Global Knowledge Transfer and Telecommunications: The Bell System in Japan, 1945–1952

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This study evaluates the Bell System's role in the revival of Japanese telecommunications during the post-World War II occupation. Civilian and military personnel who had worked for the firm and who served in the Civil Communications Service (CCS) of the Supreme Command Allied Powers represented the primary agents for knowledge transfer to Japan's Ministry of Communications (MOC) and its supporting independent equipment manufacturers. The MOC became a channel for communicating ideas about management practices at the Bell System to the local telecommunications industry. The CCS's actions in Japan represent what Alfred D. Chandler has termed the "integrated learning base" in action in the public sector. The

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CCS's role in knowledge transfer has been underestimated by many scholars who have focused primarily on its contributions to promoting production and quality engineering in telecommunications manufacturing. Its central achievement was laying the managerial groundwork for the establishment in 1952 of the governmental enterprise Nippon Telegraph and Telephone.

The Japanese telecommunications infrastructure was a major casualty of World War II. Wartime air raids destroyed about half of Japan's 1.6 million telephones and half of its telecommunication equipment factories.[1] American engineers estimated the country would need at least three million telephones to support the postwar economy.[2] If Japan were to successfully rebuild its economic system and establish a new political regime, a reliable telecommunication system was a must. This came to pass, in no small part, because of a process of global knowledge transfer involving representatives of an American firm that provided a broad range of managerial and technical capabilities.

This article demonstrates the role of individuals from the Bell System in restructuring the telecommunication system through their service in the occupation government's Civil Communications Section (CCS). The Bell System was well suited for this mission because of its close relationship with the US government and its earlier contributions to Japanese telecommunications. The Bell System was the largest telephone system in the world, and ranked among the most technologically advanced networks.[3] Its CCS representatives provided state-of-the-art technology, systems, and managerial ideas. The modernization of telecommunications benefited from the bootstrapping of new business institutions during the occupation, built up from decades of learning overseas. The absorption of the practices that the CCS disseminated reduced the time and costs necessary for Japan to build the foundations for global competitiveness. As Japan began to advance into the ranks of the technological elite, the visitors departed and the hosts embraced their

1. S. B. Akin, "Report 31 October 1945," p. 26, Box 3167 in Archives of Supreme Command Allied Powers, Civil Communications Section, National Archives II, College Park, Maryland.

2. Memo for File (hereafter denoted "MFR"), Action Recommended to Meet Minimum Japanese Telecommunications Requirements," W. L. Wardell, June 14, 1949, p. 2, Box 3161.

3. Joel, *A History of Engineering and Science in the Bell System*, chap. 4.

independence. In this respect, the CCS experience fit a long-standing pattern of Japanese techno-nationalism.[4]

During the occupation, and particularly in the years 1947–1950, Bell System associates shaped the transformation of Japanese telecommunications in three ways. First, they extended functional knowledge relating to traffic, maintenance, manufacturing, marketing and other activities necessary to support an emergent consumer market for communication services. Second, they helped raise technical capacities that improved operating efficiency and encouraged engineering standardization and education to surmount chronic problems of high-cost and low-quality equipment production. Third, they facilitated building managerial capacities for coordinating functions, monitoring performance, establishing strategies and allocating resources. Overall, the Bell System's role in the CCS stands as a revealing case study in organizational learning involving global transfer of managerial knowledge.

An extensive literature exists on American activities in postwar Japan. Moses Abramovitz and Paul A. David argue that the process of catch-up and convergence with US standards was contingent on Japan's natural resource endowments, prevailing technological commitments and social capabilities for accommodating change.[5] Richard Pascale and Anthony Athos focus on social capabilities by distinguishing between two types of knowledge in comparing Japanese and American management. Their three hard S's of management—strategy, structure and system—seemed readily transferable, while their four soft S's—skill, style, shared values and staffing—seemed less so because of the pull of embedded social and cultural values.[6] William M. Tsutsui, focuses on the progress of Taylorism in Japan, showing how socioeconomic change after 1911 shaped knowledge absorption.[7] The separate studies of Bowen C. Dees and Kenneth Hopper stress how the occupation's civil administration helped modernize manufacturing through product standardization,

4. Anchordoguy, ''Nippon Telegraph and Telephone Company (NTT).''

5. Abramovitz, ''Rapid Growth Potential and Its Realization,'' in *Thinking about Growth*, chap. 6; Abramovitz, ''Catch-up and Convergence in the Postwar Growth Boom and After,'' in Baumol, Nelson, and Wolff, eds., *Convergence of Productivity*, 100–101; Abramovitz and David, ''Convergence and Deferred Catch-up,'' in Landau, Taylor and Wright, eds., *The Mosaic of Economic Growth*, chap. 2; Abramovitz and David, ''American Economic Growth in the Era of Knowledge-Based Progress,'' in Engerman and Gallman, eds., *Cambridge Economic History of the United States*, vol. 3, 66–84.

6. Pascale and Athos, *The Art of Japanese Management*, 78–84 and chap. 4.

7. Tsutsui, *Manufacturing Ideology*, 236–244.

quality control, and professional education.[8] Michael Cusumano explains how market, technological and social factors influenced the adaptation of US management techniques by the Japanese automobile industry.[9] Martin Fransman, on the other hand, emphasizes governmental initiatives in promoting industrial cooperation and controlled competition as a means for improving economic efficiency.[10] Jonathan Zeitlin and Gary Herrigel see US knowledge transfer as ''a locally effective ensemble of interdependent elements, which could be deconstructed, modified and recombined to suit foreign circumstances by self-reflective actors.''[11] Wyatt Wells's work demonstrates how differing local circumstances in occupation-era Germany and Japan resulted in divergent responses to antitrust efforts. Ironically, this research has come full circle with a new body of scholarship that explores the reverse transmission of industrial practice back to the US.[12]

This article evaluates the transformation of the Japanese telecommunication system from a military to a market orientation during the occupation period (1945–1952). This transformation involved the transfer of managerial knowledge through the actions of about one hundred civilian and military personnel who served in the CCS and whose senior echelons were primarily drawn from the Bell System.[13] The CCS operated from October 1945 until the signing of the Treaty of San Francisco, which marked the end of the occupation, in April 1952.

Our research both affirms and amplifies the main findings of earlier contributors who have dealt with the reform of postwar Japanese

8. Dees, *The Allied Occupation and Japan's Economic Miracle*; and Hopper, ''Creating Japan's New Industrial Management,'' 13–34.

9. Cusumano, *The Japanese Automobile Industry*.

10. See Fransman, ''Controlled Competition,'' in Antonelli, ed., *The Economics of Information Networks*, 253–275; Fransman, *Visions of Innovation*, 114–120, 160–165.

11. Zeitlin and Herrigel, *Americanization and Its Limits*, 14 and 18–19.

12. See, for example, Mishina, ''Making Toyota in America'' in Boyer, Charron, Jurgens, and Tolliday, eds., *Between Imitation and Innovation*, 99–127; and Liker, Fruin, and Adler, ''Bringing Japanese Management Systems'' in idem, eds., *Remade in America*, 3–35.

13. See ''Biographical Sketches of Men Going to Japan,'' dated April 5, 1946, which includes a letter from Robert P. Patterson to Walter S. Gifford dated March 5, 1946; and also, the memo to the Chief, ''Report on Communications Experts Arriving for Duty with the Civil Communications Section,'' by Major G. L. Davis, June 14, 1946, both in Box 3157. Initially, the CCS depended heavily on military personnel, some of whom are identified in a memo of October 17, 1945, from Col. Paul E. Hannah to General Akin entitled, ''Activities of the Civil Communications Section since September 19, 1945,'' in Box 3167.

telecommunications. Yet, unlike much of the earlier literature that has concentrated on manufacturing, we focus on a service industry. Moreover, our study forms a bridge between the work of Daqing Yang on the imperial telecommunication system through the end of World War II, and Marie Anchordoguy's research on the postwar rise of the NTT.[14] We examine the postwar origins of R&D reorganization, which, Anchordoguy has argued, was a principal link connecting the Bell System to NTT.[15] This study also provides greater insight into the role the CCS played in the evolution of quality education discussed by Tsutsui and the more general drive to promote product standardization documented by Dees and Hooper.[16]

We also address the previously overlooked contribution that the CCS and its Bell System agents made in restructuring the organizational capabilities for coordinating and controlling activities within the telecommunication system.

We argue that the CCS's chief legacy lay in establishing what Alfred Chandler has termed an ''integrated learning base'' for Japanese telecommunications modeled after the US Bell System.[17] Unlike the Chandlerian format, however, which stresses firm-specific learning, our approach explores the efforts of a governmental organization to assimilate knowledge through consultation with a global leader. Such was the case in the core functions of plant and traffic engineering, personnel training and management, and research and development. Learning integration also involved the incorporation of new concepts and functions that had not been central during the imperial era. These included such notions as ''systems engineering'' and ''development engineering,'' and such functions as advertising, marketing, commercial engineering, and public relations. Here the CCS provided invaluable consultancy about the best practices in the world's largest and, arguably, most successful telephone enterprise, the Bell System. The CCS offered a solid institutional foundation that Japanese managers adapted to local economic and cultural circumstances, contributing to Japan's spectacular takeoff in global electronic markets beginning in the 1960s.

14. See Yang, ''The Technology of Japanese Imperialism,'' for the imperial era, and Anchordoguy, ''NTT.''

15. Anchordoguy, ''NTT,'' 519–520.

16. Tsutsui, *Manufacturing Ideology*, 160–161, 192; Dees, *The Allied Occupation and Japan's Economic Miracle*; Hopper, ''Creating Japan's New Industrial Management.''

17. Chandler, *Inventing the Electronic Century*, chap. 1.

In what follows, we will first discuss the structure of the occupation forces, the long-standing relations of the Bell System with the US military and Japanese telecommunication officials, and the various difficulties the CCS encountered during the first eighteen months of Japan's Ministry of Communications (MOC). We will then analyze the development of Japan's telecommunication capabilities in operations, research and development, and manufacturing. Our conclusion outlines how the CCS's experience expands our understanding of transnational knowledge diffusion.

The Postwar Occupation and the Bell System's Connections

The CCS was one of the fourteen special staff of the Supreme Command Allied Power (SCAP), the civil governmental unit in General Douglas MacArthur's General Headquarters.[18] The SCAP implemented the Potsdam Declaration's mandates for demilitarizing and democratizing the Chrysanthemum Empire and establishing a subsistence economy.[19] The CCS dealt successively with the wartime Bureau of Telecommunications, the MOC (formed January 1, 1946) and the Ministry of Telecommunications (MOTC, formed June 1, 1949).[20] Although the CCS included several key civilians, it had military leadership. Major General Spencer B. Akin, who had escaped with MacArthur from Corregidor and served as his wartime Signals Chief, was the CCS's first head, succeeded in 1947 by Brigadier General George I. Back.[21]

In the search for experienced managerial personnel to serve the occupation government in communications, Assistant Secretary of War Robert P. Patterson turned to AT&T President Walter S. Gifford.[22] The Roosevelt administration had recruited this key industrialist

18. For detailed discussion of the SCAP's organization and mission, see Eiji, *Inside GHQ*, chap. 4, with an organizational chart at 47, and a brief discussion of CCS at 194–195; and Finn, *Winners in Peace*, chap. 3. The CCS apparently operated unofficially as early as September 9, 1945. See memo from Col. Paul E. Hannah to General Akin, ''Activities of the Civil Communications Section since 19 September 1945,'' dated October 17, 1945, in Box 3167.

19. Miwa, ''Formulation and Reversal,'' in Sumiya, ed., *History of Japanese Trade and Industry Policy*, 153–160.

20. A useful chronological list may be found in Yamauchi, ''GHQ and Changes,'' in Nakayama, ed., *Social History of Science and Technology*, 363–364.

21. Eiji, *Inside GHQ,* 11 and 194; Breuer, *MacArthur's Undercover War*, 158 and 163, for Akin's role in signals intelligence.

22. See letter from Robert P. Patterson to Walter S. Gifford, dated March 5, 1946, in Box 3157.

to the War Resources Board in 1939.[23] At the war's end, Gifford received the Medal of Merit, the highest US civilian decoration, for his leadership in placing his company's technical facilities at the Army's disposal, and for furnishing highly trained technical specialists, enrolled in military service under what was known as the ''Affiliated Plan.''[24] These efforts represented an extension of the close and abiding collaboration between the Army and the Bell System that dated back to World War I. At that time, AT&T's chief engineer, J. J. Carty, played a key role in expanding the Signal Corps and in creating the network for the American Expeditionary Force in France. During the 1930s, AT&T formed close connections with the Ordnance Corps when Major (later General) Leslie Simon began to utilize statistical quality control (SQC) techniques pioneered by his mentor, Walter Shewhart of the Bell Laboratories. During the Second World War, cooperation widened with both the Signal and the Ordnance Corps. In addition, W. Edwards Deming and others provided SQC training to defense industry managers under the War Production Board's sponsorship.[25]

Before the war, the Bell System also had maintained direct contacts with Japanese telecommunications. Beginning in 1899, through negotiations initiated by future AT&T president H. B. Thayer, Western Electric (Bell System's manufacturing arm) maintained partial ownership of Nippon Electric Company (NEC), a major supplier to the telecommunication system.[26] In 1925, after the great Kanto earthquake, the NEC reconstructed its Mita factory along the lines of Western Electric's Hawthorne plant.[27] During that decade, AT&T laid an 800 km cable connecting Tokyo to Okayama in Western Japan.[28] In 1924, the Emperor of Japan awarded AT&T's chief engineer, Bancroft Gherardi, the Imperial Order of the Rising Sun, Fourth Class, for the assistance he had rendered to Sannosuke Inada, chief engineer of the Japanese Department of Communications, and his staff, in investigating telephone engineering.[29]

23. See *New York Times*, ''Industrial Mobilization,'' August 11, 1939, p. 11; ''Maps First Steps on War Resources,'' August 18, 1939, p. 5; and ''U.S. War Resources Board Confers with the President,'' August 31, 1939, p. 8.

24. *New York Times*, ''Gifford and Behn Get High Awards,'' February 17, 1946, p. 32.

25. Miranti, ''Corporate Learning and Quality Control,'' 67–68.

26. Anchordoguy, ''Nippon Telegraph and Telephone Company,'' 510; see also NEC, *The First 80 Years*, 4–5, 8, 11.

27. NEC, *The First 80 Years*, 21.

28. Yang, ''The Technology of Japanese Imperialism,'' 147.

29. *Bell System Quarterly* 3 (1924): 62–63.

The post–World War II occupation sustained the Bell System's involvement in Japan. The CCS's staff of military signals personnel and civilians on loan (primarily from the Bell System) advised the MOC in reorganizing its telephone, telegraph and radio broadcasting networks, research laboratories, and postal system (with its large savings and insurance funds).[30] It also interfaced with about three hundred telecommunication equipment manufacturers.[31]

The CCS's organization reflected the diverse and significant roles played by individuals from the Bell System. All of the CCS's divisions reported through its deputy chief, a post occupied at various times by J. D. Whittemore (Chase Manhattan Bank), T. E. Nivison, and Archibald J. Allen (AT&T). The telecommunication divisions reported through the CCS's assistant deputy chief, W. T. Wooters (Pennsylvania Bell). The telephone and telegraph division, headed successively by Lt. Col. William L. Wardell (AT&T) and J. M. Roche (New York Telephone), focused on restoring network viability. The industry division, headed by Garrett B. Combs, advised on the reestablishment of manufacturing capabilities, and assisted in monitoring compliance with prohibitions against the production of war material. Dr. Kent E. Gould, R. D. Parker and Frank Polkinghorn, Bell Laboratories alumni, successively headed the research and development division.[32]

Challenges Confronted by the CCS, 1945–1947

During the first eighteen months, food shortages, poverty, inflation, and economic depression combined to limit the CCS's impact. Furthermore, the CCS dealt with an organization (the MOC) exhibiting serious structural problems. Congested internal communication and the failure to focus responsibility for system operations in a senior executive position weakened management at its highest

30. See ''Biographical Sketches of Men Going to Japan,'' dated April 5, 1946, which includes a letter from Robert P. Patterson to Walter S. Gifford dated March 5, 1946; and also memo to the Chief, ''Report on Communications Experts Arriving for Duty with Civil Communications Section,'' by Major G. L. Davis, June 14, 1946, both in Box 3157. Initially, the CCS depended heavily on military personnel, some of whom are identified in a memo of October 17, 1945, from Col. Paul E. Hannah to General Akin entitled, ''Activities of the Civil Communications Section since September 19, 1945,'' in Box 3167.

31. Eiji, *Inside GHQ*, 194.

32. See Office Order of General G. I. Back entitled, ''The Industry Division and the Research and Development Division,'' April 9, 1947, Box 3167.

echelons. The MOC's ministerial and vice-ministerial levels became overwhelmed in dealing directly with eleven staff bureaus (planning, commercial, traffic operations, traffic engineering, radio-wave, supply, building and repair, labor and personnel, construction engineering, maintenance, and accounting and finance) and ten regional bureaus roughly based on the country's major prefectures.[33] Committees composed of bureau chiefs and the vice minister played a leading role in making important operating decisions.[34] Two advisors for plant and business operations, who lacked constitutionally defined authority, provided technical guidance to the Vice-Minister, a political appointee with limited knowledge of telecommunications.[35]

Here was the basic situation. The MOC did not employ critical practices for assuring network efficiency. It lacked standards for coordinating field operations and maintenance. It never prepared a national switching plan or diagrams of major toll circuits. It did not study either traffic patterns that contributed to load imbalances or its limited trouble-shooting records to make plans for reducing network vulnerabilities.[36] Moreover, poor equipment design increased maintenance costs and taxed costly automatic switches because large numbers of busy signals generated excessive redialing. There were no engineering standards for many types of apparatus. Family shops incapable of production per stringent engineering tolerances often supplied replacement parts for complex apparatus. Workers did not practice preventive maintenance, preferring to economize by repairing worn equipment, thereby increasing the chances of system failures.[37] In consequence, specialization became not a source of expertise, but a shield for assuring job security. The telephone enterprise's bloated work force of 127,000 equaled AT&T's US employment, and represented a ratio of one employee per six phones.[38] The US ratio was one employee per twenty-five phones.[39]

33. See unsigned summary of conference of September 25, 1947, pp. 1–2, attached to ''Reorganization, Ministry of Communications,'' by W. L. Wardell, Box 3159.

34. ''Proposed Reorganization of Japanese Ministry of Communications,'' T.E.N., June 20, 1947, Box 3158.

35. ''Reorganization MOC,'' and attachments from W.L.W., August 19, 1948, Box 3175.

36. ''Telegraph Service,'' by W. L. Wardell, March 30, 1946, in Box 3157; and Memo for Lt. Col. W. L. Wardell, ''Problems Involving Japanese Toll Network,'' by A. N. Buck, August 29, 1946, Box 3158.

37. H. F. Van Zandt, ''The Japanese Telephone System,'' Box 3161.

38. S. B. Akin, ''Report 31 October 1945,'' p. 4, Box 3167.

39. ''Supplementary Budget,'' by W. L. Wardell, September 22, 1947, p. 5, Box 3170.

The MOC's training capabilities were uneven. Although it recruited its two top executive echelons directly from elite universities and rotated them through varied management assignments, limited practical knowledge of telephone operations hindered their effectiveness. In the view of W. L. Wardell, the most promising echelon was the highly knowledgeable ''Class 3'' executives, individuals in mid-career, who rarely progressed to higher grades because of their social backgrounds.[40] A similar pattern also affected line and craft personnel. Uneven on-the-job training often provided instruction in too few skills making it difficult to reassign workers to unfamiliar tasks.[41] Moreover, a serious lack of supervisory and competent maintenance skills for toll operations existed.[42]

Limitations of accounting and budgeting information undermined decision processes. The MOC employed a cash-basis, fund-accounting system to control expenditure under its annual appropriation. A lack of information segmentation and the failure to use accrual accounting made it impossible to evaluate the profitability of key service activities.[43] The MOC did not develop long-term budgets. Instead, top management planned on the basis of expected annual appropriations without consulting with its operating units.[44] Nor did planners try to exploit economies of scale that could arise from increasing the subscriber base. Instead, they relied on rate increases to close deficits.[45] Controls over capital expenditure and equipment inventories were weak, resulting in overstocked warehouses and inadequate reviews of major spending projects.[46]

War damage, a lack of programmatic focus, and weak organization also undermined scientific research and development. Bombing

40. ''Action Recommended to Meet Minimum Japanese Telecommunications Requirement,'' by W. L. Wardell, June 14, 1949, pp. 16, 19–20, Box 3161.

41. F. A. Polkinghorn, ''Some Observations Concerning Engineers and Engineering in Japan,'' p. 13, Box 3191.

42. Ibid., 14; and Memo for Lt. Col. Wardell, ''Problems Involving Japanese Toll Network,'' by A. N. Buck, August 29, 1946, Box 3158.

43. ''Increasing Ministry of Communications Revenue,'' T.E.N., July 12, 1947, pp. 2–3, Box 3158.

44. Van Zandt, ''The Japanese Telephone System,'' p. 11.

45. ''Conference Reorganization Committees, Tel. & Tel. and Radio,'' by W. L. Wardell, May 28, 1947; ''Proposed Reorganization of Japanese Ministry of Communications,'' T.E.N., June 20, 1947, both in Box 3158; and ''Reorganization, Ministry of Communications,'' plus attached transcript of conference of September 25, 1947, by W. L. Wardell, Box 3159.

46. ''Reorganization, Ministry of Communications,'' by W. L. Wardell, September 30, 1947, Attachment, p. 3, Box 3159; and ''Action Recommended to Meet Minimum Japanese Telecommunications Requirements,'' by W. L. Wardell, pp. 17–19.

destroyed about 40 percent of the MOC's Electro-technical Laboratory (ETL). Poor organizational arrangements undermined ETL's effectiveness in monitoring postwar systems performance, integrating new technologies, defining equipment standards, coordinating innovation with industry and maintaining contact with universities. Similar problems also adversely affected private R&D. The largest private telecommunication laboratory maintained by Tokyo Shibaura had been completely destroyed. Slow economic recovery also cut research funding.[47]

Limited public access to telecommunication services slowed realizing the political goals defined in the Potsdam Declaration. Shortages of receivers and components also limited public access to radio service, which, besides transmitting weather, news, and other vital information, represented a powerful medium for promoting democracy. Private telephone service remained largely restricted to the elite social classes.[48]

These multiple factors limited the CCS's ability to extend the MOC's integrated learning base. The CCS's early achievements included service improvement for occupation forces, demobilization of Japanese military facilities, elimination of militaristic influences at the MOC, and first-phase reconstruction of transmission and manufacturing capabilities.[49] The Telecommunications Coordinating Committee (TCC), headed by Pennsylvania Bell's Wooters and the MOC's vice-minister, furthered recovery by prioritizing governmental requests for construction.[50] For example, TCC cleared a major bottleneck by repairing the Hiroshima switching and repeater facilities that channeled traffic for Korea and Kyushu, the latter with its major naval base at Sasebo, and shipyard and undersea cable connections to the Asian mainland at Nagasaki.[51] As well, TCC resolved network coordination problems deriving from the military's requisition of circuits. The CCS prepared surveys of plant and switching facilities[52]

47. S. B. Akin, ''Report 31 October 1945,'' pp. 29–31, Box 3167.

48. J. D. Whittemore, Civil Communications Service, Monthly Report No. 4, Section 11, January 1946, pp. K10–K11 and K16–17, Box 3167.

49. Memorandum for Supreme Commander, ''Report of the Civil Communications Section on First Year's Occupation of Japan,'' July 26, 1946, Box 3171.

50. ''Telecommunications Coordinating Committee,'' September 30, 1946; and memo for Lt. Col. W. L. Wardell, ''Pending Projects in Plant Branch,'' July 23, 1947, both by Bruce H. McCurdy in Box 3158; and Memo for Record, ''Priorities in the Installation of Local Telephone Service in Japan (Project T27),'' by H. F. Van Zandt, May 10, 1946, Box 3157.

51. S. B. Akin, ''Report 31 October 1945,'' pp. 5, 6–7, Box 3167.

52. See ''Report of Civil Communications Section on First Years Occupation of Japan,'' July 26, 1946, Box 3171; see also memos to Lt. Col. Wardell,

and an inventory of telecommunication manufacturing facilities.[53] The CCS also searched for ways to improve employee welfare.[54] As of mid-1947, however, much work still needed to be done before Japan would have an efficient telecommunication system.

Organizational Foundations for Systems Management

Two external factors helped transform the occupation's goals. First, concerns about the advance of Communism on the Asian mainland led the Truman Administration to strengthen Japan as a regional ally by accelerating economic recovery. Second, American officials increasingly sought to place telecommunications on a firmer economic footing as a means for eventual privatization, thereby reducing burdens on US taxpayers. The strong advocacy by General MacArthur and the Japanese Diet for spinning off a telecommunication enterprise compelled US and Japanese planners to confront the problem of redefining the organizational connection between the system and the state. The prospect of a more market-sensitive network increased receptivity to the organizational reforms that the CCS planners proposed.

General MacArthur and the Japanese government wanted to close telecommunications' accumulated deficit of nearly $20 million by reorganizing its activities within a new type of special entity known as a *Kosha*.[55] This was a state-owned, semi-autonomous corporation

''Problems Involving Japanese Toll Network,'' August 29, 1946, by A. N. Buck and ''Transmission Problems Inclosed [*sic*] in Japanese Toll Network,'' by Bruce H. McCurdy, September 3, 1946, both in Box 3158; see ''Condition of Wire Plant, Repeater Stations, Telephone and Telegraph Offices and General Characteristics of Design and Construction of the Wire Plant Belonging to the Japanese Board of Communications and the International Telecommunications Company in Japan,'' by Lt. Col. H. L. Jacobs and Maj. B. W. Caron, April 25, 1946, Box 3157.

53. ''Accomplishment of Industry Division Since March 1947,'' by Garrett D. Combs, October 31, 1947, p. 3, Box 3170; and memo of J. D. Whittemore to Chief, Civil Communications Service, ''Status and Progress of Civil Communications Section, February 26, 1946,'' for details about activities of other divisions, Box 3167.

54. ''Conference—Japanese Communication Workers,'' prepared by Majors B. E. Small and B. W. Caron, December 29, 1945; and ''Foods Rationing, Japanese Communications Personnel,'' by W. L. Wardell, June 1, 1946, both in Box 3157.

55. This organizational structure is discussed in Johnson, *Japan's Public Policy Companies*, 34–38, 149–166. This organizational form was also consistent for a private monopoly status, which MacArthur, for a period, favored according to Yoichi, ''Telecommunications and Industrial Policies in Japan,'' in Snow, ed., *Marketplace for Telecommunications*, 207.

that financed its activities exclusively from its own revenue sources rather than taxes. It created an organizational structure dedicated to telecommunications that might be spun off from government at any time.

The subtle and implicit shift in emphasis toward creating a more market-oriented system became evident by mid-1947 in the debate over telecommunication financing. AT&T's Nivison and Wardell began to militate for establishing a more narrowly focused and economically autonomous ''telephone enterprise'' that would raise revenues by promoting greater consumer demand and cost cutting, replacing the traditional expedient of raising rates. In July, the MOC proposed a doubling of rates to achieve profitability by fiscal 1950/51. Nivison and Wardell, however, challenged this approach, which they believed was self-defeating, because it would make telephone service too expensive for most consumers. Their proposal included three features:

(1) Cut staff by forty thousand, a difficult goal for a political agency.
(2) Persuade the MOC to raise prices for the under-assessed wholesale users such as the Kyoda News Service.[56]
(3) Increasing the number of active phones from its current level of about 1.1 million to the existing system maximum of 1.7 million. (The original goal of three million phones had to be deferred because of the inability to raise $10 million in financing for the requisite expansion of the system's wire plant).[57] Any resultant economies of scale could lower the average cost of service, thus reducing pricing pressures.[58]

The CCS persuaded the MOC to restructure its highest management strata to assure more effective system coordination and control. This involved vesting strong power in the new director general (DG), who reported to the vice-minister and had responsibility for overall system performance. The DG's duties included top-level planning, project approval, national system coordination, and setting operating standards. The DG's chamber replaced the special advisors for business operations and plant with small advisory staffs

56. ''Increasing Ministry of Communications Revenue,'' July 12, 1947, and ''Increasing Ministry of Communications Revenue,'' July 28, 1947, both by T. E. Nivison, Box 3158.

57. See Memo for Chief, ''Supplementary Budget,'' by W. L. Wardell, September 22, 1947, Box 3170.

58. ''Increasing Ministry of Communications Revenue,'' T.E.N., July 28, 1947, Box 3158.

for inspection, personnel, training, and enterprise management and analysis.

To avoid communication overload, the CCS persuaded the MOC to elongate its hierarchy by reducing to four (from eleven) the number of bureaus reporting directly to the DG, and pushing down other staff specializations to the divisional level. The bureaus and their subordinate divisions included:

- *research and development* with its ETL
- *business operations* with divisions for traffic operations, traffic engineering and advertising, public relations, and commercial engineering
- *plant* with divisions for plant engineering, maintenance, construction and installation, and supply
- a *service secretariat* with divisions for accounting and finance, law and labor, and welfare.

These bureaus and divisions maintained a dotted line reporting relationship to subsidiary units in the field bureaus.[59]

The telephone enterprise introduced a new accounting and budgeting system, which enabled management to assess the profitability of its operations, measure its surplus, and inform capital budgeting. Following the counsel of L. Donald Angus (AT&T) of the CCS's analysis division, the new unit developed an accrual-based accounting system that provided more comprehensive reporting of revenues, expenses and profits by source. It prepared long-term plans and allocated resources on the basis of expected investment returns.[60]

The CCS advised the telephone enterprise how to organize its marketing and customer service departments, functions that had been poorly developed during the imperium. Key players included J. S. Hash (AT&T), CCS's commercial operations advisor,

59. Ibid.; ''Report on Conference on Reorganization Held on July 9 and July 16, 1947,'' by W. L. Wardell, July 22, 1947, and ''Report on Conference on Reorganization,'' by W. L. Wardell, July 23, 1947, both in Box 3158; ''Reorganization—Director General's Chamber,'' and attachment, J. L. Vandergrift, July 5, 1949; and ''General Statement of Policy (Reorganization of Ministry of Telecommunications)'' and attachment, by J. M. Roche, both in Box 3161.

60. ''Conference, Reorganization Committees, Tel. & Tel. and Radio,'' by W. L. Wardell, May 28, 1947, Box 1358; ''Reorganization, Ministry of Communications,'' by W. L. Wardell, September 30, 1947, and attachment, ''Conference held this date with the Minister, Mr. Miki, and the Vice Minister, Mr. Suzuki, Messrs. Nivison, Allen and Wardell, CCS, regarding the proposed recommendation on the reorganization of the MOC,'' no author, dated September 25, 1947, all in Box 3159; see also, ''Staff Conference Notes-Analysis Division,'' by C. A. Feissner, for June 10, 1947 and September 16, 1947, Box 3167.

and H. F. Van Zandt (AT&T), its traffic operations advisor. Insights into the Bell System's practices came from documents, manuals and instructional sessions.[61] Besides organization, CCS provided guidance about procedures for controlling service orders, billing, accounting and collections, service complaints, trouble reporting and resolution, and rate specification.[62] The CCS persuaded the MOTC to base service rates on either station-to-station or person-to-person calling. The Bell engineers developed new channels of communication between commercial operations and plant engineering, including routines for equipment installation and network testing. Sales engineers assisted high-volume customers in developing economical wire plans.[63] Additional revenue also accrued from promoting advertising in telephone books published twice each year.[64] A public relations section explained enterprise policies both to the public and employees.[65]

CCS also played a key role in reorganizing vocational and leadership training so that it could be more responsive to the service needs of a market economy. In early 1948, the MOC had enrolled over 5,300 students in its Tokyo communications schools

61. ''Traffic Engineering Training School,'' by W. A. Zimmer, July 10, 1950, for a discussion of the Bell System toll centering plans, equating of line work to unit basis and combined line and recording method of toll operation; ''Organization of Commercial Personnel Handling a Large Telephone Exchange in the United States,'' and enclosures, by J. S. Hash, November 12, 1949; ''Some Facts Related to Financial Operations of a Typical American Telephone Company,'' and attachments, by J. S. Hash, October 14, 1949; and ''Supervisory Report for the Commercial Division, MOTC,'' and attachment, by J. S. Hash, October 29, 1949; all in Box 3161.

62. ''Organization of the Commercial Operations Division, MOTC,'' and attachment, by H. S. Hash, June 23, 1949; ''Service Order Practice for MOTC,'' by J. S. Hash, December 22, 1949; Service Order Practice, for MOTC,'' by H. F. Van Zandt, February 1, 1950; ''Service Office Practice, by J. S. Hash, December 29, 1949; ''Introduction of Complaint Clerks for Receiving Subscribers' Trouble Reports,'' by C. R. Peddle, December 2, 1949; ''Business Office Practice Covering the Handling of Collection for Telephone Service,'' by J. S. Hash, October 23, 1950; ''Wiring Plan Rates and Development,'' by J. S. Hash, February 6, 1950; and ''Toll Message Rate and Revenue Study for Japan,'' by J. S. Hash, September 28, 1950; all in Box 3161.

63. ''Organization of the Commercial Services Engineering and Advertising and Public Relations Division, MOTC,'' and attachment, by J. S. Hash, undated; and ''Wiring Plan Rates and Development,'' by J. S. Hash, C. R. Peddle, and C. E. Zahm, February 6, 1950, both in Box 3161.

64. ''Organization of the Commercial Services Engineering and Advertising and Public Relations Division, MOTC,'' and attachment, by J. S. Hash, undated; and ''Compilation and Publication of Telephone Directories, by J. S. Hash, February 18, 1950, both in Box 3161.

65. ''Proposed Reorganization of Japanese Ministry of Communications,'' T.E.N., June 20, 1947, Box 3158; ''Advertising and Public Relations Matters,'' by J. S. Hash, December 6, 1947, Box 3161.

and 1,800 students in its radio training institute. J. M. Roche and H. D. Yankey of CCS believed that these schools' programs failed to prepare candidates adequately because of an overly academic emphasis. Moreover, student selection and advancement were not solely contingent on merit but, rather, seemed to be influenced by the old imperial bureaucracy's nepotistic practices.[66] After consultation with other US advisory groups,[67] the CCS secured legislation in April 1948 to establish more focused vocational training.[68] In September, J. L. Vandergrift, who became the CCS's director of training, began using materials donated by AT&T and Chesapeake and Potomac Telegraph and Telegraph in supervisory, traffic, plant, business management, and instructor training. He also played an active role in promoting safety training to reduce accident and fire losses.[69] Vandergrift's analyses revealed overstaffing of administrative, accounting, and welfare personnel at school locations.[70] To achieve greater instructional efficiency, MOTC reduced the number of schools from thirty-eight to fourteen by 1950.

Vandergrift also played an active role in establishing a more systematic basis for personnel management. This was important for maintaining employee morale and health and for reducing staff turnover and absenteeism. Vandergrift provided the personnel division with information about Bell System's employment practices, job classifications, and management–labor relations. The extension of welfare services became crucial because of the widespread incidence of tuberculosis. In 1949 Japan recorded 1.3 million cases with a 10 percent morbidity rate. Vandergrift confronted this problem by helping to form a medical board and a visiting nurse service

66. ''Ministry Schools,'' by Harry D. Yankey, February 13, 1948, Box 3159.

67. ''Report of Conference—Training Programs of the Various Ministries,'' by C. A. Feissner, February 18, 1948, Box 3159.

68. ''Training,'' by H. D. Yankey, April 1, 1948, ''Training Project,'' by J. M. Roche, April 12, 1948, and ''Training Project,'' by H. D. Yankey, May 19, 1948, all in Box 3159.

69. ''Training—Business Officer Management,'' November 29, 1949, ''Instructor Training,'' and Training—Supervisory Training of MOTC Officials,'' all by J. L. Vandergrift, November 29, 1949; and also ''Accomplishments in Personnel & Training Activities—September 1948 to Date,'' by J. L. Vandergrift, May 8, 1950, all in Box 3161.

70. ''Training—Instructor and Administrative Staff of Schools,'' March 7, 1950; ''Personnel Department of Bureaus—Analysis of Number of Personnel,'' March 8, 1950; ''Training—Improving Effectiveness and Efficiency of Training Schools,'' March 20, 1950, all by J. L. Vandergrift in Box 3161.

that received assistance from the Red Cross and the Rockefeller Foundation.[71]

The CCS planners identified the need to restructure the management of field bureaus to lower costs and improve the quality of local service. In planning the MOTC's ten field bureaus, Charles E. Zahm (Southwestern Bell), chief of the CCS's plant branch, emphasized the important role of district managers, who controlled activities in towns, and local wire supervisors.[72] He explained the advantage of district managers exercising authority through local functional chiefs for business, traffic, and plant to avoid becoming overwhelmed by excessive staff contact. Zahm stressed the critical role of wire supervisors in minimizing network failure through frequent facilities inspection, preventive maintenance, work organization, and staff training and evaluation. The analysis of trouble reports assumed new importance in pinpointing field maintenance problems.[73]

Recognizing the need for vastly improved traffic management practices in serving a market economy, the CCS successfully counseled for establishing both new operating specializations and practices for promoting interfunctional coordination and system automation. To focus responsibility for planning local office automation, the CCS persuaded the MOTC to form a traffic engineering division, a function that had not existed in prewar Japan.[74] This led to the development of what had been known in the fast-growing 1920s US telephone markets as the ''fundamental plan.''[75]

71. ''Accomplishments in Personnel and Training Activities,'' by J. L. Vandergrift. See also, ''Personnel—Labor Relations,'' and attached memo entitled, ''Improving Employee–Management Relations,'' by J. L. Vandergrift, July 7, 1949, Box 3161.

72. For a list of districts, see ''Proposed Reorganization of Telecommunications Areas of Japan,'' by J. S. Hash, May 4, 1949, Box 3161.

73. ''Summation of Comments on Plant Field Bureau Organizations—MOTC,'' by Charles E. Zahm, September 23, 1949, Box 161.

74. A principal responsibility of traffic engineering was to analyze current and prospective telephone call patterns as a basis for specifying the physical requirements of the telephone system. This information was used by the plant engineering department to design, install, and maintain the physical infrastructure necessary for providing efficient and economical service. Traffic engineering data were also used by the commercial engineering department to plan rates and classes of services offered to customers in various service districts. For a discussion of contemporary planning issues in establishing traffic engineering capabilities, see ''Organization of Traffic Engineering Department—MOTC,'' by W. A. Zimmer, June 25, 1949, Box 3161.

75. For a discussion of the evolution of the fundamental plan, see Miranti, ''Corporate Learning and Traffic Management,'' 748–753.

Such a plan involved estimating local telephone market growth for five-year increments up to fifteen- to twenty-year horizons, and projecting the system's physical requirements.[76] CCS militated for forming special committees representing business operations, traffic, and plant engineering to resolve cooperatively major urban load imbalances.[77] This helped reduce costly delays in call placement and the heavy usage of expensive switching gear because of excessive redialing. The CCS also discovered that many large businesses with private board exchange (PBX) equipment maintained multiple telephone listings rather than converting to a single organizational number.[78] In congested traffic areas, such multiple listing undermined automatic switching efficiency by tying up space on call selectors. This problem declined when plant and traffic engineers with better knowledge of exchange capabilities took over number assigning from business operations.[79]

A major challenge involved the acquisition and control of supplies and replacement-parts inventories. In 1947 the Economic Stabilization Board (ESB) began assigning priorities to business and government telecommunication projects. After receiving the TCC's approval, the ESB's supply and allocation section arranged for inventory delivery through its production and allocation bureau and production planning committee. Projects requiring new manufacturing effort also demanded approval from the Ministry of Commerce and Industry (MOCI, predecessor of the Ministry of International Trade and Industry). The ESB's supply and allocation

76. ''Reorganization of MOTC—Plant Engineering Division Tokai Bureau (Nagoya),'' by H. C. Shepard, August 11, 1949, Box 3161.

77. ''Minutes of Conference Pertaining to Improvement of Completion of Local and Toll Call on First Attempt,'' April 27, 1949; and ''Minutes of Conference-Call Completion Committee,'' and attachment, January 12, 1950, both by C. E. Zahm, Box 3161.

78. Investment in PBX equipment enabled major subscribers to establish privately controlled local switching offices for serving both internal and external calling requirements at large facilities such as factories or office buildings. One of the principal advantages of such an arrangement was the ability to shunt all calls through a single telephone number connection served by a relatively few dedicated trunk lines for interfacing with the common carrier grid. This avoided the costs of multiple telephone book listings and eliminated the need for the costly installation of individual circuits for connecting all phones at particular locations to external switching stations.

79. ''Traffic Load Balancing,'' by H. F. Van Zandt, December 15, 1949; and ''Coordination of Exchange Area and Central Office Area Cuts and Manual to Dial Conversions with Directory Publication,'' and attachment, by J. S. Hash, December 30, 1949, both in Box 3161.

section monitored the progress of all approved material acquisitions.[80] The CCS recommended that the MOC maintain contact with the ESB through its general supply section, which handled both order placement and contract negotiation, while directing the flow of goods to warehouses. New accounting procedures based on practices at Bell's manufacturing arm, Western Electric, tightened control over supplies.[81]

After the MOTC's 1949 formation, the focus of supply advice shifted to internal management challenges. The supply division confronted problems of overstaffing, excess facilities, overstocking, and slow adoption of new procedures.[82] The most dramatic change resulting from the CCS's counseling involved centralizing supply administration. Prior to March 1949, the supply department maintained its inventories both at 260 warehouses and at the telecommunication system's fourteen thousand local post offices, telegraph agencies, and other buildings. Such extreme fragmentation weakened control and contributed to uneconomical equipment stocking. To assure more cost-effective administration, the CCS successfully recommended abandoning the practice of spatially broad inventory storage. Under a new arrangement that became effective during March 1950, the MOTC redeployed its supply function into seventeen warehouse centers encompassing seventy dedicated buildings that served the system's major regional districts and largest cities. This step led to a reduction of $7.5 million in facilities investment. This also enabled the MOTC to shrink its supply staff from 10,383 to 7,173, yielding an annual wage savings of about a million dollars.[83]

80. ''The Telecommunications Coordinating Committee and the Communications Bureau of ESB,'' by Bruce H. McCurdy, June 30, 1947, Box 1358; and ''Report on Conference on Reorganization,'' no author, July 9, 1947, both in Box 3158.

81. ''Report on Conference on Reorganization Held on July 9 and July 16, 1947,'' by W. L. Wardell, July 22, 1947, Box 3158.

82. ''Reorganization of the Supply Division,'' June 18, 1949; and ''Initiation of Operations by the Supply Division,'' August 8, 1949, both by W. A. Price, Box 3161.

83. ''Survey of Supply Distribution Operations within the MOTC during 1949,'' by W. A. Price, March 21, 1950, Box 3161.

Building Technical Capabilities

The CCS advisors believed that telecommunication efficiency depended heavily on strengthening technical capabilities. This partially involved promoting innovation at ETL (later the Communications Laboratory, CL), seeking better designed, less costly, and more reliable equipment rather than inventing revolutionary products.[84] Reform also involved the establishment of more effective means for coordinating and integrating the activities of the ETL's many specialist groups in support of network operations. As well, the ETL needed to develop more cooperative relationships with industry to advance innovation and to establish engineering standards for system apparatus. Moreover, it had to focus its program exclusively on telecommunications. At its founding in 1891, the ETL had a broad-based charter, studying the economic potential of electricity.[85] Besides radio and wire communications, a portion of its budget had financed electrical power research and equipment maintenance for other government units.[86]

The transition began by refocusing the CL exclusively on telecommunication research. Legacy responsibilities for testing power equipment and appliances, studying electrical power applications for agriculture or industry, and defining electrical standards moved in 1947 to the Agency for Industrial Science and Technology within the MOCI, which continued to operate as the ETL.[87] The ''new'' CL absorbed the Ministry of Education's Physical Institute for Radio Waves, which specialized in ionospheric studies. It also acquired

84. ''Disposition of Non-Communications Work in the Research and Development Agencies of MOC,'' Research and Development Division—CCS, p. 1, Box 3171.

85. For evolution ''The Electrotechnical Laboratory,'' by Dr. K. Ohashi, October 5, 1945, attachment to memo, ''Disposition of Non-Communications Work in the Research Development Agencies of MOC, Research and Development Division—CCS,'' June 4, 1947, Box 3171; and Fransman, *The Market and Beyond*, 17.

86. See Appendix B, ''Government of Communication, Fransman, System,'' in *The Market and Beyond*, and also minutes of meeting held July 7, 1947, ''Reorganization of Research and Development in the Ministry of Communications,'' by E. Gonzalez-Correa, July 17, 1947, Box 3158.

87. Fransman, *The Market and Beyond*, 17; and Research and Development Division, ''Disposition of Non-Communications Work in the Research and Development Agencies of MOC,'' Box 3171.

the radio and systems research and equipment units from the MOC's Radio Wave Bureau and investigative section.[88]

Largely because of advocacy by Bell's King E. Gould and R. D. Parker in 1947, CL eventually adopted an organizational structure similar to that of Bell Laboratories.[89] The new arrangement better focused CL's skills to satisfy network operating requirements. Its key unit was the systems development section (SDS), which maintained a comprehensive overview of all aspects of the system's design and function. It served as the nexus between field operating bureaus, the plant engineering division in the headquarters plant bureau, and the laboratory. CL began to pioneer a comprehensive definition of equipment engineering standards as a means to raise production quality and to control costs. The equipment development section (EDS) used specifications to design apparatus and parts, a task that frequently drew on the expertise of the research section's departments of chemistry, physics, and transmission technology (i.e., electrical engineering). Its model shop translated designs into operating prototypes that plant engineering representatives, apparatus designers, and SDS staff field tested. The patent section's publications group documented final specifications.[90]

Standards specification offered a means for surmounting persistent problems of quality and cost for the more than ten thousand items that supported the network. The CCS advisors had cautioned that lack of uniformity threatened network viability and that improved product design could lower manufacturing costs, improve operating performance, and help conserve scarce raw materials.[91] Progress was

88. ''Research and Development in the Ministry of Communications,'' by E. Gonzalez-Correa, January 13, 1947, plus attachment, and memorandum to Chief, Civil Communications Section, ''Communications Research in Japan,'' by K. E. Gould, January 14, 1947, and attachments, both in Box 3158.

89. R. D. Parker's explication of the organization of the Bell System may be found in Memorandum to Deputy Chief, Civil Communications Section, October 3, 1947, and attachment, ''Bell Laboratories, Inc.: Its Functions and Organization,'' Box 3170. The paper was presented to a joint meeting of the Japanese Institute of Electrical Engineers and the Institute of Electrical Communication Engineers and Illumination Engineers on October 26, 1947.

90. Minutes of meeting held June 10, 1947, ''Reorganization of Research and Development in the Ministry of Communications,'' by E. Gonzalez-Correa, June 23, 1947; minutes of meeting held June 30, 1947, ''Reorganization of Research and Development in the Ministry of Communications,'' by E. Gonzalez-Correa, June 16, 1947; ''Reorganization of Research and Development in the Ministry of Communications,'' by E. Gonzalez-Correa, July 19, 1947, all in Box 1358.

91. ''Reorganization of Research and Development in the Ministry of Communications,'' by E. Gonzalez-Correa, July 23, 1947, and Memorandum for Record, ''Reorganization of Research and Development in the Ministry of

slow, however, because of delays in enlisting support from producer associations.[92] The first standard reviews centered on telephone instruments, protectors, and dials.[93]

Because of their limited resources, the CCS advisors had only a modest impact on engineering education. They sought to close the gap that separated theory from practice by promoting closer contacts between industry and academe. Japan's top ten communication engineering programs enrolled about fifteen thousand students and employed about 1,300 instructors in 1947.[94] Although the scientific content of curricula seemed adequate, instruction in economics, cost analysis, and production and development engineering was missing. Moreover, Frank Polkinghorn, one of the three former Bell Laboratory managers who served as advisors to the CL, worried about the level of intellectual challenge in engineering and scientific education. A dearth of textbooks, poor laboratories, and heavy reliance on lectures with optional attendance requirements weakened pedagogy.[95] Although Polkinghorn had first tried to connect engineers and teachers in August 1948, this initiative did not bear fruit until March 1950, with the creation of a joint task force whose members represented Toshiba, Fuji Tsushinki Seijo, Furukawa Electric, Tokyo University, Tokyo Institute of Technology, and Waseda University.[96]

Reviving Production Capabilities

The most celebrated role the CCS played was in manufacturing. The CCS employed two clever strategies to maximize its limited personnel's benefits to the industry's three hundred firms through conveying knowledge of US manufacturing techniques as practiced at Western Electric. The first involved promoting corporate learning

Communications'' (eighth meeting, July 21, 1947), by E. Gonzalez-Correa, August 5, 1947, both Box 3158.

92. ''Reorganization of Research and Development in the Ministry of Communications'' (ninth meeting of committee, July 28, 1947) by E. Gonzalez-Correa, August 5, 1947, Box 3158.

93. ''Reorganization of Research and Development in the Ministry of Communications,'' by R. D. Parker, August 11, 1947, Box 3158.

94. ''Condition of Technical Communication Societies and Courses at Universities and Colleges,'' by F. A. Polkinghorn, September 2, 1948, Box 3160.

95. F. A. Polkinghorn, ''Some Observations Concerning Engineers & Engineering in Japan,'' pp. 9–10, Box 3191.

96. ''Relations between Telecommunication Professors and the Telecommunication Industry,'' March 13, 1950, and ''Cooperation between University Professors and Industry,'' March 23, 1950, both by F.A. Polkinghorn, Box 3162.

through imitating the achievement of leading firms that had received direct US technological assistance. CCS engineers shared their knowledge in order to design and construct several factories specializing in cutting-edge technologies. The first movers then would share their knowledge through plant visits and seminars with smaller companies, arranged through the Japanese Federation of Communication Equipment Manufacturers Associations (CEMA).[97]

One such project involved Toshiba's construction at Yobe of Asia's largest vacuum tube plant. Toshiba, a licensee of General Electric's patents, had been a prewar producer of about 50 percent of Japan's vacuum tubes.[98] CCS engineers helped to design the new postwar plant and to define its production processes. They also worked with Japan Electric to improve quality and productivity at its Tomeagawa plant that manufactured repeater vacuum tubes. To prevent a monopoly, the CCS helped the Kawanishi Company become established as an alternative source for repeaters. US advisors also assisted NEC's Mita plant in improving production of automatic telephone dials, which four other manufacturers soon imitated under the associational learning program. CCS engineers worked with the ETL and an ''improvement group'' representing three manufacturing firms—Toshiba, Nippon Denki (NEC), and Kawanishi—in designing transmission tubes for the Japan Broadcasting Company.[99]

The second strategy, guided by the Bell System's 1920s experiences, involved redesigning equipment to achieve savings through 1) more efficient use of scarce raw materials; 2) better operating performance; 3) lower maintenance costs; and in some cases, 4) the building of network volume. Two decades earlier, the Bell System had successfully implemented a comprehensive plan first proposed by H. S. Osborne to improve service quality and cut operating costs by developing vastly improved telephone receivers.[100] CCS sought to emulate this in improving Japanese operations. Working in cooperation with Charles W. Protzman, a retired Western Electric manufacturing supervisor, and six other former AT&T engineers from the CCS, CL designed an improved telephone receiver that was projected to generate nearly $800,000 in annual operating cost savings

97. Memorandum to Chief, Civil Communications Section, ''Accomplishments of the Industry Division since March 1947, by Garrett D. Combs, October 31, 1947, p. 3 Box 3170.

98. S. B. Akin, ''Report 31 October 1945,'' p. 24, Box 3167.

99. ''Development Plan for High Power Transmitting Tubes,'' by E. Gonzalez-Correa, February 17, 1948, Box 3159.

100. Miranti, ''Corporate Learning and Quality Control,'' 50–52.

because of reduced maintenance, lower replacement inventories, and less expensive wiring.[101] Although five companies produced prototypes, manufacturing was delayed when the CCS proved unable to secure support from the government's Counter Fund, which had been established to finance efficiency-enhancing investments.[102]

The CCS also played an active role in other developmental projects. The CL, for example, began to design more reliable automatic switches and improved telephone dials. By 1950, it sought to build network traffic by working with industry to design and fabricate improved teletypewriters, PBX equipment, and coin-operated telephones.[103] New standards and manufacturing techniques for producing contact points in electrical circuits reduced silver consumption. Although vacuum tube output lagged at 1.5 million units per month through 1949, this was partially offset by increases in tube life due to better designs and manufacturing. Moreover, the MOTC fostered the development of VHF-FM portable telephones under United Nations patents for the national rural police.[104]

In February 1949, the CCS initiated a new approach to address manufacturing cost and quality problems by upgrading the knowledge of Japanese engineers through training in US production management techniques. Garrett D. Combs mandated that such training should stress ''channels or organizational alignment, management, foreman, and supervisory responsibilities, association between management, engineering and the laboratory.'' The training addressed shortcomings identified in survey of industry practice conducted by Homer M. Sarasohn and Charles W. Protzman.[105]

101. ''Introduction of the new ECL Design Telephone Set,'' and attached reports, by C. W. Protzman, July 11, 1949, Box 3172.

102. ''Request for Allocation of Counterpart Funds,'' by W.F.N., August 4, 1949; and Memo, ''Request for Allocation of Counterpart Funds,'' by G.I.B., July 20, 1949, both in Box 3172.

103. ''Standard PBX Design,'' by L. W. Lamb, November 30, 1948, Box 3160; see also F. A. Polkinghorn, ''PBX Development,'' March 30, 1950, and April 14, 1950, and ''Development of Coin Telephones,'' April 19, 1950, all in Box 3162.

104. Memo for Ministry of Communications, ''Application for Japanese Police Radio Stations,'' by George I. Back, June 17, 1947, Box 3175; MFR, ''Conference with Radio Manufacturers Concerning Use of United Nations Patents in the Manufacturing of VHF/FM Radio Equipment,'' by H. T. Matsuoka, December 9, 1948, Box 3160; ''Policy for Procurement of VHF-FM Radio Equipment, by R. C. Ferrar, March 30, 1950, Box 3162; and ''Matsushita Electric Industry Co. VHF/FM Project, by R. C. Ferrar, June 8, 1950, Box 3162.

105. ''Engineering and Manufacturing Alignment Training Project in Communication Equipment Manufacturing Companies,'' by Garrett D. Combs, February 9, 1949, Box 3162.

After completing their survey in July 1949, Sarasohn and Protzman presented their derivative training course through the CEMA's successor, the Federation of Electrical Telecommunication Industries Associations of Japan. They favored associational sponsorship because it seemed more consistent with democratic values. They rejected government involvement, believing that it might lead to ''favoritism based on some hidden remuneration or unwarranted control of private enterprise.'' Moreover, the state seemed unsuitable because it lacked experienced industrial engineers.[106] Offered in Tokyo and Osaka during 1949 and 1950, the sixteen-week course had five modules: organizational control, supervisory development, engineering control, quality control, and budget and cost control. Although Sarasohn published a text entitled *The Fundamentals of Industrial Management: CCS Management Course*, which was used in Japan for over twenty-five years, it was unavailable for the initial presentations. Consequently, Protzman had to rely on Bell System supervisory notes in teaching the earliest classes.[107]

The outbreak of the Korean War (June 25, 1950) sharply curtailed the CCS's educational efforts. Although Sarasohn and Protzman returned to the United States that year, their model flourished for many decades because of the subsequent involvement of business and professional associations such as the Japanese Institute of Management and the Japanese Union of Scientists and Engineers. Through these groups, knowledge of US production and quality engineering continued to be transmitted by talented consultants such as W. Edwards Deming, Joseph Juran, and Armand V. Feigenbaum.

Conclusion: Impact, Limitations, and Implications

The CCS's main contribution involved the guidance it provided in the extensive restructuring of organizational capabilities. The CCS enabled the MOC (and then the MOTC) to become channels for

106. ''A Proposal for Management Training Course for the Communications Manufacturing Industry,'' by Homer M. Sarasohn, July 27, 1949, and attachment, ''Outline of Proposed Management Training Program,'' by Charles W. Protzman and Homer M. Sarasohn, July 27, 1949, both in Box 3162.

107. Ibid., and ''Supervisory Development,'' March 21, 1950, and attachment, ''Some Highlights of Conferee Discussion in the Supervisory Appreciation Course Given by CCS March 20, 1950 to April 10, 1950,'' both by Charles W. Protzman, Box 3162. See also Sarasohn and Protzman, *The Fundamentals of Industrial Management*, electronic edition.

communicating ideas about management practices at the Bell System to the local telecommunication industry. Drawing heavily on the Bell System's techniques, the CCS played an active role in propagating the hard S's (strategy, structure, and systems), to use Pascale and Athos's term, that shaped the development of postwar management practice.

The standardization of technology and management facilitated the transformation of telecommunications by enhancing efficiency and control. Research became one of the two handmaidens of the CCS's standardization drive. Discovery compelled the development of new standards for designing, producing, and integrating new devices, equipment, and apparatus within the telecommunication system's physical infrastructure. Absorbing new technological knowledge also implied defining new methods for exploiting its benefits by developing more responsive ways to order internal operational practices and to maintain effective relationships with external groups, including suppliers and consumers.

Education was the second handmaiden of the CCS's standardizing. It was vital in inculcating an understanding of operational norms for myriad system functions. The interim solutions proposed by the CCS involving professional training programs sponsored by associations, closer industry–university cooperation, and intraindustry imitation of manufacturing practice served as useful models for the continued upgrading of the Japanese management–engineering skill pool in the post-occupation era.

The progress achieved in system standardization had positive long-term implications for network economics through economies of both scale and scope. The system steadily became more valuable to users as the number, type, and geographic range of contact points increased. The expansion of scope also implied increases in traffic volume, which in a high fixed-cost environment could translate into sharp reductions in the average cost of service.

While the CCS exercised considerable influence on developing organizational capabilities, the Japanese government utilized the telecommunication system to assist in achieving other macroeconomic goals that the US advisors either opposed or had not anticipated. For instance, lacking the pressure of consumerist state regulatory boards that existed in the United States, the Japanese felt little compulsion to reduce rates. The idea of building a consumer base through offering more economical service gained little traction because of more critical national economic priorities. Instead, telecommunication revenues were used to foster domestic employment and international competitiveness. The government was willing to trade off service efficiency in order to maintain a bloated workforce.

At the same time, however, the telecommunication enterprise subsidized its suppliers through the purchase of their outputs and through the joint development of new products. In this regard, learning about Bell System practice from the CCS advisors provided great insight into the global telecommunication market's technological requirements for equipment and apparatus. The Japanese industry continued to build on the knowledge gained during the occupation era, eventually emerging in the 1960s as one of the telecommunications industry's world leaders.

Despite limits on its effectiveness, the CCS's legacy remains important. Its activities in postwar Japan demonstrate the breadth of capabilities required to develop or rebuild a key economic sector. The development of an integrated learning base by Japan's telecommunication ministries was a necessary precondition for the establishment of Nippon Telegraph and Telephone in 1952.

CCS's ability to provide myriad capabilities—not just functional expertise—offers lessons of broad relevance. The Bell System's CCS advisors were well suited to provide guidance as part of a vertically integrated, regulated monopoly. The combination of profit motive, government oversight, and experience in all aspects of telecommunications made the Bell System a full-service source of knowledge and practices. The world's major powers still periodically assist other nations as they attempt to develop (or return to) a market economy. The success of such endeavors depends on a government's ability to enlist private enterprise representatives, such as those from the Bell System in postwar Japan, acting as an industrial extension of governmental policy.

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