# ADAPTATION TO TECHNOLOGICAL CHANGE

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To understand fully the impact of technological progress in postwar Japan it is necessary to pay special attention to the interrelationship between technological progress and structural change. The technological progress of these years is due in no small degree to the techniques imported from industrially advanced countries: technological change in Japan has largely been brought about by exogenous factors. Of course, the techniques developed in foreign countries are essentially objective and universal, but the social conditions under which they were developed and applied are different from conditions in Japan. Prior to the introduction of foreign technology a systematic (social) order had already been established as the social structure of Japanese enterprises, influenced by unique Japanese cultural traditions. This structure was typified by the systems of seniority rule and lifetime employment.

How influential was the impact of exogenous technique on the indigenous social structure? Was it so strong as to transform the structure completely? What actions have Japanese managers taken to accommodate the technological change in their enterprises? Have structural reforms been undertaken in order to cope with technological change? If so, how have such reforms been carried out?

This paper attempts to make a rough sketch of how enterprises in postwar Japan have treated technological innovation, bringing factual data together from surveys on these problems. Since this subject covers a very wide scope, all of the related problems cannot be taken up; only some specific ones are dealt with in this paper.

### I. WORKSHOP ORGANIZATION AND SUPERVISORS

In the past, the position and the role of workshop supervisors in Many studies have been made of the characteristics and particularity of management structure in Japan. Those in English include the following: Solomon B. Levine, Industrial Relations in Post-war Japan, Urbana, University of Illinois Press, 1958; James G. Abegglen, The Japanese Factory, Illinois, Free Press Glencoe, 1958; John B. Bennet & Iwao Ishino, Paternalism in the Japanese Economy, Minneapolis, University of Minnesota Press, 1963.

large-scale enterprises in Japan have born the following general characteristics. First, the great majority of supervisors have been promoted to their present position after having finished their compulsory elementary education and serving in the same enterprise for many years as hirakō (ordinary workers). Many of them are recruited from the senior workers of their enterprise. Second, typically they do not attain their position because of special education or training. Rather they are required to have skill gained from on-the-job experience as well as the ability and temperament to instruct and direct their staff. In that sense, their particular job skill is not of great importance. Third, their role is to take part in the operations control and labor management as leaders of the smallest organizational units. They are given various jobs indirectly concerned with the assembly line from more senior people but this is not an official delegation of authority. Especially in the field of operations control, much of the job is left in the hands of their staff technicians.

The above description is something like a conceptual model. The position and role of supervisors described above was established gradually in prewar enterprise structure and formed the basis for the development of seniority rule, as well. In the confusion just after the war—in the latter half of the 1940's—this "modern traditional" supervisory role was partially broken up, largely because legalized trade union movements were intensified for the first time and the "feudalistic" organizational system of the prewar days was weakened in the face of rising "industrial democratization." In the period of industrial revival since 1950, both management and management organizations have advocated the "restoration of order at the workshop." Consolidation of the position and the role of the supervisor similar to that of the prewar days has been one of the objectives of management movement to re-establish its authority.

However, this movement to revive management authority did not aim at the restoration of a labor management system exactly like the prewar system. Instead, efforts were directed toward the development of an enterprise structure for a new age. Thus, much effort was directed toward adopting selective techniques of organizational management from foreign

Some authors hold that the original form of Japan's unique enterprise structure can be found in the management of commercial houses in the late Tokugawa years, prior to the modern era. The traditional structure mentioned here refers to the structure which has been established after the period of expanding industrial revolution in Japan in the twentieth century. This is the reason why the words "modern traditional" are used above. For further description of the historical development of supervisors in Japan, see Tsuneo Ōuchi, Shokuba no soshiki to kanri (The Structure and Management of Workshops), Tokyo, Daiamondo-sha, 1962.

countries, particularly in the United States. The introduction of the "human relations" viewpoint and "in-service training" scheme are examples. Various training schemes for managers and supervisors were introduced and put into practice. Among these schemes, TWI (Training Within Industry)—direct training for supervisors—was so extensively adopted that a law to guide and disseminate it was enacted in 1950. The total number of trainees under the scheme amounted to more than 400,000 by June of 1956 (see Table 1).

Table 1. Number of TWI Trainees by Year

				-,	
Year	Course	Job Instruction	Job Management	Job Relations	Total
To March 19	52	75,235	7,729	7,802	90,776
April 1952-M	larch 1953	66,134	26,786	23,402	116,322
April 1953-M	larch 1954	39,794	22,571	19,971	82,336
April 1954-M		28,314	17,334	17,541	63,186
April 1955-M	farch 1956	23,250	14,803	14,331	52,384
April-June 19	956	3,789	2,230	2,341	8,333
Total		236,516	91,453	85,361	413,330

Source: Rödö-shö (Ministry of Labor), Shokugyō antei gyōsei 10-nen shi (Ten-Year History of Employment Security Administration), 1958, p. 114.

The door for the importation of foreign technology was opened with the enactment of the Foreign Investment Law in 1950. In the same year the Law to spread the TWI scheme was also amended. However, this amendment did not anticipate the need that developed from the mid-fifties of a training scheme to assist supervisors in adapting to imported technology. Like many other schemes TWI was introduced from the United States of America and promoted extensively by Japan's Ministry of Labor. The duties and responsibilities as well as the social surroundings of supervisors in Japan are very different from those of foremen in the United States. It is difficult to transplant a seedling into foreign soil. As a natural consequence, TWI did not have great impact on the enterprise structure through the change it brought to supervisors' functions. However, TWI provided the basis for a systematic training scheme program in postwar Japan. Since 1955, efforts have been made so that uniformity in contents and method may be avoided, and that training suited to Japanese enterprises may be provided.3

Technological innovation produced its most extensive effects for several years after 1955. The heavy and chemical industrial sectors took In Chapter 3 of Kögyö-ka to gemba kantoku (Industrialization and Workshop Super-

visors) by Hideaki Okamoto (Tokyo, Nihon rōdō kyōkai, 1966), the development of training program is described in factual details.

the lead in economic growth in these years. Especially in large-scale enterprises such as electric power, shipbuilding, iron and steel, chemical, automobile manufacturing, and electrical machinery industries, entirely new equipment was installed and modern factories were built. Marked changes were brought about by technological innovation in the nature and the structure of production operations, which have been reported in many monographs and surveys on labor economics and industrial sociology.<sup>4</sup>

The changes mentioned may be outlined as follows. In such industries as shipbuilding and automobile manufacturing, assembly-line production methods were introduced at a plant, and standardization of operations based on standard schedules and process control was adopted. Some jobs which had required men of experience disappeared in the process. In many of the newly-created or re-organized jobs, work-operations were simplified. Centralized controls became a major part of operations at a thermal power station, and the number of operations governed by a remote control system increased at the strip mill plant of an iron manufacturing company. In the above two cases, new types of jobs were created.

Changes in the nature of work-operations have taken place broadly along the following lines. In jobs involving purely mechanized automation, work-operations have been increasingly simplified; while broader and deeper scientific knowledge is required in jobs involving process automation. As a result, young and highly-trained workers have come to play an important role.

These changes stimulated the re-organization of the traditional workshop structure. The workshop structure headed by an experienced supervisor, could no longer cope with the technological innovation. Rapid change in an organization is apt to give rise to complications as well as dissatisfaction. Change in the organizational structure on the production sites possibly effects clerical and administrative (or management) sectors as well. However, though the structure of production operations might have been

These include: Masumi Tsuda, Rōdō-mondai to rōmu-kanri (Labor Problems and Labor Management), Kyoto, Mineruba-shobō, 1959; Masaji Shiba, Ōtomēshon to rōdō (Automation and Labor), Tokyo, Tōyō keizai shimpōsha, 1961; Nihon jimbun kagakukai (Japan Cultural Sciences Society), Gijutsu kakushin no shakai-teki eikyō (Social Impacts of Technological Innovation), Tokyo, University of Tokyo Press, 1963; Shizuo Matsushima, Rōmu-kanri no Nihon-teki tokushitsu to hensen (Characteristics of Japanese Labor Management and Changes Therein), Tokyo, Daiamondo-sha, 1962; Ken'ichi Kobayashi, Gendai Nihon no koyō-kōzō (Employment Structures in Contemporary Japan), Tokyo, Iwanami-shoten, 1966; Kunio Odaka, ed., Gijutsu kakushin to ningen no mondai (Technological Innovation and Human Problems), Tokyo, Daiamondo-sha, 1964; Kiyoshi Yamamoto, Nihon rōdō shijō no kōzō (Structure of the Japanese Labor Market), Tokyo, University of Tokyo Press, 1968.

partially re-organized changes in the nature of jobs in production sectors caused little, if any, change in the principles of management.

A factual survey of developments in organization, conducted at a large shipbuilding yard around 1957,<sup>5</sup> reveals the following changes in the position of supervisors. (1) Rationalization of production control brought about a narrowing of the scope (or duties) of the shokuchō (a chief workman or a senior supervisor); (2) Greater authority was vested in staff technicians and control workers in the indirect sector, while the shokuchō and hanchō (lower-ranking supervisor) assumed heavier responsibilities. Thus, the shokuchō became a lower-ranking foreman and the hanchō became a leader of a small workers' group respectively, lowering their position.

The above survey shows that supervisors' duties are tending to become heavier while the role of technical staff is becoming greater. Similar developments were also discerned in automated factories aside from shipbuilding yards. Thus, the importance of the functions of the old type of supervisor has decreased, while a new type of supervisor—one with more specialized knowledge who is able to share in the responsibilities of production control-has become necessary. Since around 1960, changes in the structure of the production sector have been effected in advanced enterprises and the sagyōchō (similar to a general foreman in the United States) system has gradually been adopted. Under the new system, former supervisory functions have been given to workers of lower position and the sagyōchō has assumed such duties as were formerly assigned to a representative of management. In other words, he is required not only to be in charge of his production site but also to be a channel of communications between the technical sectors. Also, he has come to be rated as almost equal in rank to an upper technician or lower engineer.6

At Yawata Iron & Steel Co., Ltd., the first to introduce this new system, the criteria by which workers are promoted to  $sagy\bar{o}ch\bar{o}$  are not school career or length of service. Instead, they are required to take part in a formal educational program within the company. A step-by-step educational system from a course for those who have newly joined the company to one for  $sagy\bar{o}ch\bar{o}$  has been established (see Figure 1).

Such a major structural reform on the production site, however, has not resulted in an organizational reform of the enterprise as a whole. The reasons are: (1) Educational systems have been established for the pro-

Tokyo daigaku shakai kagaku kenkyūsho (Institute of Social Science, University of Tokyo), Zōsengyō ni okeru gijutsu kakushin to rōmu kanri (Technological Innovation and Labor Management in the Shipbuilding Industry), Tokyo, Tokyo daigaku shakai kagaku kenkyūsho, 1960.

<sup>6</sup> H. Okamoto, op. cit., pp. 243-252.

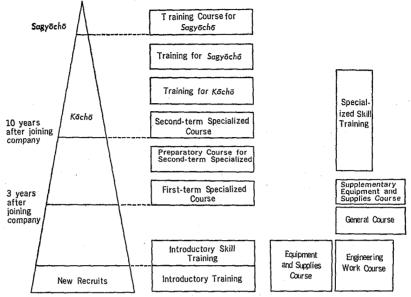


Figure 1. Line Education System at Yawata Iron & Steel Co., Ltd.

Source: Yawata Iron & Steel, Waga-sha no kyōiku katsudō (Educational Activities of Our Company), 1967.

duction line, staff and management, respectively. A distinct course of promotion for each division has clearly been set up. In addition it is necessary to have been with the division for a certain required number of years before undergoing further education for the next step. (2) Even though more importance is attached to ability, the seniority rule is still maintained in actual management.

However, the supervisors' position in Japan is, on the whole, changing steadily. According to a general survey in 1965, not less proportion of supervisors in both automated and non-automated workshops were university graduates. Also, skill is a more important requirement than length of service for selection as a supervisor (see Figure 2). These are trends which have never been noticed in the past. Table 3, comparing supervisors at an automated workshop with those at a non-automated workshop, reveals that the former are not only better educated but also their skills and qualifications are more important for appointment.

The position, role, job training and work of supervisors in postwar Japan have undergone truly drastic change. On the one hand, they are the ones who have always been in the forefront of technological innovation and who have been influenced most by the current of change. On the other hand, they have assumed the responsibility both for maintaining

Table 2. Standards for Appointment

	Length of Service	Age	Skill	Job Experience	Training Courses	School Careers	Others	No Answer
A Supervisors	42.4	24.2	60.6	15.2	24.2	12.1	3.0	24.2
B Supervisors	36.4	13.6	63.6	13.6	22.7			27.3
C Supervisors	32.1	10.7	60.7	17.9	21.4	_	3.6	28.6

Note: A supervisors are those persons who lead workers and guide and direct them at production sites. C supervisors are junior supervisors under the command of A supervisors. B supervisors are intermediate between A and C supervisors. Source: Nihon sangyō kunren kyōkai (Japan Industrial Training Association), Nihon no gemba kantokusha-seido no jittai—chōsa kekka no bunseki to tembō (Actual Conditions of Workshop Supervisors in Japan—Analysis of Survey Results and Prospects) (Special Material No. 25), Tokyo, Nihon sangyō kunren kyōkai, 1966, pp. 90-91.

high morale among the workers (the vast majority of company employees) and order in the workshop. Since recent trends show that their scholastic qualifications are constantly rising, and that they are increasingly taking part in management, it may be that the time is approaching in which the concept of the supervisor may take another turn.

#### II. UTILIZATION OF AVAILABLE MANPOWER

To change the quantity and quality of manpower is one of the methods to improve the quality of enterprise structure. The emphasis of the labor policy of an enterprise can be either on qualitative change in manpower within the enterprise or on the recruitment of manpower from outside. A fundamental characteristic of the process of technological innovation in Japanese enterprises can be seen in the major policy of utilization of manpower available within the enterprise.

The following are the two most representative measures an enterprise may adopt in utilizing available manpower: (1) Transfer of workers within an establishment<sup>7</sup> or among establishments—both are turnover within an enterprise; (2) Re-training for the purpose of improving the performance abilities of existing manpower.

- (1) With the change in the job structure and the nature of skills, transfers of workers within an establishment are very frequently made. However, since personnel changes often occur within an enterprise in Japan, even though there is no great change in the conditions both within and
- A large-scale enterprise usually has, in addition to the main office, branches and subbranches, factories scattered in local places. Each of these independent units is called "an establishment."

Table 3. Differences Between Supervisors at an Automated Workshop and Those at a Non-automated Workshop

	A	Minimum Age Non-au Non-au Worl		At	Attended Non-au Worl		Automated Worksho	. va
	utomated Workshops	Non-automated Workshops		ntomated Workshops	Non-automated Workshops		utomated Workshops	Non-automated Workshops
	A supervisors B supervisors C supervisors	A supervisors B supervisors C supervisors		A supervisors B supervisors C supervisors	A supervisors B supervisors C supervisors		A supervisors B supervisors C supervisors	A supervisors B supervisors C supervisors
0€~	27.6 14.3 4.0	26.9 6.7 4.2	Universities, Higher Schools & Colleges	44.8 28.6 4.0	23.1 26.7 8.3	Length of Service	55.2 42.9 36.0	46.2 66.7 41.7
~35	3 31.0 3 14.3 0 52.0	) 15.4 7 33.3 2 12.5	Middle Schools under the Old System	3.5 7.1 8.0	3.9 13.3 0.0	Age Skills and Qualifications	37.9     65.5       28.6     57.1       20.0     52.0	7.7 46.2 13.3 46.7 8.3 50.0
~40	27.6 28.6 36.0	23.1 26.7 54.2	Senior High Schools under the New System	34.5 61.5 72.0	38.5 26.7 70.8	ind Job tions Experience	27.6 21.4 12.0	23.1 20.0 16.7
~45 ~!	3.5 0 21.4 7 0.0 0	19.2 7 26.7 6 20.8 4	Primary Schools under the Old System	0.0	0.0 6.7 0.0	Training Se Courses	17.2 7.1 4.0	23.1 33.3 16.7
~50 No Answer	0.0 10.4 7.1 14.3 0.0 0.0	7.7 7.7 6.9 0.0 4.2 4.2	Junior High Schools under the New System	0.0	26.9 26.7 16.7	School Other Career	3.5 10.4 0.0 7.1 0.0 0.0	3.9 11.5 6.7 6.7 0.0 12.5
z	29 14 4.0	25 24 24	Other	17.2 7.1 8.0	7.7 0.0 4.2	No Answer	24.1 35.7 4.0	23.1 26.7 29.2

Note: For the definitions of A, B and C supervisors, see the note of Table 2. Source: H. Okamoto, op. cit., p. 220.

without, it is difficult to make a distinction between turnover directly caused by technological innovation and that occurring for other reasons. According to one survey on transfers caused by the technological innovation, the transfer rate is higher in machine industries than in process industries (see Table 4).

The high transfer rate in machine industries reflects the gradual introduction of mechanized automation. By industry, the rate was high in heavy and chemical industries where technological innovation has been rapid, such as automobile manufacturing, electrical machinery and chemical industries. In process industries, more difficulties or complications arose or were expected to arise in connection with transfers, which is believed to have been caused by the fact that technological innovation in chemical industries in Japan has generally been carried out by restructuring the

Table 4. Some Features of Transfers by Industrial Categories

(%) Transferred Did not Transfer With No Need Trouble Smoothly Industrial Categories Sub-Sub-Considerable for Was Done Total Total Difficulties Transfers Expected (a) (b) (c) (d) (e) (f) Process Industries Total 35.4 4.9 40.0 57.4 2.6 60.0 Pulp & Paper 35.1 10.8 45.9 51.4 2.7 54.1 Chemicals 7.6 47.6 55.2 42.9 1.9 44.8 Petroleum Refining 28.6 14.3 42.9 42.8 14.3 57.1 Iron & Steel 27.8 9.2 37.0 53.6 9.463.0Non-Ferrous Metals 32.1 2.9 35.0 55.0 10.0 66.0 Machine Industries Total 39.0 4.0 64.0 35.0 1.0 36.0 Textile Machinery 48.0 48.0 36.0 36.0 Heavy Electrical Machinery 37.5 2.5 59.0 41.0 41.0 Light Electrical Machinery 45.0 19.0 64.0 36.0 36.0 Communications Machinery 26.0 1.5 48.0 27.5 48.0 Automobile Manufacturing 55.5 5.5 73.0 27.0 27.0 39.1 6.9 Business Automation 46.0 31.0 31.0

Notes: (1) In some cases, the sum of columns (c) and (f) does not add up to 100.00, because of some other replies were made.

(2) Information on the transfer situation was collected and analyzed on an enterprise-by-enterprise basis.

Source: Tsūshō sangyō-shō kigyō kyoku (Enterprise Bureau, Ministry of International Trade and Industry), Waga-kuni sangyō no ōtomēshon no genjō to shōrai (Automation of Japanese Industries—Present Outlook and Future Prospects), Tokyo, Hokuetsu bunka kōgyō, 1957, pp. 71, 143 and 196.

The period of the survey is the six years from 1955 to 1960 in process industries, and the five years from 1955 to 1959 in machine industries. This makes us believe that the transfer rate in machine industries is a little higher.

entire plant.

This is more visibly reflected in the labor supply situation at a newly-established factory (see Table 5). Though there are some discrepancies between the time when operations started and the time when the survey was conducted, many newly-established factories in the chemical industry have higher transfer rates.

Table 5. Transfer at Newly-Established Factories

Industri Name Facto	e of	Date Operations Started	Date Survey Made	Number of Employees Transferred from Old Factories (a)	Number of New Employees at a New Factory (b)	Transfer Rate $\left(\frac{a}{a+b}\right)$ (%)
	A factory	Sept. 1951	July 1963	3,971	7,915	33.4
Iron & Steel	B factory	July 1959	Sept. 1963	478	624	43.4
Iron & Steet	C factory	Feb. 1962	May 1965	1,400	700	66.7
	D factory	Oct. 1963	Nov. 1964	700	<b>2,</b> 600	21.2
	A factory	Feb. 1958	Feb. 1961	504	158	77.2
	B factory	Feb. 1958	July 1959	236	628	37.6
Chemical	C factory	Nov. 1959	July 1963	259	167	60.1
	D factory	March 1961	July 1963	353	54	86.7
	E factory	May 1962	July 1963	95	219	30.3
	F factory	Jan. 1963	July 1963	401	106	· 79.1
	A factory	March 1961	July 1963	132	208	38.8
3.6 11	B factory	Aug. 1961	July 1963	336	599	35.9
Machinery	C factory	May 1962	July 1963	274	173	61.3
	D factory	Jan. 1965	Apr. 1965	1,500	690	68.5

Source: K. Yamamoto, op. cit., pp. 86-87.

As background for the fact that there are many persons who have been transferred to an entirely new factory, we must take into consideration the management structure of Japanese enterprises as well as the special characteristics of the labor market. The first point is that employees are not always obedient to the policies of management. Table 5 shows the result of a survey made on the attitude of employees toward transfers between establishments at a time when a new factory has been built at some distance from the old one, but has not yet started operations. About 79 per cent of the employees did not wish to be transferred. Naturally their attitude differed according to their age group. Though replies were not made to that effect in the survey, the survey result suggests that many of the middle and old age brackets were flatly opposed to transfer because (1) they did not wish to leave their present place of work since they were almost ready to retire; or (2) they were very reluctant to be transferred

to another establishment since they had farms or a family to look after. This also shows that employees, faced with technological innovation, have anxiety and uneasiness about leaving the locality where they have been living for a long time, or leaving the factory where they have been old hands. However, management took the initiative and enforced the transfers. Behind this enforced measure lies the fundamental premise that present employees would continue to be employed. On the other hand, the trade union, reflecting the desire of its members, first waged a campaign to strongly oppose the transfer, but it was compelled to retreat, in the face of determined management policy, only advocating the continued secure employment of its members and the maintenance of labor conditions already obtained.

Table 6. Composition of Employees by Age Group and by Attitude Toward Transfers (Former O Factory, 1960)

					(%)
Attitude Toward Transfers	Wishes to Be Transferred	Does not particularly Wish to Be Transferred but May Do so, if Recommended	Does not Wish to Be Transferred, if Possible	Does not Wish to Be Transferred at any cost	Total
Under 20	10.7	43.1	41.6	4.6	100.0
21-25	11.0	30.3	40.8	17.9	100.0
26-30	3.4	24.7	49.3	22.6	100.0
31-40	3.9	18.1	53.6	24.4	100.0
41-50	1.6	9.9	51.1	37.4	100.0
51-55	2.0	12.3	47.4	38.3	100.0
Total	3.6	17.3	50.7	28.4	100.0
	(81 persons)	(389)	(1,138)	(637)	(2,245)

Notes: (1) Results of an inquiry made at the former O factory of the C Chemical Industry Co., Ltd. The inquiry was conducted by sending out questionnaires to all the employees of the O Factory. Answers to the questionnaire were received from 95 out of the 100 persons questioned. The number of persons tabulated in the above table is 2,245.

(2) Before this inquiry was conducted, about 200 employees were transferred from the O Factory in Kyūshū to a new factory located in the Keiyō (Tokyo-Chiba) industrial area.

Source: K. Yamamoto, op. cit., p. 283.

The transfer was carried out according to the principles that (1) both management and labor should not suffer either dismissal or resignation and that (2) preference should be given to the continued employment of present employees over the recruitment of workers from the area where the new factory was built.

The second point in an understanding of the special characteristics

of such a transfer is that an organ to adjust the supply and demand of labor is not yet well-developed in the labor market. It is true that public organizations for this purpose do exist, but their service, either to secure employment for job seekers in large-scale enterprises or to find employees for the enterprise, is rather limited. Instead, the enterprises themselves have for a long time undertaken their own recruitment of workers. Powerful craft unions are not developed, either. As a result, exclusive labor markets have been formed on an enterprise-by-enterprise basis. It follows, therefore, that if an employee continues to refuse transfer to a new factory, the obvious result is for him to be thrown out of work. When an employee is compelled to choose between the two-either to comply with the transfer or to be thrown out of work—he usually chooses the former, if he has been in service for many years. The merits and demerits of the high transfer rate from the social and economic viewpoint have not been fully probed yet, but in the background of the transfer as a measure to cope with technological innovation, there exist such special conditions as those outlined above.

(2) The second measure for utilizing available manpower is re-education or re-training. According to the survey referred to earlier, re-training programs undertaken up to the beginning of the 1960's may be summarized as follows. (a) More enterprises undertook re-training schemes in process industries than in machine industries. (b) There was no difference between the two industry groups in the ratio of re-training undertaken by enterprises themselves, but more enterprises in machine industries found that re-training was not necessary. (c) In process industries, many re-training schemes were carried out under the sponsorship of manufacturers of automation instruments. (d) The re-training period is of short duration. This is particularly so in the schemes sponsored by manufacturers of automation instruments.

As noted above, many short-term training schemes are being carried out by instruments manufacturers, which indicates that training aimed at bringing about an immediate effect in the operation of a new machine is often required. On the other hand, many enterprises undertake their own in-service training programs, without depending on outside organs. This fact suggests that many enterprises have developed their own facilities for undertaking educational or training programs.

Another survey made for the early 1960's shows that education and training are regarded as one of the most important means to tackle the problems of labor management brought about by the change in labor structure (see Table 9). (The table also reveals that technological innovation

Table 7. Re-training Programs

Whether			(9
Undertaken or Not	By Industry Group	Process Industries	Machine Industries
	In-service Re-training	33.4	32.5
Undertaken	Instruments Manufacturers	33.4	6.0
	Utilized Outside Organs or Universities	s 6.7	8.0
	Sub-total	73.5	46.5
	Re-training Programs Thought to Be	***************************************	-
	of Little Effect, if Undertaken	1.4	1.5
Not Undertaken	Found not Necessary	17.4	37.5
C Madramon	Found them Necessary but No Organs	3	
	Were Available	7.7	7.5
	Sub-total	26.5	46.5

Source: Tsūshō sangyō-shō, op. cit., pp. 74 and 146.

Table 8. Methods and Periods of Re-training Programs for Employees Engaged in Installation of Instruments

					(%)
Method Period	Less than 3 Months	3 to 6 Months	6 months to 1 Year	More than 1 Year	Total
In-service Programs	81.8	6.9	3.4	7.9	100.0
	(49.8)	(82.8)	(70.9)	(69.4)	(52.9)
Undertaken by Instruments	97.3	0.8 (3.5)	0.8	1.1	100.0
Manufacturers	(22.0)		(6.1)	(3.3)	(19.6)
Outside Organs	93.5	1.7	2.9	1.9	100.0
	(11.9)	(4.3)	(12.8)	(3.3)	(11.1)
Universities	52.0 (0.3)	( <del></del> )	4.0 (0.7)	44.0 (3.0)	100.0 (0.4)
Others	87.0	2.6	1.5	8.9	100.0
	(16.0)	(9.4)	(9.5)	(23.0)	(16.0)
Total	86.9	4.4	2.5	6.2	100.0
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)

Source: Tsūshō sangyō-shō kigyō-kyoku, op. cit., p. 111.

has exerted a great influence on the seniority rule system, a time-honored practice in employment management. This problem will be taken up in the last section.) According to Table 9-(2), a deeper interest is shown in "the expansion and improvement of in-service training facilities" rather than in "re-education," among the various measures to cope with the problems which emerged as a result of the change in labor structure.

It could be said that more importance is given to the long-term overall improvement and development of manpower rather than to temporary measures for adaptation to technological innovation. Education and training within enterprises, as will be discussed in the following section, have long been the strategic concern of management since the latter half of the 1950's.

Other No Reply

2.3

1.6

2.5

 Table 9.
 Changes in Labor Structure Brought about by Technological Innovation in the

 Last Three Years—Problems and Countermeasures

(1) Major Problems in Labor Management Emerging from Change in Labor Structure

		Total	Insufficient Vocational Training	Insufficient Emergence Vocational of Surplus Training Labor	Emergence of Surplus Management	Increase in the Degree of Labor Tension	Widening of the Gap between Performance and Seniority Wages	Other	No Reply
	Total	100.0	25.3	6.7	2.7	4.9	56.4	2.7	1.3
***************************************	Less than 5 billion 100.0	100.0	31.0	5.7	4.6	4.6	4.6 4.6 51.7 1.1 1.1	1.1	1.1
	5-10 billion	100.0	22.5	7.5	ſ	7.5	52.5	2.0	5.0
lotal Assets	10-20 billion	100.0	27.8	11.1	2.8	8.3	50.0	}	1
	More than 20 billion	100.0	17.7	4.8	1.6	1.6	69.4	4.8	1
(2) Counterm	(2) Countermeasures for the Problems Emerging from Change in Labor Structure*	ms Eme	rging from C	hange in La	bor Structure*				
						4		  -	

Improvement of In-service Training Programs Amendment or Re-examina- Expansion and 77.3 69.0 67.5 88.9 88.7 Abolition of tion of the the Seniority Lifetime System (Wages Employment and Promotion) System 3.6 2.8 2.5 4.8 3.4 61.3 54.0 60.0 2.99 69.4 Talent Scouted from Other Companies 3.6 8.3 4.6 2.5 Re-education of Workplace Employment Plans 22.5 14.5 13.8 16.7 16.0 38.9 51.6 45.0 45.8 44.8 37.9 27.5 58.3 54.8 44.0 More than 20 billion Less than 5 billion Total 10-20 billion 5-10 billion

Source: Keizai dōyū-kai (Japan Committee for Economic Development), Rōdō-shijō no henka to kigyō-katsudō (Changes in the Labor Note: \*Because more than two items were selected to some questions, totals are not in all cases the sum of the parts. Market and Enterprise Activities), Tokyo, Keizai dōyū-kai, 1963.

# III. SYSTEMATIZATION OF INDUSTRIAL TRAINING AND RAISING OF WORKERS' EDUCATIONAL STANDARDS

As was described in Section II, the TWI scheme was introduced and widely adopted in Japan before the full-scale influx of technological innovation. In that sense, the scheme became the prototype for educational programs within enterprises in the following years. It also provided data for a reconsideration of the kinds of educational and training programs that would be suited to Japanese enterprises.

Educational and training programs within enterprises since 1960 have been expanded, systematized, specialized, and greater range of programs have been introduced. A survey on the theme of rationalization of management under technological innovation enables us to get a glimpse of the developments that have been taking place (see Table 10). Many large-scale enterprises have established educational facilities and courses with systematic curricula. These are programs similar to the system of public school education, and include not only training for workers and supervisors at production sites, but also educational courses for all types of employees within the enterprise. These developments reflect the fact that the need to cope with both structural innovation throughout an entire enterprise as well as technological innovation in the production sector has become more and more acutely felt. Interest in administration of education and training has grown to the extent that the subject has become a matter involving executive level decisions.

Table 10. Survey of Educational and Training Programs, 1961 to 1963

I diple 10	- Curio,	or Education	ur una rrun				
Tota	Have Not 1 Been Under taken	maar		Specialized		Partici- pating	No Reply
New Recruits 100	.0 3.9	69.6	29.3	8.9	7.2	4.8	2.1
General Staff 100	.0 6.4	21.1	39.9	50.4	25.0	47.1	1.9
Supervisors 100	0 5.6	27.3	36.4	38.2	30.4	40.3	3.3
Middle-level Management 100	.0 12.0	18.8	24.8	25.6	31.0	56.0	4.3
Top Management 100	.0 27.7	4.3	5.4	9.1	18.4	46.5	12.0
Educational Instructors 100	.0 18.4	4.1	18.0	26.3	5.4	46.7	16.3

Note: Because more than two items were selected in some answers, totals are not

always the sum of the parts.

Source: Keizai dōyū-kai, op. cit.

As described above, the educational programs have been developed as part of the labor policies of individual enterprises. The subject has also been taken up as an important matter by the government, as well. Though comprehensive legislation for such programs has not been enacted as yet, in 1958 an independent system of public and private industrial training centers was set up to train persons who have at least finished their compulsory education. (The law was completely revised in 1969, and measures to meet the demands of a new age are now being formulated.) Private centers are run by enterprise, singly or jointly, in accordance with the provision for industrial training in enterprises. Many "schools" in companies are institutes to cultivate technical skills, approved by the Ministry of Labor.

Figure 2 shows the number of trainees and the rate of achievement of planned targets under industrial training schemes at the public and private technical training institutes. The increase in the number of trainees has slackened and the rate of achievement of planned targets has decreased at private institutes, as compared with public ones. Some reasons for these trends lie in the fact that educational facilities for white-collar workers

(In 10 Thousand Persons) Number of trainees under (%) in-service industrial <del>7</del> 110 13 training schemes Number of trainees under 100 public industrial training 12 schemes 11 90 Achievement rate of planned targets under 10 in-service industrial 80 training schemes 9 70 Achievement rate of planned targets under 60 public industrial trainģ ing schemes 50 40 30

Figure 2. Number of Trainees and Rate of Achievement of Planned Targets under Industrial Training Schemes

Note: The rate of achievement of planned targets under industrial training schemes means the ratio of the number of trainees who have actually undergone training to the planned number of trainees.

67 68

65

61 62 63

60

Source: Rōdō-shō shokugyō-kunren kyoku (Industrial Training Bureau, Ministry of Labor), Shokugyō-kunren kankei kihon shiryō (Fundamental Data on Industrial Training), 1969.

Table 11. Number and Percentage of Employees Classified by Education and by Industrial Sector, 1959 to 1963 —Changes in Level of Education—

	Compc	Composite Ratio by Education in 1963	' Education	in 1963	Increase Composite	Increase or Decrease in the Composite Ratio, 1959 to 196	in the to 1963	Average Decrea	Average Rate of Increase Decrease, 1959 to 1963	rease or 1963
Industrial Sector	Total	Elementary Secondary School School Graduates* Graduates	Secondary School Graduates	Higher School Graduates	Elementary School Graduates	Secondary School Graduates	Higher School Graduates	Elementary Secondary School School Graduates Graduates	Secondary School Graduates	Higher School Graduates
All Industries Number (in thousand)	43,976	29,023	11,688	3,265						
	100.0	0.99	. 26.6	7.4	10.2*	8.5	1.7	1.5*	14.7	10.5
Agriculture, Forestry & Fishery	100.0	88.3	11.1	9.0	2.3*	2.3	0.0	3.1*	3.4	4.6*
Mining	100.0	7.97	17.1	6.2	<b>6.2</b> *	4.9	1.3	6.1*	3.6	0.7
Construction	100.0	0.69	24.8	6.2	13.3*	11.2	2.1	6.5	43.3	32.0
Metal & Engineering	100.0	63.6	28.5	7.9	10.0*	9.4	0.5	7.9	31.9	2.6
Other Manufacturing	100.0	71.4	23.2	5.4	*6.7	6.9	1.0	1.1	16.3	10.3
Wholesale & Retail	100.0	52.0	43.0	2.0	14.2*	13.0	1.2	3.6*	14.1	11.1
Banking, Insurance & Real Estate	100.0	17.7	63.9	18.4	7.5*	10.3	2.8*	0.3	18.0	6.3
Transportation, Communication & Public Utilities	i- s 100.0	58.9	33.6	7.5	11.1*	9.1	1.9	0.2*	15.4	14.8
Service	100.0	37.2	33.5	29.3	15.8*	10.4	5.4	4.3*	17.7	11.1
Civil Service	100.0	28.2	55.4	16.4	13.5*	12.1	1.3	*1.9	9.6	4.4

Note: \*In the educational reform of 1947, compulsory education was extended to include junior secondary school education. those who graduated from junior secondary schools are included in "elementary school graduates."

Source: Mombu-shō (Ministry of Education), Shokuba no gakureki to shokushu kōsei (Workers' Composition as Classified by School

Career and by Industry), 1966, p. 25.

and administrators have expanded and that the number of those educational and training institutes which do not come under the Industrial Training Law has been increasing; but the most direct reason is the change in the level of education of employees.

Table 11, though based on rather old statistics, shows the change in educational background of employees by industry. The rate of junior high school graduates (those who complete the nine years of compulsory education) attending higher secondary schools has been on the increase, which results in a constant rise in the level of education of new recruits in secondary and tertiary sectors.

The number of junior high school graduates seeking employment has been decreasing since 1960, and hence enterprises find it difficult to employ them. A high school education will soon be required of all employees except those who will be trainees at technical institutes. However, the number of candidates for such institutes has tended to decrease, so that some enterprises have closed their technical institutes. The reason for this is the increasing rate of those attending secondary public schools.

There is an aspect to the increase in the rate of those attending schools of higher grade which meets the demand of the technological innovation. With rapid advances in technology, the nature of employees' work is to be raised and employees of more dependable fundamental scholastic abilities are required. Thus, the minimum requirements of employees are set by such enterprises as at least senior secondary school graduates.

However, the raising of workers' educational standards gives rise to organizational conflicts. In enterprises where the seniority system has been dominant, university graduates have been employed as candidates for future executives. But their chances for management posts are reduced as additional university graduates join the company. Those university graduates who cannot become middle-level managers after more than twenty years' service, or those who believe they may not reach such a position tend to feel uneasy and anxious. The basis upon which management policies have coped with technological progress while retaining the longestablished seniority system is on the brink of collapse. Thus, the raising of workers' educational standards is a new factor accelerating organizational change.

For details, see the article by Yoshio Hara, "Changes in Education in Postwar Japan," in the present issue of The Developing Economies.

## IV. INTRODUCTION OF MANAGEMENT TECHNIQUES

Japanese enterprises have learned various techniques for rationalization of management mainly from the United States. Several techniques were introduced around 1950, and some enterprises tried to apply them. Around 1960 hot discussion centered on methods to apply various new techniques to Japanese enterprises in all sectors of management, such as production control, organization control, personnel management. There was a "boom" in industrial administration. It was also about this time that a reappraisal of the "Japanese way of management" began to be made due to the excessive influx of management techniques from foreign countries, which were difficult to implement. Although efforts were made to absorb rational and scientific management techniques into the traditional Japanese style of management, the situation differs from the introduction of production techniques in the following way. The introduction of production techniques is based on material change, while the influx of management techniques exerts direct influences on human organization. The real penetration of management techniques requires change in traditional management structure.

If management techniques are only partially put into practice, without changing the fundamental principles of the management structure, the form of the structure may change, but its substance may not. A survey conducted in 1963 covering representative enterprises indicates that while new management techniques were being actively introduced, in some cases they were not fully operative functionally. Rational forms of structure have been adopted since 1959 (see Table 12), "though the structural chart has been re-written into the structure of line and staff departments, the fact is that in many cases, the substance still remains as the long established primitive functional structure."

Thirty-four per cent of the enterprises the survey covered have

Table 12. Change in Form of Structure

		1963	1958
(A)	Structure of Line and Staff Departments	77 companies	84 companies
(B)	Functional Structure	14	8
(C)	Mixture of (A) and (B)	2	12
(D)	Others	7	20
Т	otal	100	124

Source: Susumu Takamiya, "Nihon no 100-sha—keiei kindai-ka no jittai to mondai-ten" (Rationalization of Management in 100 Japanese Companies and Its Problems), Chāō kōron, Special Issue on Management Problem, Winter, 1963.

See the source of Table 12.

adopted a divisional system as an autonomous "profit centers" (see Table 13), but in some cases, divisions are not actually profit centers and are not functioning as the nuclei of a decentralized unit.

This survey reports that thirty-nine out of one hundred companies covered have installed electronic computers, but the majority of these companies utilize computers only for clerical work. The points mentioned above suggest that (1) it takes time before techniques for rationalization of management will take firm root in management structure, and that (2) the existing management structure is an obstacle to the planting of a new management structure.

Table 13. Application of Divisional System

34 companies
61
5
100

Source: S. Takamiya, op. cit.

The increase in the number of computers installed in Japanese enterprises has been remarkable, registering 12-fold growth in the years from 1960 to 1966 (see Table 14). Though there has been a considerable time lag in the introduction of computers, compared with the progress in production techniques, the spread of computers has been rapid in recent years. Their applications have become more and more sophisticated, from the expost processing of partial business work, ex-post processing through the total system, mechanization of routine matters of judgment, to standardization of non-routine decision-making. In the future, they will be utilized for the Management Information System (MIS) (67 per cent) or for centralized processing through the Real-time System (23 per cent).<sup>11</sup>

With the spread of computers, various scientific techniques have come to be absorbed into management. For example, Industrial Engineering and Operational Research has been much discussed for about ten years. Operational Research has been attracting particular interest for a longer period. However, it took a considerable number of years before it was adopted in management (see Figure 3). There has been a time lag between the introduction of the various techniques of scientific management and the adoption of these techniques in enterprise management for many reasons. Among these reasons, the most fundamental are the seniority system and the lifetime employment system.

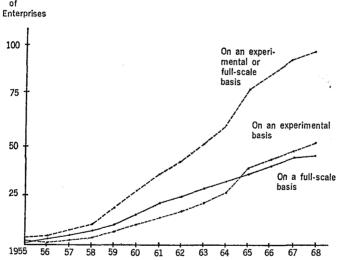
Nihon denshi keisan kaihatsu kyōkai (Japan Computer Usage Development Institute), Kompyūta hakusho (White Paper on Computers), Tokyo, Nihon denshi keisan kaihatsu kyōkai, 1967, pp. 105–109.

Table 14. Installation of Electronic Computers in Various Countries

				•			
Country	Year	1957	1959	1960	1963	1965	1966
U.S.A.		1,350	3,612	4,600	14,000	26,340	28,500
U.K.		66	171	234	626	1,225	1,700
Germany (Federal	Republic of)	20	85	170	1,012	1,980	2,750
France		15	60	125	791	1,320	1,550
Italy		10	55	100	592	1,000	1,150
Japan		3	46	102	870	1,790	2,100
Others (25 countrie	es) u	nknown	unknown	unknown		2,955	6,705

Note: "Others" include U.S.S.R. and Canada. Source: Nihon denshi keisan kaihatsu kyōkai, op. cit.

Figure 3. Enterprises Adopting Operational Research



Source: Sangyō-kōzō shingikai kanri-bu (Administration Division, Council on Industrial Structure), "Kokusai-ka jidai ni okeru waga-kuni kigyō keiei no kōdo-ka ni tsuite" (On Effective Management of Enterprises in Japan in the Age of Internationalization), Tokyo, Tsūshō sangyō-kyoku, 1969, p. 279, (mimeograph).

#### V. DRASTIC REFORM OF ENTERPRISE MANAGEMENT

We may summarize the discussion in the preceding sections as follows: (1) both technological progress and the introduction of organizational techniques have been rapid in Japanese enterprises since 1955; (2) progress in production techniques began to take shape earlier than the spread of organizational techniques; and (3) the introduction of the two kinds of techniques has had great impact on the existing enterprise structure. The preceding sections have also indicated that adaptation to change was made through the partial alteration of structure, but both the seniority system and the lifetime employment system have not been reformed extensively.

It is expected that technological progress will continue in the years ahead, and that the gap between technology and organizational structure will be widened further. How will enterprises try to cope with technological changes in the future? There is no report directly related to this, but the following survey<sup>12</sup> is helpful in examining this problem.

The survey was conducted by asking top-level managers of enterprises about the facts about and their opinions on personnel administration under the merit system. On the whole, they have adopted the principle of actively carrying out personnel administration under the merit system. They believe it desirable for future management. However, the merit system and the

Table 15. Present Status of Personnel Management

	(%)
Merit system fully applied.	0.7
Merit system adopted as the basis, but some elements of the seniority system are maintained.	40.3
Seniority system adopted as the basis, but some elements of the merit system are used.	47.9
Seniority system adopted on the whole.	10.4
Other	0.7

Source: Nihon keieisha dantai remmei (Japan Federation of Employers' Association) & Kantō keieisha kyōkai (Kantō Employers' Association), "Nōryoku-shugi kanri ni kansuru toppu keieisha-sō no iken chōsa kekka hōkoku" (A Report of the Opinion Survey of Top Management under the Merit System), Tokyo, Nihon keieisha dantai remmei & Kantō keieisha kyōkai, 1967, (mimeograph).

Table 16. Direction of Wage Control

	(%)
Will try to eliminate elements of the seniority system.	48.5
Will keep some elements of the seniority wage system.	3.0
Seniority wage system to be adopted as the basis.	20.9
System of wages according to position to be introduced and expanded.	50.0
System of wages according to function to be introduced and expanded.	6.7
System of wages according to achievement to be introduced and expanded.	8.2
Assessment of promotion according to ability to be strengthened.	31.2

Source: The same as Table 15.

See the source of Table 15.

Table 17. Future of the Lifetime Employment System

	(%)
Will not change.	6.0
Will diminish, but the basis will not change.	91.0
The basis will change and the movement of labor will be freed.	3.0

Source: The same as Table 15.

seniority system are co-existing at present, and the number of enterprises applying the merit system fully to their personnel administration is negligible (see Table 15).

Though they are tending in principle to move toward a wage control system based chiefly on the merit system, they believe that the lifetime employment system will not change (see Tables 16 & 17). The majority of the same respondents replied elsewhere in the survey that they believed that there is relationship between the lifetime employment system and the seniority system, and answered, "There is a limit to the changes that may be made in the seniority system under the lifetime employment system" (77 per cent).

In view of the fact that most of the important reforms within companies have been carried out under the leadership of top-level managers, it is worthy to note how managers comprehend the fundamental principle of corporate structure and the prospects for their alteration. Top corporate executives wish to introduce major structural changes, but they have expectations concerning change. They recognize the rigid elements inherent in Japan's corporate structure—the preference of the *status quo* by most middle management and the workers. However strong the impact of technology may be, the underlying structure will not easily submit to a drastic reform. These characteristics of corporate structure are to be found in all the other structures in Japan and structural changes are indeed the greatest challenge of the 1970's.