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The Japanese Model of the Transition from an Industrial to Information Society

—— An Example of the Machinery Sector*——

Kunio Hisano

The Implications of the Information Society

While there have been many technological inventions and innovations in economic development and every one has had some effect on society, the impact of important technological inventions can be distinguished from each other depending on the subject that is being investigated. When we consider the implication of information society, microelectronics technology plays a decisive role.

Technological innovation has two types : process and product innovation. Both of them have a different effect on economy and society. Process innovation, or a technological innovation to improve production processes, reduces manufacturing costs, thereby enhancing a firm's competitive position over rival firms. Furthermore process innovation in the broad sense of the word could bring about many changes in the workplace. On the other hand, product innovation, namely introduction of new products, overcomes the saturation of demand. This latter type of innovation is vital for the existence of a capitalist economy, because it opens up a new market and new capital investment areas. This could have implications for lifestyle. However, in practice it is very difficult to classify the individual technology as either process or product innovation.

The transition from the tool to the machinery stage in the development of technology essentially (although not totally) has broken through the dependence on the craftsman's skill, thereby permitting the substitution of machinery for the labourer's function in a technological sense. Many kinds of machines from the Industrial Revolution onwards were invented and spread across various industries, gradually replacing the old craftsmen. However in the machinery sector, the substitution of machinery for labourer was limited because the production process still needs a quasi-craftsman's skill to transform metals, even with the aid of machine tools. Therefore, the machine factory without skilled workers couldn't *economically* be attained because of the enor-

* This is based on my paper that I presented at the University of New England, Australia where I stayed as Visiting Professor in 1995-96.

mous cost of building up a 'machinofacture.' So-called 'automation' (I define it as a perfect phase in the stage of machinery technology), partly removed this limit in a few industries which can exploit economies of scale by mass production, namely consumer durable industries such as automobile and household appliance. The appearance of the mass-production assembly line was based on the introduction of interchangeable parts manufactured by special-purpose machines and transfer-machine. In other words, the mass consumption of a commodity was prerequisite for the automation of the production process.

On the other hand, microelectronics, above all integrated circuit (IC) technology, makes it possible to extend automated manufacturing process to the machinery sector. This is because microprocessor technology (i. e. microcomputer on a single chip, enabled by the IC) allows automatic control of production, in contrast to machinery that achieves at best an automatic operation. Microelectronics technologies along with the development of numerical control (NC), make it possible to develop automatic control devices for machines. In this sense, a series of machines that are NC machine tool, MC (Machining Centers) and industrial robots embody different types of technology which represent a further stage in the technological development. While the technological development of microelectronics still go on and on, the aim of this technology in manufacturing is the factory which "would be run from the order book : orders and materials would go in one end, and would pass through the design, engineering, production and packaging stages and come out the other end, without being touched by human hand."[1)]

In this discussion, we must distinguish the technological changes coming from microelectronics, including information technology, from product innovations like biotechnology, high definition television and so on. I am concerned here with the microelectronics (ME) revolution.

The microelectronics revolution has another implication for the composition of the labour force, that is the shift of labour from material production to non-material. M. Castells and Y. Aoyama distinguish "informational" societies by comparing the employment structure among Group of Seven advanced nations. The following is their summary.

"Our empirical observation of the evolution of employment in the G-7 countries shows that a number of common fundamental features do seem to characterize informational societies:

−the phasing-out of agricultural employment;

−the steady decline of manufacturing employment;

−the rise of both producer services and social services (especially business services among the first, and health services in the second);

−the increasing diversification of service activities as sources of jobs;

1) Tom Forester (1987), *High-tech society: the story of the information technology revolution,* Oxford: Basil Blackwell, p. 171.

—the rapid rise of managerial, professional and technical jobs;

—the formation of a white-collar proletariat of semi-skilled clerical and sales workers;

—a substantial and relatively stable share of employment in the retail trade;

—the overall upgrading of the occupational structure over time, with an increasing share going to occupations that require higher skills and advanced education. But it does not follow that societies at large are upgraded in their skills, education, or income status, or in their stratification system. The impact of an upgraded employment structure on the social structure will depend on the ability of institutions to incorporate the labour demand into the labour force and to reward workers in proportion to their skills."[2)]

This distinction between the expansion of information employment and the informatization of work and society caused by the development of information technologies illustrates their view of the information society. I agree with their "hypothesis that information processing is more effective when it is embedded in material production or in goods handling, rather than when it operates disjointedly in a technical division of labour. After all, most automation occurs precisely when information processing is integrated in goods handling."[3)] Starting from this hypothesis, they propose two different informational models: the service economy model (USA, UK and Canada) and the info-industrial model (Japan and Germany). Despite their identifying two models, they seem to regard the latter as implicitly successful. However, I disagree with their view that the Japanese model is more successful. This is because they see today's technological trends as a continuation of past one, don't see the discontinuity between them. In other words, they assume that it is still likely to produce new inventions or innovations as can be seen in the following quotation: "Second, industrial producers of new technologies have been the fastest-growing sectors in the world economy in the last 25 years, and in spite of business cycles they have certainly not yet reached their mature stage, driven as they are by constant innovation."[4)] However, I think differently from them that the technological stage of production of material goods reaches its maturity.

About the Japanese model I refer in this paper, it is the export-oriented industrialisation for catching up with and overtake the West through state intervention in market. Whereas governments lead the market and foster some industrial sectors in this system, it is often likely to generate a close relations between ruling parties and favored corporations and bank.[5)]

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2) M. Castells and Y. Aoyama (1994), "Paths towards the informational society: Employment structure in G-7 countries, 1920-1990." ILO, *International Labour Review.* Vol. 133, No. 1, p. 26.

3) Ibid., p. 14.

4) Manuel Castelles and Peter Hall (1994), *Technopoles of the World—The making of twenty-first-century industrial complexes,* London & New York: Routledge, p. 4.

5) See, World Bank. *The East Asian Miracle* (1993), Oxford University Press.

Table 1 Changes in distribution ratio of workers in employment by industrial sector and occupation in Japan (1975-1990, Except public employee)

Occupation	Industry	Total	Material production[1]	Distributive services[2]	Producer services[3]	Social services	Personal services
Total	1990	100.00	42.47	29.58	12.05	5.94	9.96
	1985	100.00	44.49	30.16	10.02	5.77	9.56
	1980	100.00	46.66	30.27	8.56	5.59	8.91
	1975	100.00	50.44	28.88	7.31	5.62	7.76
Productive workers[4]	1990	39.11	31.17	4.53	1.54	1.36	0.61
	1985	41.51	33.87	4.39	1.29	1.36	0.60
	1980	44.03	36.78	4.02	1.13	1.50	0.61
	1975	46.61	40.08	3.89	0.70	1.58	0.37
Indirect workers[5]	1990	22.28	5.67	9.06	4.63	0.85	2.07
	1985	21.12	5.33	9.06	3.98	0.76	1.99
	1980	20.19	5.37	8.71	3.60	0.66	1.84
	1975	20.39	5.90	8.78	3.43	0.69	1.60
Administrative & managerial workers	1990	4.12	1.71	1.28	0.76	0.19	0.18
	1985	4.06	1.79	1.32	0.60	0.18	0.17
	1980	4.78	2.17	1.60	0.63	0.18	0.21
	1975	4.28	1.96	1.42	0.55	0.18	0.17
Sales workers	1990	14.83	1.65	10.76	2.16	0.24	0.03
	1985	14.77	1.38	11.38	1.77	0.21	0.02
	1980	14.89	1.16	12.07	1.48	0.16	0.02
	1975	13.80	1.21	11.25	1.19	0.13	0.02
Professional & technical workers	1990	12.02	2.19	0.40	2.62	0.30	6.52
	1985	11.15	2.02	0.40	2.17	0.26	6.29
	1980	8.86	1.05	0.31	1.55	0.23	5.72
	1975	7.64	1.02	0.31	1.15	0.22	4.95
Service workers	1990	7.53	0.08	3.55	0.34	3.01	0.55
	1985	7.37	0.09	3.60	0.22	2.97	0.50
	1980	7.26	0.15	3.56	0.17	2.86	0.52
	1975	7.27	0.26	3.23	0.30	2.84	0.63

1) Agriculture, Forestry and Fishing; Mining; Construction; Manufacturing; Electricity, gas, heat supply and water.
2) Wholesale and retail trade and eating and drinking places; Transport and communication;
3) Financing and insurance; Real estate; business services in Services.
4) Agricultural, forestry and fisheries workers; Mining workers; Craftsmen, production process workers and labourers.
5) Clerical and related workers; Workers in transport and communications occupations; Protective service workers.

Source: *Population Census of Japan.*

Recent Occupational Structure in Japan

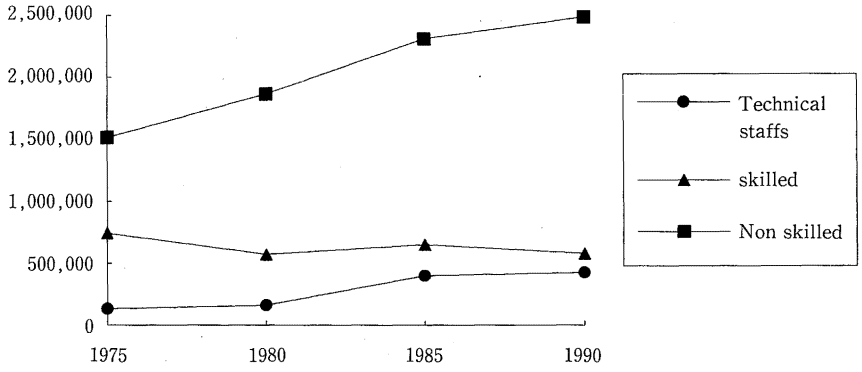
Table 1 shows the changes in the composition of employment in Japan by industrial sector and occupation from 1975 to 1990. As is well known, it is very difficult to classify services employment. Although the classification employed in this table is similar to that of Castells & Aoyama, there are a few differences. For example, we include eating and drinking places in the distributive services, while they include those in the personal services. As a result, in this table "the percentage for distributive services becomes overestimated and personal services becomes underestimated"[6], for eating and drinking places make up a considerable part of service industries. However these differences of classification don't cause a serious problem in analysing the implications of the information society.

The trends indicated in Table 1 generally support the common fundamental features of information society cited above. Although, as we lump the primary sector together under "material production", the decline of material production may appear exaggerated, employment in the Japanese manufacturing sector is not always as stable as Castells & Aoyama emphasise. Even when we define goods-handling workers in a more narrow sense, that is "productive workers in material production" in Table 1, the ratio of productive workers in manufacturing industry to the total workforce tends to fall off.[7] In contrast to these workers, the increases of producer service sector are remarkable. Looking at occupational employment, we can see that only professional and technical workers have increased as a proportion of the workforce. This means that the service economy or information economy results in an increase of professional and technical workers rather than service workers in the narrow sense of the word. In this respect the figures in Table 1 support Castells & Aoyama's hypothesis that: "most automation occurs precisely when information processing is integrated in goods handling."

We may note, in passing, that "Japan shows significantly lower level of employment in social services than do other informational societies." I agree with Castells & Aoyama in thinking that the increase in social services is "linked to the impact of social movements rather than to the advent of postindustrialism", and I accept their explanation that Japan's lower level of social services "probably arises because of the structure of the Japanese family and the internalization of some social services in the structure of firms: a cultural and institutional analysis of the variegations of employment structure appear to be necessary if the diversity of informational

6) Castells and Aoyama, op. cit., p. 31.
7) Kunio Hisano (1991), *Gendai Shihonshugi no Seisanryoku Kôzô.* (The Structure of Production in Modern Capitalism), Aoki-shoten.

Figure 1 Changes of the structure of division of labour in Japan



Source: *Population Census of Japan.*

societies are to be accounted for."[8] Nevertheless, Castells & Aoyama regard Japan as an example of good economic performance similar to Germany. Yet the social structure in both countries is very different. The competitiveness of German capitalism handicapped by a strong labour movement, whereas Japan is free not only of such a labour movement, but also the burden of social security. And I suggest the poor level of social security in Japan is one of the reasons why the Japanese household saving rate is so high.

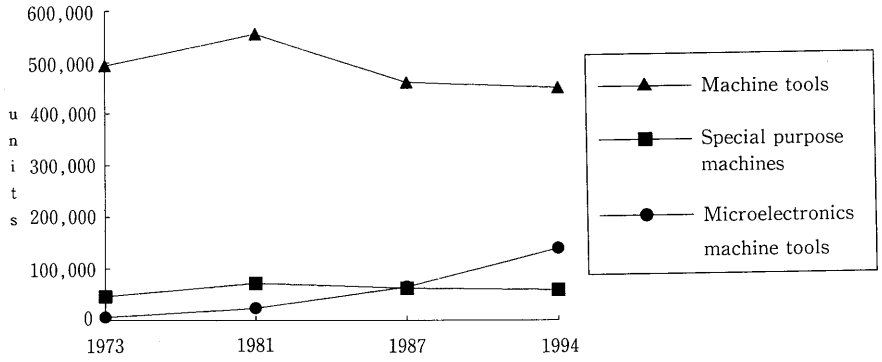
To return to our main subject, the social and economic changes now in progress associated with the information society or service economy result in changes in the process of production or occupation rather than change in the structure of industry. In other words, rather than a relative decline in the industrial sector, and a corresponding increase in the service sector, more and more professional and technical workers engage in the production of tangible products. The increases of producer services are a reflection of these change on the social division of labour. In my view, the microelectronics revolution underlies these changes. In this sense, I conceptualise the structural changes in occupations based on the automatic manufacturing process mentioned above as the changes in the structure of production.

The Structure of Production in Machinery Sector

Figure 1 shows the changes of main occupations in machinery sector 1975 to 1990 based on Table 2, in which production and related workers are divided into two groups depending on their level of skill. But this grouping is based only on my interpretation of the classification of minor occupation groups. We have no definite data on workers' skill in Japan, because companies

8) Castells and Aoyama, op. cit., p. 27.

Figure 2 Changes of the technological stages



Source: MITI, *Kôsaku-Kikai Setsubi Tôkei Chôsa.*

employ workers without any particular skill, and workers' skills are mainly built up through on-the-job training. Generally speaking, the distinction in Japan between skilled and unskilled work is vague. As we shall see later, this creates difficulty for an international comparison of employment structure or industrial relations ; strictly speaking, it is impossible to translate skilled works in Japan perfectly. Technical staffs amongst professional and technical workers are separated as a third occupational group.

Figure 2 shows the stages of technological change according my classification from 1973 to 1994. The source is MITI's *Kôsaku-Kikai Setsubi Tôkei Chôsa*, which surveys the installed machine tools in machinery sector, that is ones such as general machinery, electrical machinery, transport equipment and precision instrument. Each machine tool represents each stage or phase of technological development: 'Machine tools' in Figure 2, the old metal cutting machine tools such as lathe and balling machine, represents the machine stage; 'Special-purpose machines' corresponds to the automation (a perfect phase in the stage of machinery technology); 'NC and MC' (numerical-control machine tool and machining center) is manufacturing process based on microelectronics revolution.

When we contrast Figure 1 with Figure 2, we see the gradual transition from old metal cutting machine tools to microelectronics forms of labour, above all from 1981 onwards, and a corresponding increase of technical staff and unskilled occupation. However, the exact relationship between machine tools and skilled workers, special-purpose machines (automation) and unskilled workers, and microelectronics and technical staff is not absolutely clear.

In order to make clear the effect of the microelectronics revolution on the occupational structure, Figures 3-4 show the relationship between the ratio of NC and MC to total installed machine tools and the ratio of technical staff to total workers by minor industry groups in the machinery sector and metal product manufacturing from the 1980s onwards. These graphs show

Table 2 Changes of workers in employment in machinery sector by occupational type

Occupation \ Year	1975	1980	1985	1990
Total	3,741,990	3,896,909	4,780,251	5,096,838
Professional and technical workers	142,960	168,284	414,213	441,564
Technical staffs	131,030	158,044	399,671	426,665
Administrative & managerial workers	183,275	211,524	181,927	187,669
Clerical and related workers	593,055	555,357	680,155	787,822
Sales workers	105,350	101,759	138,328	183,955
Workers in transport and communications occupations	36,065	30,128	30,717	25,565
Craftsmen, production process workers and labourers	2,642,015	2,803,465	3,318,235	3,454,157
Skilled*	744,180	571,114	651,220	580,014
Non-skilled*	1,520,150	1,866,669	2,309,798	2,488,661
Other	377,685	365,682	357,217	385,482
Protective service workers	16,415	13,511	11,439	9,445
Service workers	22,685	12,625	6,909	6,239

Source: *Population Census of Japan.*
*estimates by author

that there is a proportional relationship between the ratio of NC and MC to total installed machine tools and the ratio of technical staff to total workers with a few exceptions. That is electric measuring instruments; motor vehicles, parts and accessories; other transportation equipment and optical instruments & lenses. With the exception of electrical measuring apparatus, they show a high ratio of NC and MC to total installed machine tools and a low ratio of technical staff to total workers. It is noteworthy that the stronger the international competitiveness of that industry, the higher is the ratio of NC and MC to total installed machine tools.

To sum up, the increase of microelectronics technology in any industry generally has caused an increase of research and development (R&D) personnel in that industry; but the relationship between both of them is not always a linear one. In this respect, Castells & Aoyama are generally right. However their arguments "that a significant proportion of producer services are internalized in Japan in manufacturing companies, a feature that could be related to the fast growth of competitiveness and productivity in the Japanese economy", and "that [where] Japanese and German firms do use such services, it is probable that they rely on a specific organizational structure that ties producer services more closely to the production process within the firm"[9] are wrong. Rather, microelectronics technology plays a significant role in productivity and competitiveness. The introduction of NC and MC (microelectronics revolution) increased sharply in the 1980s, while the percentage of technical staff, as shown in Table 3, decreased slightly in the latter half of the 1980s when, because of rapid yen appreciation, Japan's competitiveness becomes

9) Ibid., p. 17.

Table 3 The left wing's share of the vote on union officials (%)

	Nippon Steel (Yahata factory)		NKK (Keihin factory)	
Year	President	Chief secretary	President	Chief secretary
1966	37.6	45.1		
68	26.0	29.9		
70	35.4	36.6	29.9	
72	19.0	16.9	16.9	19.8
74	25.5	27.4	20.7	22.3
76	19.3	21.0	17.8	13.4
78	15.9	18.5	14.6	14.5
80	12.7	14.9	10.8	12.5
82	11.3	12.7	11.6	13.0
84	11.6	11.5	10.1	10.4
86	9.5	10.0	9.6	10.6
88	12.1	12.1	12.3	12.3
90	13.3	13.4	13.2	12.9
92	10.1	10.4	11.9	11.0

Source: Fusao Shimoyama, "Postwar Japanese Capitalism and Labor Union Movement," *The Bulletin of Japan Society of Political Economy,* No. 33, (Tokyo: Aoki Shoten, 1996), p. 92.

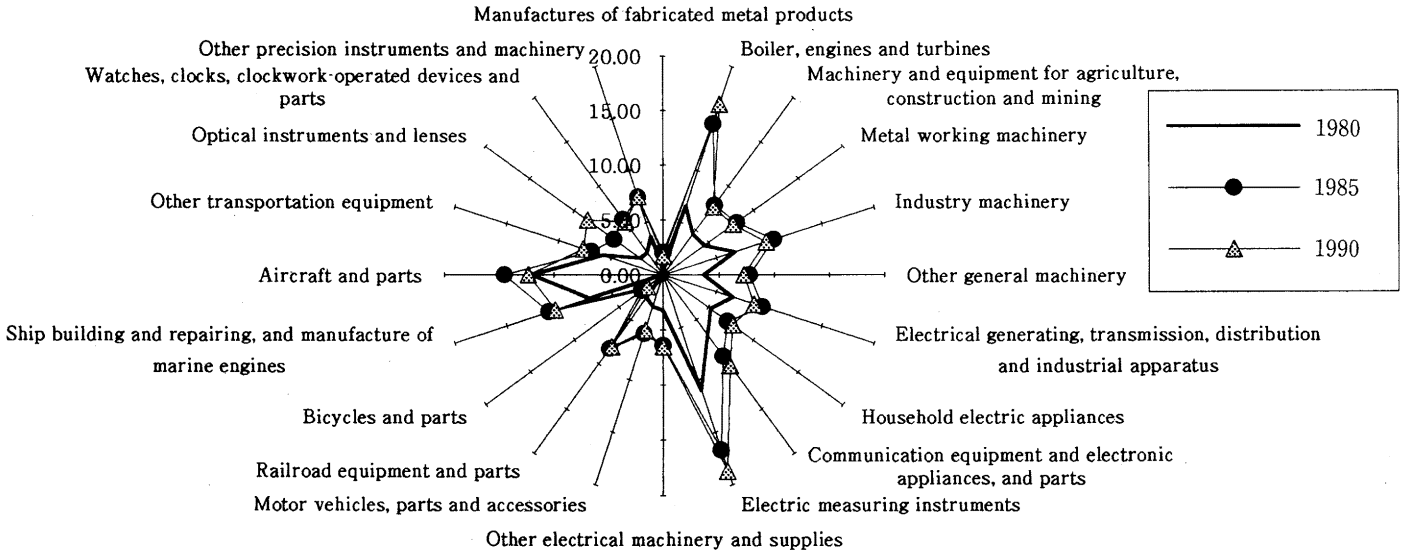
the focus of attention in the rest of the world. It is important to understand why Japanese firms could employ electronics technology so rapidly.

Enterprise Unionism

It is only after the Second World War that Japanese-style employment practices which are well known as lifetime employment, seniority-based payment system, and enterprise unionism, became established. If we define it more exactly according to its spread among people—that is the extent to which people are aware of and behave according to these practices—it might be dated from the 1960s afterwards (see. Table 3). In pre-war Japan, all labour unions were banned, and the agricultural labour force was still a relative majority. Therefore, it is wrong to seek the root of these labour practices in Japanese culture or legacies of feudal society. Rather, the difference in industrial relations between Japan and the West consists in the difference between enterprise unionism and trade unionism.

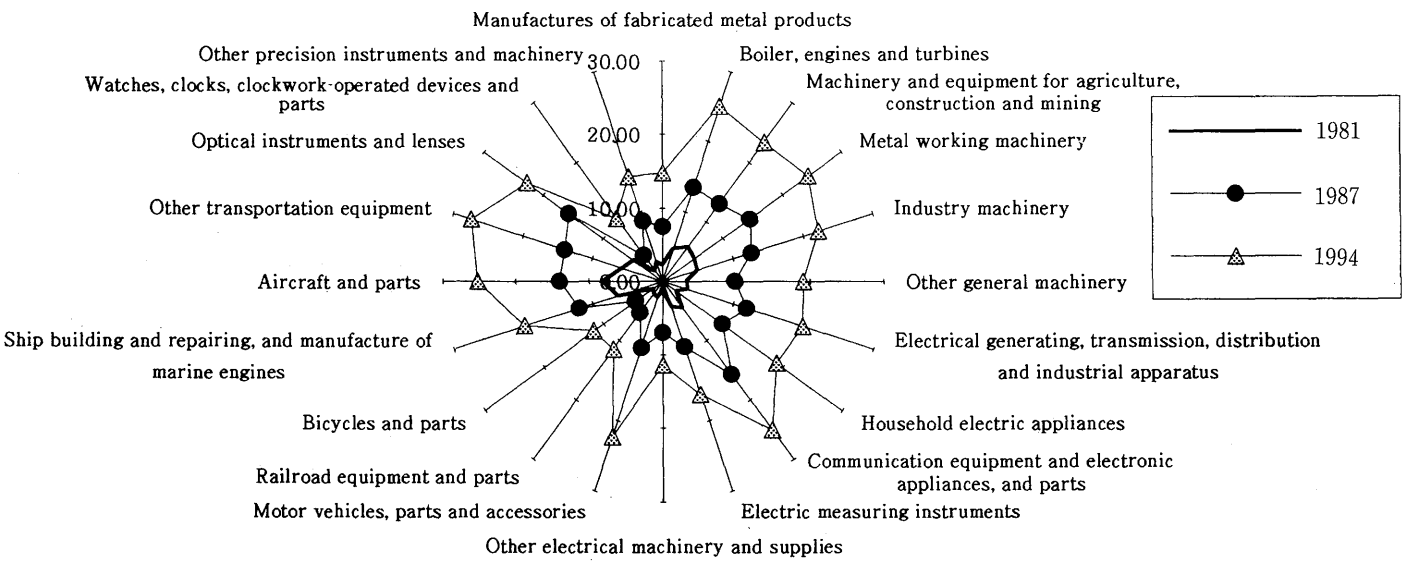
One might argue that because of job security arising from practices like lifetime employment (in fact, long-term employment because there is a mandatory retirement age) and seniority-based wages and promotion, a Japanese company secures employee loyalty thereby enabling investment in human-capital through on-the-job training, which pays off later in the workers' careers. Further, Japanese workers don't oppose the introduction of new technology like mi-

Figure 3 The ratio of Technical staffs by industry (minor group)



Source: *Population Census of Japan.*

Figure 4 The ratio of microelectronics machine tools by industry (minor group)



Source: MITI, *Kôsaku-Kikai Setsubi Tôkei Chôsa.*

Table 4 Top ten commodities that reduced the number of establishments most from 1991 to 1995 (machinery sector)

		Establishments (1995) employee 4～9	(%)
1	Supervisory and control equipment	1,275	9.3
2	Parts, attachments and accessories of audio equipment	1,025	33.9
3	Press dies	3,041	57.6
4	Parts, attachments and accessories of metal cutting machine tools	2,826	59.0
5	Parts, attachments and accessories of video equipment	640	31.7
6	Parts, attachments and accessories of consumer electric appliances	1,796	30.7
7	Parts, attachments and accessories of electronic computers and related equipment	934	26.9
8	Jigs and accessories for metal working	813	55.0
9	Moulds for plastics	2,860	53.8
10	Parts, attachments and accessories of other conveying system	1,601	76.9

Source: MITI, *Census of manufactures* (1995).

croelectronics technology but cooperate with it on the ground that it doesn't threaten their employment. In return, they have to accept the possibility of assignment to any kind of job, for example, in an extreme case from production line to dealership. But it is a mistake to think that craftsman's skills or multi-skills are built up only by on-the-job training. Strictly speaking, in Japan there is no concept of 'skill' as the West, because of the absence of a tradition of craft unionism. In any event, Japan's employers have faced little worker's resistance to the introduction of new technology, and this is one of the reasons why Japan's economy overcame the global depression after the oil crisis of 1973 and drew increasing attention from the rest of the world.

However, it is a fact too that many employers have wanted to revise these practices, that is they have wanted the abolition of lifetime employment and the replacement seniority wage by a more meritocracy system. Further, at present even these practices increasingly exist in name only because of the weakening labour union movement. For employers, it is a matter of balancing employee loyalty and company wage bills. On the other hand, it is vitally important to understand that these employment practices are only effective when limited to a minority of the workforce. Such circumstances exist in Japan. These employment conditions, above all stable employment, apply only to the majority of male regular workers in large firms (around 30 per cent of total workforce). Although small firms also endeavour to keep stable employment, because of their high rate of bankruptcy, there are of no value in attracting qualified workers.

An important feature of the Japanese economy is the fact that there is still a large divergence

in wages, employment conditions, and fringe benefits between those employed in large-scale enterprises and those in small-scale enterprises. In assembly-type industries, such as electrical-goods and vehicle, the final-assembly manufacturer buys many parts from outside, rather than make them in-house. This is because on two social conditions. One is the necessity of making use of the social division of labour indispensable in the machinery sector, and the other is a wage difference between scales of enterprise. By putting these together, a hierarchical relationship comes into existence between the main company and subordinate subcontractors which is peculiar to Japan. A main assembly maker orders systems components from first-tier subcontractors, who make use of a cluster of second-tier subcontractors for specialised parts, and then second-tier subcontractors buy discrete parts from third-tier subcontractors, and so on. In many cases, small or medium-sized firms are treated by the parent corporations as if they are a branch factory. And we should note that the products in which Japan is strongly competitive are mainly concentrated in the machinery sector, while industries such as chemical and shipbuilding industries have fallen into depression. It is in order to make use of the law level of wages in the country that Japan's main semiconductor makers often set up assembly plants in the country as subsidiary companies.

A hierarchical relationship between the main company and subcontractors continues to exist, although the divergence in wages between both could shorten or widen depending on the business cycle. Enterprise unions encourage this further. Kazuo Nimura explains the characteristics of Japan's enterprise unionism in contrast to trade unionism in the West.

"Of these, the most notable is the extremely small number of occupational-based unions or industrial unions against the vast majority of plant unions or enterprise unions. Industrial unions were formed, but they were only loose federations which were unable to exercise much effective leadership for their member unions. National umbrella organisations linking these federations were also formed, but the management of their member unions—decision-making powers as to personnel appointments, finances and union policy—was left to the individual unions themselves.

The second major characteristics is the fact that the membership of most unions include not only blue-collar workers, but supervisory and managerial staff—in fact virtually the entire workforce."[10]

10) Kazuo Nimura (1994), "Post-Second World War labour relations in Japan," in Jim Hagan & Andrew Wells eds. *Industrial Relations in Australia and Japan.*, Allen & Unwin, p. 69. Relevant to this point is his following remark: My tentative conclusion is that there are two main reason why Japanese labour relations have differed from those of the West, in which I include Australia. The first is that Japan has lacked a tradition of craft unionism, and the Japanese artisan's guilds of pre-modern times had little sense of autonomy. Secondly, Japanese blue-collar workers felt no particular pride in being members of the working class and constantly sought to escape working-class status. That they were able to succeed in this was due to the democratisation policies of the post-war Occupation which enabled them to demand equal treatment with white-collar workers (p. 65).

As a result, he continues, "within the company, Japanese workers felt no sense of 'them and us', but it is no exaggeration to say that in those industries where marketplace competition was especially fierce, Japanese workers did indeed come to regard people in other companies as 'them' and all members of their own company as 'us'"[11]. Japanese workers take it for granted that payment differs amongst enterprises. This is the reason why Japanese employers prefer enterprise unions (they don't want unions at all if possible), and try to introduce them into offshore plants.

In conclusion, we can summarise the reasons for Japan's recent economic success as the following. Firstly, Japanese workers have not opposed the introduction of new technology such as microelectronics technology. Japan's employment practices, above all enterprise union, have stabilised its industrial relations. Secondly, large Japanese machinery companies can exploit cheap qualified labour through subcontracting. And finally, Fordism as a mass production of standardised (though relatively new) products is extended through this subcontracting. As mentioned above, Japanese products that have a strong competitive edge are concentrated not only in assembly-type industries rather than process industries, but also in assembly industries manufacturing specific products : passenger cars in the automobile industry, memory-chips in the integrated circuits sector, NC lathe in the machine tool sector, and so on. This means that Japanese firms avoid the risk associated with the early stage of product innovation, instead they give up the lion's share of a new market, wait until the product achieves a mass market, and then begin mass production. In the standardised stage of the product's life-cycle, Japanese firms must expand their market-share in order to exploit economies of scale. Hence the foreign market becomes essential for realising them. Here we need to remind ourselves of the wage difference between different scales of enterprise in Japan. According to Masami Nomura, Japanese firms advance the automation of an assembly-line on the assumption that the parent factory produces largescale products in-house, and makes use of subcontractors for small batch products. Furthermore, the division of labour between in-house production and subcontractors assumes that the conditions of employment in the parent factory are based on a relative high wage rate and stable employment, and those in the subcontractor firm on a relative low wage and the exploitation of cheap unskilled labour.[12]

Conclusion-the Japanese Model at the Crossroads

Looking back on Japanese economic history, Japan's development strategy since the Meiji

11) Ibid., p. 85.
12) Masami Nomura (1993), *Jukuren to Bungyô (Skill and Division of Labour)*, Ochanomizu-syobô, p. 126.

Restoration in 1868 has consistently been one of export-oriented industrialisation. Before the Second World War, Japan had often stumbled because this strategy needed continuous expansion of foreign markets. As a result, pre-war Japan's economy depended on a form of war cycle involving a succession of conflicts: the Sino-Japanese War (1894-95), the Russo-Japanese War (1904-5), and the First World War (1914-17). Finally, Japan's economy fell into a financial crisis in 1927 (Shôwa Crisis) followed by Great Depression in 1929. As a consequence, Japan invaded China and became involved in the Second World War. Moreover, because the products made in pre-war Japan were cheap and law quality, Japan's economic success as an industrial nation has been limited to the post-war period, particularly recent years. For these reasons, I define Japanese model as one of industrialisation to catch up with advanced economies through export-oriented industrialisation.

This model was successful, provided there were foreign markets and it was possible to borrow technology: these were made possible by the IMF-GATT regime, Cold War, and Pax Americana. There was plenty of scope for technological innovation in post-war Japan because of wartime isolation,[13] and Japan was able to have easy access to markets and technology transfer on the grounds through it's in the Western bloc. The economic success of the Asian Tigers exemplifies the effectiveness of this model. But it becomes weak unless these conditions are met. Today, because of the end of the Cold War, western countries have no need to open their domestic market to prevent developing countries from entering Soviet bloc. Moreover, new technologies available for commercialisation are running out. Trade disputes between Asian economies and the West will get worse and worse.

Secondly, this model creates monster companies separated from the domestic economy that dominate domestic enterprises, because they are close to earning the nation's trade surplus as its principal breadwinners. A hierarchical relationship between the main companies and the subcontractors in Japan and the anomaly of a strong yen abroad and a weak currency at home, illustrates this. A symptom of this is a Japanese type hollowing-out in industry. Table 5 shows the top ten commodity group in the machinery sector that most reduced the number of establishment between 1991 and 1995. Half of them produce components of final products, and the remaining four manufacture some kind of machine tool. Together they comprise a huge concentration of small and medium-sized, but technologically very sophisticated, firms in Kantô (the area around Tokyo). Faced with the continuation of a strong yen, Japan's companies have been

13) See for example, Penelope Francks (1992), *Japanese Economic Development – Theory and Practice.* (Routledge), p. 192. "But the weakness of Japanese 'indigenous technological capacity' was revealed by the widening technology gap which emerged as Japan became increasingly cut off from her sources of foreign technology prior to and during World War II."

shifting production abroad. Assuming that a hierarchical relationship between the main company and subcontractors stays alive in Japan, a hollowing-out in industry is caused by the disappearance of small to medium sized components industries and machine tool firms rather than manufactures of final products. This could, therefore, cause a decline in the productive capacity of the national economy as a whole.

Finally, what matters most is the impact of microelectronics on economic activity. In my view, a change is occurring in the structure of production globally at present. This means the end of the machine stage in technological development. More and more, in this new technological stage service inputs such as software, design, and knowledge make up a large part of value added to a product. In this stage, innovation with respect to existing product (or the simulation of new product) through addition of service inputs is more important than producing more cheaply. Thus, there is a transition from an industrial to a sort of 'perpetual innovation economy.'[14]

Japanese model is effective, when the objective is to catch up in the production of product for which there is already a prototype. The iron triangle of bureaucrats, LDP politicians and big-businesses, has worked as follows: firstly MITI sets the technology goal to ami to catch up, then selects suitable big companies in which LDP politicians are partly involved, thus arranging the legislation, including subsidisation, to accomplish this goal. If there is no prototype, however, the model doesn't work. One feature of the information era is the emergence of newcomers like the computer game maker Nintendo that appear outside MITI's policy.[15] As *the Economist* points out, "Japan's over-regulated economy discourages innovations and imposes high costs on businesses, such as exorbitant fuel and telecommunications charges. In 'creative' industries, such as software and media, which are booming in the West, Japan is way behind, isolated by language and hampered by a conformist educational system."[16] Assuming that Japanese model is deadlocked, the rising Asian economies will also face similar problems sooner or later.

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14) Tessa Morris-Suzuki (1985), 'Robots and Capitalism'. *New Left Review.* No. 151.
15) See Tessa Morris-Suzuki (1994), *The Technological Transformation of Japan: From the Seventeenth to the Twenty-first Century,* Cambridge University Press, p. 221-2.
16) *The Economist.* January 13th-19th 1996, p. 63.