... *If vacuum tube parts are contaminated with grease or dust, good vacuum tubes cannot be produced.*" During 1949 and 1950, CCS organized seven-week long seminars for the Presidents and executive directors of the Japanese makers of telephone equipment, communications equipment, and vacuum tubes. The seminar emphasized the significance of cleanliness, and also taught principles for statistical quality control to evaluate the extent of contamination problem in various manufacturing processes. Japanese firms diligently diffused these principles to their suppliers over the 1960s and 1970s, and generated improvement in the quality and productivity of their operations.

During the 1980s and 1990s, Japanese firms diffused these methods overseas. The studies, of the auto and electronic firms, conducted by the Japanese Multinational Enterprise Study Group (JMESG) show that the "Japanese multinationals apply method aspects (work organization, quality control, maintenance, and just-in-time) most in Asia, followed by Europe, and then the US. The application of result aspects (bringing-in of equipment, parts and Japanese expatriates from Japan) is done in the reverse order." (Abo, 1995) To evaluate the implications of applying Japanese organizational system, data on 14 organizational skills were obtained from the

JMESG. The data measure the application of Japanese system, for each organizational skill, on a scale of 1 to 5. These data were gathered by JMESG, through field visits and interviews over 1989-95. The sample data is for nine Japanese multinationals, comprising of 3 firms each in the auto assembly, consumer electronics, and intermediate input sectors. The nine sampled firms had data on at least one transplant in each of the three regions.

1) Analysis of the Method Aspects: The cost-escalating aspects of organizational skills are evaluated in Table 9.1(a), and the rent-generating aspects of vendor services in Table 9.1(b). The sharing of firm-specific information, enforcement of systems intended to create sense of unity among the employees, and intensive vendor-involvement methods of procurement, contributed to the highest costs of organizational skills in Asia. The reliance on the local information, sense of independence, and diversity of vendor services, in the US obviated some of these costs.

Table 9.1(a): Cost-escalating Aspects of Japan's Overseas Method Application

Parameter	Asia	Europe	US
Information Sharing	3.78	3.67	3.56
Sense of Unity	4.22	3.94	3.33
Procurement Method	3.11	2.67	2.44
Costs of Method	3.70	3.43	3.11

To sustain the cost-effectiveness of Asian operations, Japanese multinationals delegated greater authority to the local employees, motivated them to self manage maintenance, and entrusted them with the responsibility for operating a diverse lot of new products. In the US, they retained the authority for evaluating the value of local services, acquire additional maintenance services from the market, and operate a selected line of products that had mass demand.

Table 9.1(b): Rent-generating Aspects of Japan's Overseas Method Application

Parameter	Asia	Europe	US
Delegation of authority	2.78	2.78	3.11
Maintenance management	3.67	3.61	2.56
Operations management	3.72	3.72	3.44
Benefits of Method	3.39	3.37	3.04

The above system implied lower costs of Japanese organization in markets where the local services were costlier. The lower cost of Japanese organization generated increasing

benefits from the use of local services, so that the inter-regional benefit differentials were much smaller than the inter-regional cost differentials. Thus, there was a significant motivation for the Japanese firms to diffuse their result aspects overseas for additional technological servicing.

2) Analysis of the Result Aspects: The cost-escalating aspects of technological services are evaluated in Table 9.2(a), and the rent-generating aspects in Table 9.2(b). The limited initiatives for obviating the unionization, more cumbersome grievance procedures, and expatriation of few Japanese employees, made the local technological services costliest in Asia. In the US, firms expatriated significant proportion of Japanese employees for evaluating the potential uniqueness of the local services. In Europe, involvement of workers as equal partners, and more collaborative grievance procedures, formed a most efficient system for discovering the value of local apprenticeship and crafts services.

Table 9.2(a): Cost-escalating Aspects of Japan's Overseas Result Application

Parameter	Asia	Europe	US
Labor Unions	3.61	4.33	4.00
Grievance Procedures	3.17	3.67	3.22
Ratio of Japanese Expatriates	1.78	2.83	3.11
Cost of Results	2.85	3.61	3.44

To upgrade the quality of their Asian operations, Japanese firms encouraged the local employees to assume greater responsibility for checking the inputs so that the defects in the processed products are minimized, used a growing proportion of imported inputs, and assigned a lower position to the local managers in the global hierarchy. In the US, where the Japanese expatriates were more prominent, there was a growing use of the services of experienced quality control specialists from the other firms. In Europe, where their system was most conducive to mutual problem solving, Japanese firms made a growing use of the local vendors, and offered a stronger position to the local managers in the global hierarchy.

Table 9.2(b): Rent-generating Aspects of Japan's Overseas Result Application

Parameter	Asia	Europe	US
Quality Control	3.67	3.56	3.33
Local Content	2.72	2.06	2.11

Position of Local Managers	3.50	3.00	3.22
Benefit of Results	3.30	2.87	2.89

The above model of technological servicing implied lower priorities on organizational learning from regions where the Japanese firms enjoyed greater benefits. The growing use of services from the costlier regions motivated an increased reliance on the managerial skills of those regions, and helped discover the opportunities for utilizing new local vendor services.

3) Evaluating Overall Cost-effectiveness: In Table 9.3, the costs of local managerial skills are evaluated as the strategic efforts devoted to the hiring policy. The benefits of local vendor opportunities are evaluated as the enhanced job security. In Asia, where there was least application of Japanese managerial skills, involvement of local employees helped save some costs. In Europe, where the local managerial skills were most utilized, there was greatest security in local competitiveness. In the US, where the Japanese expatriates led a considerable use of the experienced market services, Japanese firms suffered the highest operating costs.

Table 9.3: Cost Effectiveness of the Japanese Overseas Investments

Parameter	Asia	Europe	US
Hiring Policy (A)	3.11	3.83	3.56
Job Security (B)	3.39	3.50	3.22
Cost-effect (A-B)	-.28	0.33	0.34

Hypothesis Formulation

The greater return on equity (ROE) attracts better quality resources from the market. Lambert and Larcker (1987: 114) analyzed the policy for compensating the top executives in a sample of 370 large American firms over the period 1970-84. The findings highlighted “a positive association between the relative influence of RET [Security market return] versus ROE in compensation and the correlation between RET and ROE.” The data on the price-earnings ratio in Japan and the US, duly corrected for the variations in the inter-corporate holdings and accounting procedures, are available from French and Poterba (1991: 348, 357). As is evident from Table 9.4, the price earnings ratio in Japan was consistently higher than that in the US. The

differentials became wider through the 1980s. The forecasts of the major econometric firms did “not support the view that accelerating growth expectations in Japan are responsible for the 1986 rise in share values. If anything, the expected growth rate for the next decade declined.”

Table 9.4: Comparative Price-earnings Ratio for Japan and the US

Year	Japan	US
1975	15.2	11.0
1976	14.9	10.1
1977	13.1	8.1
1978	14.9	7.5
1979	11.5	6.8
1980	12.6	8.7
1981	17.0	7.6
1982	16.3	11.1
1983	21.5	11.9
1984	18.0	9.4
1985	18.6	14.2
1986	36.5	17.5
1987	30.4	12.9
1988	32.7	11.7
1989	32.6	13.5
1990	22.8	14.5

Source: French and Poterba (1991: 348)

The ratio of overseas to domestic production of the Japan’s multinational firms jumped from 9.1% in fiscal 1995 (ending March 31, 1996) to 9.9% in fiscal 1996 (ending March 31, 1997). During the fiscal 1996, the sales of Japan’s overseas subsidiaries grew 12% while that of the sister domestic subsidiaries grew just 3%. The sales of North American subsidiaries grew 5.7%, and contributed 37.4% to the total overseas subsidiary sales of \$330 billion. In contrast, the sales of Asian subsidiaries grew 15% and contributed 36.6%. The sales of Rest of the World subsidiaries grew 17.8% and contributed 25%. The overseas operations of Japanese firms were more profitable than their domestic operations. During the fiscal 1996, pre-tax profits-to-sales ratio of the domestic operations was 1.9%, as against 2.32% of the overseas operations. Though the pre-tax profit ratio in Asia fell from 3% in fiscal 1995 to 2.8% in fiscal 1996, 45% of the overseas pre-tax profits – or a record \$3.44 billion – were generated in Asia (Ministry of International Trade and Industry, 1997: B9C). A critical factor sustaining investments in the

regions with more competitive markets, such as the US, was the visible prospect for upgrading the corporate services. Table 9.5 highlights the generous training support sought by the Japanese auto assemblers from the local and federal governments, as a condition for investment in the US.

Table 9.5: US Government Training Support to the Japanese Auto Assemblers

Firm Ownership	Location	Government Offer (million \$)	Government's Training Fund offer (million \$)	% training
Toyota	Georgetown, Kentucky	125	55	44.0%
Toyota-GM	Spring Hill, Tennessee	80	30	39.0%
Nissan	Smyrna, Tennessee	33	11	33.3%
Honda	Marysville, Ohio	20	0.74	3.7%
Mitsubishi-Chrysler	Bloomington, Normal Indiana	83.3	40	48.0%
Sabaru-Isuzu	Lafayette, Indiana	86	21	24.4%

Source: Yanarella (1996: 131)

Of the \$55 million training funds secured by Toyota for its Kentucky plant, \$31.61 million were for training the American workers how to continuously innovate on-the-job. \$7.09 million were for bringing in Japanese instructors, and \$7.04 million for the revisions in standard training programs used in Japan. \$4.66 million were for assessing the new training needs, \$2.83 million for organizing special training in Japan. The remaining \$1.75 million were for the translation services and the maintenance of the unproductive old firm-specific equipment imported from the Japanese factories. The rent-generating value of the training package was exemplary. In the early 1990s, Japan had a global bond and equity holding of about \$700 billion (Organization for Economic Cooperation and Development, 1993). By January 1998, Japanese investors had accumulated about \$300 billion of the US treasury bonds alone. Along with other unspecified overseas investors, they held another \$300 billion of the US treasury bonds through the UK-based branches (Financial Times, 1998: 1).

As of April 1998, principal Japanese banks held an option worth Yen 77,000 billion (about \$525 billion) on inherently bad loans. In 1998, they received a commitment of Yen 30,000 billion (about \$225 billion) from the Japanese government as non-repayable funds. In addition, Japanese government unveiled an annual fiscal package of Yen 77,700 billion in 1998,

potentially connoting super-normal returns on the firm-specific technological services. Financial Times (1998: 4) reported "Mr. Sakakibara, who is known as 'Mr. Yen' for his ability to influence currency markets, said that the worst of the banking sector's problems were over and forecast that as the economy started to grow again, 'the yen will strengthen further quite substantially.'... He said the current situation in which Japan, the world's largest creditor nation with the largest foreign reserves, was suffering a crisis while the world's largest debtor country (the US) was enjoying a boom was 'abnormal.'" On the whole, thus, Japanese firms derived substantial benefits from the services of the overseas vendors, despite the super-normal costs incurred by the Japanese institutions. Therefore it is proposed that:

Hypothesis: Technological Servicing and Manufacturing Creativity

The less vertically integrated a firm's development, the greater the competitive advantage.

Operational Measures

The firms that use the services of the less integrated vendors derive super-normal advantage. As of 1996, Ford Motors used dealership services of the 28 of the 50 majority African-American owned American auto dealerships that had sales revenues of at least \$4 million. 18 had an exclusive contract with Ford, and 10 had a joint contract. 7 of these 10 had contracts with at least one Japanese firm, and 9 with at least one overseas assembler. Black Magazine published the descriptive data on sampled 28 dealers in June 1997 (Automotive News, 1997: 36). One of these, Mel Farr Automotive Group, had grown to be the largest US African-American dealer since its establishment in 1975. In 1996, it generated total sales of \$506.3 million, averaging at \$1 million of revenues/1.613 employees. On the whole, Ford, Toyota, Volkswagen, Mazda, and Hyundai, marketed 10,756 new, 9,450 used, and 5,466 fleet vehicles through Mel Farr. Over time, Mel Farr's customer base became more affluent, allowing the use of shorter-term leases. The simplicity of administering such leases allowed 75% savings in the financial department staff

costs at its Oak Park Michigan Ford branch in March 1997. 60-65% of the retail business at this branch was in the form of short-term leases.

The benefits of less integrated dealer services motivate additional development of such services. These benefits are reflected in the establishment of new African American dealers over time, and the future value of the option may be measured as the ‘Year of Dealer Establishment.’ Further less integrated dealers add to the competitiveness of the firms, the productivity of which is measured as the ‘Number of Dealer’s Employees.’ The vertically integrated development of the firm is evaluated as the exclusive dealership contracts of Ford. Such **integration-effect** is measured as the ‘Sales of a dealer in million US\$ * Dummy = 1 if exclusive Ford contract.’ Additional services for improving the affluence of the targeted customer group is termed as servicing-effect. **Servicing-effect** is measured as ‘Sales of a dealer in million US\$ * Dummy = 1 if no exclusive Ford contract.’ The data are for the largest 28 majority-owned African American dealers with a Ford contract. Table 9.6 presents the regression of Year of Establishment and Number of Employees on the integration-effect and servicing-effect. The intercepts yield **cost-effectiveness** of dealer services. The t-values are in brackets.

Irrespective of the number of employees, the services of all the African-American auto dealers offered similar cost-effectiveness. Integration with Ford significantly added to the dealer employees. Servicing of additional assemblers generated further growth in the employees (1.570 – 1.362). On the whole, integration with the assemblers explained all the employee cost, while the local knowledge bases of the dealers dominated their competitiveness through time.

Table 9.6: Growth of the African-American Auto Dealers

	Year of Establishment	Number of Employees
Cost-effectiveness	1985.041 (872.404)	16.652 (1.626)
Integration-effect	0.031 (0.763)	1.362 (7.466)
Servicing-effect	-0.024 (-1.762)	1.570 (25.897)
R sq.	0.226	0.967

The above suggests a need to correct the **assimilation-effect** of market know-how for testing the proposed effect of less vertically integrated development on competitive advantage.

Test of the Hypothesis

With increased liberalization of the tariffs over the 1960s, Japanese firms sought high quality resources from the global markets. These resources inputs enjoyed super-normal tradability, so that just incremental into product modules yielded increasing competitive advantage.

Sample and Data Source: The annual data on the 30 industrially classified goods and service inputs used by Japanese motor vehicle and electrical sectors are available from Uno (1989). The assembly of resource networks is evaluated for four dates: 1970, 1975, 1980, and 1985. The vertically integrated organization is termed as **history-effect**. History-effect is measured as the difference in the value of inputs used 15 and 10 years before date. The reengineering of the assembly network over time is termed as **innovation-effect**. Innovation-effect is measured as the difference in the value of inputs used 10 and 5 years before date. Table 9.7(a) presents the regression of the present network assembly on the history-effect and innovation-effect. The data are for the inputs used in the motor vehicle sector. The resulting intercept yields the **competitive-effect** of the networked inputs in the sector. The t-values are in brackets.

The competitiveness of networked resources grew over the early 1970s, but got dissipated over the late 1970s and early 1980s. In 1970, both historical as well as innovation forces were significant, with the former dominating marginally. Over the early 1970s, the growth was guided by a new set of innovative forces that had been discovered during the late 1960s. During the late 1970s, manufacturing operations continued to be dependent on the path discovered by these late 1960s historical forces. By 1985, the impact of the early 1970s history had attenuated, but still dominated the incremental innovation of the late 1970s.

Table 9.7(a): Vertical Integration of the Japanese Motor Vehicle Manufacturing

	1970	1975	1980	1985
Competitive-effect	6204 (1.081)	18191 (1.977)	2041 (0.058)	-30112 (-1.380)
History-effect	2.88 (3.412)	0.20 (0.256)	6.39 (8.500)	2.36 (8.278)
Innovation-effect	2.82 (10.44)	2.47 (7.620)	-0.17 (-0.240)	1.71 (21.988)
R sq.	0.985	0.986	0.984	0.994

Under these conditions, there was an increased use of the more innovative electrical inputs to sustain the competitive advantage of the motor vehicles. Table 9.7(b) presents a comparable analysis for the Japanese electrical sector. The competitiveness of networked resources was negative in 1970. The competitiveness improved through the 1970s, but there was a rapid hollowing-out over the early 1980s. The innovation of early 1960s dominated the history of late 1950s in sustaining the electrical operations in 1970. The innovation of late 1960s guided the growth of electrical operations over the early 1970s, and the history of late 1960s continued to dominate the growth over the late 1970s. During the early 1980s, the history of early 1970s became substantially strong, and dominated the innovation of the late 1970s.

Table 9.7(b): Competitive Advantage of Japanese Electrical Manufacturing

	1970	1975	1980	1985
Competitive-effect	-14078 (-1.989)	31863 (3.044)	48529 (2.130)	-164205 (-2.753)
History-effect	3.52 (10.565)	0.66 (0.664)	3.63 (30.764)	6.83 (7.637)
Innovation-effect	4.20 (10.538)	1.53 (9.252)	0.64 (1.800)	2.93 (21.690)
R sq.	0.992	0.987	0.990	0.985

Correction Factor for the Assimilation-effect

The growing demand for the innovative services fostered assimilation of the new workforce groups especially women, with potentially unique knowledge endowments, in the mainstream.

Sample and Data Source: The annual data on the assimilation of women in the US for the period 1961 to 1990 are available from the US Department of Labor (Sept. 1993: 67, 70, 75; Dec, 1993:

4). **Education-effect** of assimilation is measured as the ‘average years of education for women workers – average years of education for men workers.’ **Experience-effect** of assimilation is measured as the ‘average years of work experience for women workers – average years of work experience for men workers.’ Enhanced assimilation could help save the (a) research and development (R&D) costs, measured as (Aggregate US R&D/Gross Domestic Product) * 100, (b) cut the labor costs, measured as (Index of labor compensation/ number of hours) for the US business sector, with 1960 =100, and (c) improve the overall value of the market’s services,

measured as (Index of gross domestic product/ number of workers in the US), with 1960 = 100.

Table 9.8 presents the regression of these on education-effect and experience-effect. The intercepts yield the constant **manpower-effect** over time. The t-values are in brackets.

Manpower in the US devoted 4.09% of the value-added for research and development of the opportunities for further growth. These efforts nearly tripled the costs of labor, and added only 159% to the value of each worker's services. The assimilation of educated women encouraged additional research, and helped save the labor costs. The enhanced cost-effectiveness of the services of men then contributed to a significant growth in the overall value-added per worker. The assimilation of experienced women moderated the research costs, and helped the experienced men work with significantly less laborious effort. The result was a further growth in the value-added per worker led by women experiences. In fact, the social security offered by new services helped the 60 to 64 years old men in the US to take time off the work, and reduce their involvement rate from 82% in the early 1960s to 53% by mid 1990s.

Table 9.8: Assimilation of the New Workforce Services in the US

	R&D Intensity	Labor Cost	Value added
Manpower-effect	4.092 (4.712)	296.278 (8.969)	259.596 (11.247)
Education-effect	1.230 (4.349)	-86.337 (-8.024)	-45.959 (-6.113)
Experience-effect	0.240 (1.689)	26.944 (4.986)	22.320 (5.911)
R sq.	0.655	0.788	0.753

Why Do the Firms Value the Potential of Emerging Networks?

The flexible applicability of the traded intellectual software-based services is helping to boost the growth, even in nations where the workers have only limited expertise in software programming.

Sample and Data Source: The data on the operations of Japanese electronics firms were secured from the NIKKEI NEEDS database, using the assistance of Takahiro Fujimoto at the University of Tokyo. The selected sample includes the three members of the Japan's first-tier consumer electronics group (Matsushita Electric, Matsushita Electronics, and Victor Company of Japan), three second-tier full-line electronics firms (Fujitsu, Mitsubishi Electric, and Sanyo), and three

third-tier business equipment firms (Ricoh, Canon, and Oki Industries). The data are for the core domestic operations, excluding all affiliates and subsidiaries. The data were converted from the varying accounting years to a common calendar year basis, and translated into the US\$ to evaluate the global effectiveness. The trial-and-error effects were smoothed by averaging the data for each firm over three-year sub-periods, 1985-87, 1988-90, and 1991-93.

The cost-effectiveness of the creative services of new workforces is termed as ‘creativity-effect.’ Creativity-effect is measured as the ‘[(purchases of a firm from the affiliates – sales of the firm to affiliates)/total sales of the firm].’ The marketing advantage from such creative services is termed as ‘marketing-effect.’ Marketing-effect is measured as ‘[(purchases of a firm from the affiliates/total sales of the firm) – (aggregate purchases for all sample cases from the affiliates/aggregate sales for all sample cases)].’ The growth from the assembly of creative services is evaluated on three parameters: (1) Human Power, measured as value-added/employee, (2) Trading power, measured as gross profit/employee, and (3) Reputation power, measured as exports/employee. Table 9.9(a) presents the regression of human, trading, and reputation powers on creativity-effect and marketing-effect. The resulting intercepts yield the constant **manufacturing-effect** of collective Japanese know-how. The t-values are in brackets.

The manufacturing networks of Japanese electronics firms sustained a significant human, trading as well as reputation power. Neither the creative affiliate services, nor the innovative marketing of these services, offered any significant advantage.

Table 9.9(a): Manufacturing Networks of the Japanese Electronics Firms

	Human Power	Trading Power	Reputation Power
Manufacturing-effect	187.79 (5.728)	72.92 (6.518)	86.91 (4.666)
Creativity-effect	63.67 (0.691)	39.94 (1.269)	-18.05 (-0.344)
Marketing-effect	-122.12 (-0.554)	30.38 (0.404)	163.97 (1.309)
R sq.	0.024	0.090	0.067

Japanese firms motivate the emergent workforce to diffuse its know-how to them through creative technological services. **Creativity-effect** is measured as ‘[(receivable of a firm from the

affiliates - payable of the firm to the affiliates)/ total sales of the firm].’ Innovative marketing boosts the gains from such servicing. **Marketing-effect** is measured as ‘[(receivable of a firm from the affiliates/ total sales of the firm) – (aggregate receivable for all sampled cases from the affiliates/ aggregate sales for all sampled cases)]. Table 9.9(b) is the regression of human, trading and reputation powers on the creativity-effect and marketing-effect, for servicing networks.

Under the influence of technological servicing packages, the manufacturing-effect on human and trading power declined marginally, but that on the reputation power rose substantially [Compare with Table 9.9(a)]. Nor the creativity of technological services, nor the innovative marketing of such technological services, had any significant influence.

Table 9.9(b): Servicing Networks of Japanese Electronics Firms

	Human Power	Trading Power	Reputation Power
Manufacturing-effect	186.02 (4.611)	70.97 (5.046)	113.22 (5.343)
Creativity-effect	-191.14 (-0.171)	-328.28 (-0.841)	-957.93 (-1.628)
Marketing-effect	10.78 (0.010)	230.58 (0.592)	163.66 (0.279)
R sq.	0.003	0.029	0.185

Japanese firms use their reputation to offer creative loan packages, which obligated the agents to share fundamental sources of their advantage. Creativity-effect in developing such institutional path is measured as ‘[(loans of a firm to the affiliates – equity of the firm in affiliates)/ total sales of the firm].’ Innovative marketing-effect of such gainful option is measured as ‘[(loans of a firm to the affiliates/ total sales of the firm) – (aggregate loans for the sampled cases to the affiliates/ aggregate sales of the sampled cases)].’ Table 9.9(c) presents the regression of human, trading, and reputation powers on the creativity-effect and marketing-effect.

Under the influence of institutional support, the manufacturing-effect on human power, and especially trading and reputation powers, diminished. Creativity of designing institutional loans generated no significant impact, beyond those of equity ownership. But innovative marketing of the institutional loans significantly reduced human as well as trading power.

Table 9.9(c): Institutional Networks of Japanese Electronics Firms

	Human Power	Trading Power	Reputation Power
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Manufacturing-effect	178.67 (5.141)	49.60 (4.318)	59.576 (2.917)
Creativity-effect	-143.44 (-0.425)	-198.85 (-1.783)	-334.70 (-1.693)
Marketing-effect	-3145.85 (-2.394)	-964.94 (-2.221)	-1001.98 (-1.297)
R sq.	0.232	0.327	0.214

The detrimental effect of institutional force on the trading power helps firms further their organizational learning about the operating, financial and strategic value of their networks. (1) **Operating Value** is measured as the residual of trading power equation for the manufacturing networks in Table 9.9(a). (2) **Financial Value** is measured as the residual of trading power equation for the servicing networks in Table 9.9(b). (c) **Strategic Value** is measured as the residual of trading power equation for the institutional networks in Table 9.9(c). Human capital and reputation forces could be used for supporting the organizational learning. **Human-effect** is measured as the residual of the human power equation for respective networks. **Reputation-effect** is measured as the residual of the reputation power equation for respective networks. Table 9.10(a) presents the regression of operating, financial and strategic powers on human-effect and reputation-effect. The intercepts yield the **trading-effect** of the constant workforce initiatives. Cum. R sq. reflects the assembly of workforce services. The t-values are in brackets.

Core trading competencies of the Japanese workforce had no net impact on the operating, financial or strategic value of networking. Human-effect significantly added to all the three, with highest impact on operating value, followed by financial and strategic value. Reputation of the Japanese firms for the translation of operating relationships into financially motivated strategic relationships had a significant negative impact on the operating value.

Table 9.10(a): Organizational Learning of Japanese Electronics Firms

	Operating Value	Financial Value	Strategic Value
Trading-effect	0.0000 (0.000)	0.0000 (0.000)	0.0000 (0.000)
Human-effect	0.4084 (10.055)	0.3837 (7.170)	0.3694 (9.244)
Reputation-effect	-0.165 (-2.314)	-0.1294 (-1.270)	-0.1325 (-1.949)
R sq.	0.925	0.872	0.878
Cum. R sq.	0.932	0.876	0.918

The value of financial networks in the firm-specific organizational learning generated high-powered incentives for diffusing such networks to encompass all the operating relationships. **Learning Power** is measured as the residuals of operating value equation in Table 9.10(a). There existed both financial as well as strategic approaches for boosting the learning power. **Financial-effect** is measured as the residuals of financial value equation in Table 9.10(a). **Strategic-effect** is measured as the residuals of strategic value equation in Table 9.10(a). Table 9.10(b) presents the regression of learning power on financial-effect and strategic-effect. The intercept yields the **operating-effect** of the constant trading networks. Cum. R sq. reflects the diffusion of Japanese investment networks internationally. The t-values are in brackets.

The constant operating relationships supported no firm-specific organizational learning of Japanese electronics firms. The diffusion of financial networks added to the learning power. But the strategic initiatives to further institutional hold had a substantially negative impact. On the whole, the diffusion of investment networks for proprietary control on the emergent workforce services contributed to 98.7% of a firm's competitiveness (\$gross profit/worker). The market services, amidst falling proprietary control opportunities, sustained 1.3% of competitiveness.

Table 9.10(b): Hollowing-out of the Japanese Electronics Firms

	Learning Power
Operating-effect	0.0000 (0.000)
Financial-effect	0.8213 (9.020)
Strategic-effect	-0.3434 (-3.058)
R sq.	0.805
Cum. R sq.	0.987

Trading-effect of creative workforce initiatives, and operating-effect of marketing vendor networks, is diffused to vendors internationally. Such diffusion of the learning properties helps Japanese firms further boost their trading power competitiveness (\$gross profit/employee). The following **technological equation** evaluates the contribution of diffused learning properties to the trading power of the Japanese firms. The contribution of diffused learning is measured as 1- R sq., evaluated as the correlation of the residuals of measured constant manufacturing-effect,

human-effect, reputation-effect, financial-effect and strategic-effect on the trading power, with trading power. The resulting organizational learning of the international vendors is measured as the ‘Cum. R sq. from Table 10(b) – R sq. from the technological equation.’”

The diffusion of Japanese learning properties explained 10.5% of the variations in trading power. The resulting organizational learning of the vendors absorbed 9.2% of the variations.

$$\text{Trading Power} = 70.97 (5.046) + 0.4084 \text{ Human-effect} (10.055) - 0.165 \text{ Reputation-effect} (-2.314) + 0.8213 \text{ Financial-effect} (9.020) - 0.3434 \text{ Strategic-effect} (-3.058) \quad 1 - R \text{ sq.} = 0.105; R \text{ sq.}: 0.895$$

Table 9.11 presents the trading power generated across technology (consumer electronics firms or business equipment firms) and time (1985-87 or 1991-93) from the diffusion of the learning properties of the Japanese firms. The effect of technology and time is measured using the Dummy interactions with the 10.5% residuals of technological equation. The intercept yields the **paradigm-effect**. Cum. R sq. reflects technological servicing of the Japanese firms.

Dominant paradigm had a negative impact on the diffusion of learning properties, but the time limited the ability to keep the information about these properties secret. As the time passed by, Japanese firms developed new approaches to keep the information proprietary. Consumer electronics firms, that serviced the end consumers, had a stronger success in appropriation compared to the business equipment firms who had to interact with other manufacturers. On the whole, local market-wide competitive forces dominated the motivation of firms to voluntarily diffuse their learning know-how, and augment their \$gross profit/employee. The temporal forces impacted the ability to network fresh technological services from the international market.

Table 9.11: Sustained Market Leadership of the Japanese Electronics Firms

	Diffusion Power		Diffusion Power
Paradigm-effect	-5.2953 (-2.380)	Paradigm-effect	-5.3836 (-3.003)
1985-88 effect	0.7609 (3.701)	Consumer electronics effect	0.7441 (3.051)
1991-93 effect	0.7110 (3.082)	Business equipment effect	0.7786 (5.415)
R sq.	0.436	R sq.	0.585
Cumulative R sq.	0.941	Cumulative R sq.	0.956

Conclusions and the Recommendations for Further Research

The diffusion of rent-generating institutional services serves an important societal function of motivating all workforces to recognize the value of principal leadership, over the affiliate agency. Schumpeter (1954: 91, 101) notes, “the thirteenth-century scholastics undoubtedly held the opinion expressed by St. Thomas, namely, that... commercial gain might be justified (a) by the necessity of making one’s living; or (b) by a wish to acquire means for charitable purposes; (c) by a wish to service public good, provided that the gain be moderate and can be considered as a reward for work; or (d) by an improvement of the thing traded, or (e) by inter-temporal or inter-local differences in its value; or (f) by risk... The same applies to the considerable literature that developed in the sixteenth century on relief of the poor, unemployment, mendicancy, and the like, to which the doctors contributed copiously... The risk-effort theory of business profit is undoubtedly due to them. In particular, it may be mentioned that de Lugo – following a suggestion of St. Thomas – described business profits as ‘a kind of wage’ for a social service.”

Given the experience of the principals in strategic services, the emergent workforces derive substantial value from such services. In fact the value of US-based strategic services, evaluated as their stock and bond ownership, in the emerging markets surged from \$109 billion in 1985 to more than \$800 billion in 1997 (Securities Industries Association, 1997).

Sample and Data Source: The data on the total foreign equity investments into the top ten Asian emerging markets are obtained from Morgan Stanley Asia (1997). The sampled markets are China (including Hong Kong), India, Indonesia, South Korea, Malaysia, Pakistan, Philippines, Singapore, Taiwan, and Thailand. Amidst a surging demand for the Japanese financial services (as reflected in the appreciating Yen), the investments grew from \$12.435 billion in 1993 to \$20.544 billion in 1994. The investments dropped to \$10.681 billion in 1995 when the \$1 billion loss incurred on derivative trading in Asia by the principal British firm Barings Co. became public. With the rapid switch to the quality strategic services of the US-based firms (as reflected

in appreciating US\$), the investments jumped to \$21.633 billion in 1996. I quarter of 1997 supported record investments of \$6.105 billion.

Operating effort devoted to the development of the principal services in a given market is termed as Effort-effect. **Effort-effect** is measured as ‘foreign equity investments into a nation during a year – foreign equity investments averaged over the sampled nations during the year.’ Risks of financial services are evaluated as the escalating demand for equity investments. **Risk-effect** is measured a the ‘foreign equity investments into a nation during a year – foreign equity investments into the nation averaged over 1993-1995.’ The data are for the 10 Asian markets for the years 1993 to 1995. The **agency value**, measured as new foreign equity investments, is evaluated for 1996 and I quarter 1997. Table 9.12 presents the regression of agency value on effort-effect and risk-effect. The intercepts yield the **profitability-effect** of strategic services. The t-values are in brackets. There was a significant growth in the annualized profitability of technological servicing the Asian market over I quarter 1997. The opportunity cost of the operating effort rose, and that of the financial risks fell, at an even faster rate.

Table 9.12: Agency Value of the Emerging Asian Market Services

	1996	1997 I quarter
Profitability-effect	21.633 (11.802)	6.104 (7.154)
Effort-effect	1.945 (13.069)	0.676 (9.757)
Risk-effect	-1.508 (-6.477)	-0.524 (-4.836)
R sq.	0.863	0.779

Thus, the free fall in the Asian currency values from the III quarter of 1997 reflected the market fundamentals. The fall in the cost of the Asian workforce services added to the profitability of strategic services. There is a further need to survey the services of the emergent workforces, and the tactical approach to perpetuate technological servicing from the dominant organizations. A comprehensive technological exchange between the dominant and the emergent workforce groups could obviate the volatility in currency values, and help stabilize the currency values at the true and essential purchasing power fundamentals.

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