

Comparative Industrial Relations  
CIR/88/184

ADAPTATION IN JAPANESE MANAGEMENT: THE ENGINEERS CASE

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Discussion Paper  
No. CIR/88/184  
November 1988

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\*This is a revised version of the paper presented at the British Association of Japanese Studies Conference, Teteley Hall, University of Leeds. 6-8 April 1988.

### Abstract

Recent technological innovations have brought about a rapid growth in the number of engineering professionals and technical specialists in Japanese companies, particularly in the electronic and information technology industries. This drift towards specialisation among the Japanese workforce and the increasing demand for high-level skills and technical expertise are said to be creating tensions in the generalist-oriented personnel management strategy adopted by the major companies. This paper examines the current state of the 'engineers problem' and the emerging policy issues as revealed by two recent studies: (1) The Japan Productivity Centre (JPC) Study on R & D Engineers (1985) indicates the existence of a severe mismatch in expectations and perceptions between top management and engineers in the areas of career development pattern, reward structure and methods of skill development. (2) The Denki Roren survey (1987) on 2,500 engineers and researchers indicates a high level of dissatisfaction and professional insecurity among these people. Four key policy issues with regard to technical specialists in the areas of recruitment, utilisation and career structure, reward structure and skill development are discussed in this paper. Recent survey evidence indicates that major firms are rather reluctant to introduce drastic changes in the current pattern of personnel management system. Top management of major companies are well aware of the fact that the main source of engineering strength in Japan is to have a core group of highly committed, organisationally-minded engineers. The special adaptive strategies introduced in recent years function to preserve the existing personnel management system more effectively for a smaller number of core engineers and technical specialists. However, the conflict between the need to encourage the innovative endeavours of talented young engineers and the need to preserve a seniority (*nenko*) element in career hierarchy design and in the distribution of rewards, still awaits resolution.

## I. THE 'SPECIALIST ORIENTATIONS' OF ENGINEERS<sup>1</sup>: A CHALLENGE TO JAPANESE MANAGEMENT?

Long-term commitment, the seniority (*nenko*) wage system, a career development policy based on regular job rotation and self-development through learning on the job (O-J-T) are regarded as the most salient features of personnel management policies adopted by large companies in Japan. These policies tend to encourage the formation of generalist rather than specialist orientations among the employees. They also encourage the strong identification of the employees with the company rather than with external professional or occupational groups. Until recently, this generalist personnel management strategy has operated with great success and indeed is often regarded as a major factor contributing to stable labour-management relations and hence high productivity.

Recent technological innovations have brought about a rapid growth in the number of engineering professionals and technical specialists in Japanese companies, particularly in the electronic and information technology industries. According to the *Population Census of Japan*, in between 1980 and 1985, the total number of employed persons increased by 4.4 per cent; in the same period, the number of engineers and technical specialists increased by 65 per cent. Among these electrical and electronic engineers increased by 95 per cent and information processing engineers by 147 per cent (Table 1).

The upsurge in the number of technical specialists and the increasing demand for this group of employees are said to be creating tensions in the current pattern of personnel management systems. Friedman's recent article in the *British Journal of Industrial Relations* on 'Specialist Labour in Japan' explores the way in which the need for more computer skilled staff in Japanese companies is creating tensions in the generalist personnel management strategy and leading to certain unproductive side effects in the computer services industry (Friedman, 1987). A recent survey by the Japan Productivity Centre indicates a high level of dissatisfaction among Japanese engineers with the existing personnel management system particularly with regard to the *nenko*-based career pattern and reward structure (Japan Productivity Centre, 1985). Results from the STICERD current comparative research on the 'Roles and Careers of Electronic Engineers in Japan and the U.K.' show the relatively strong professional/specialist orientations of the Japanese engineers as compared

**Table 1** Numbers of Engineers Employed in Different Specialist Areas in Japan (1970 - 1985)

<u>Area of Specialisation</u>	<u>1970</u>	<u>1975</u>	<u>1980</u>	<u>1985</u>	<u>Rate of Increase between 1980 &amp; 1985</u>
Mining	2,505	3,140	2,796	2,900	+ 4%
Metal	14,140	10,406	12,171	18,800	+ 54%
Mechanical	119,665	104,740	117,936	212,200	+ 79%
Electrical	123,195	107,935	119,499	233,100	+ 95%
Chemical	36,180	29,010	35,940	53,600	+ 49%
Architectural	111,600	141,985	173,537	224,100	+ 29%
Civil	139,805	170,805	178,391	261,300	+ 46%
Agriculture/ Forestry	63,250	59,625	57,717	50,200	- 13%
Information Processing	44,990	80,310	129,763	320,500	+ 147%
Others	45,710	44,345	46,392	68,100	+ 47%
<b>Total Numbers of Engineers</b>	<b>701,040</b>	<b>752,295</b>	<b>874,141</b>	<b>1,444,900</b>	<b>+ 65%</b>
<b>Total employed persons in Japan</b>	<b>52,110,190</b>	<b>53,015,430</b>	<b>55,778,235</b>	<b>58,217,500</b>	<b>+ 4.4%</b>

Source: Population Census of Japan, Statistics Bureau, Prime Minister's Office, Japan.

to the UK engineers. Japanese engineers pay much greater attention to working in a specialist area and on possibilities for research and technical advancement (Thurley, Lam and Lorrinan, 1988).

In the past, when technical specialists and engineers constituted a relatively small proportion of the workforce, a generalist personnel management strategy was not seen as particularly problematic. However, in an era when there is increasing demand for high level technical skills and expertise, particularly in R & D related occupations, and when technical specialists are playing a more and more central role as the 'key movers' and 'system innovators' in the companies, the limitations of the existing personnel management system are being brought to the fore for debate. One crucial question is: How far will Japanese companies introduce major changes in their personnel management systems in the face of the increased specialisation among the workforce?

In this paper, the current state of the 'engineers problem' as revealed by two recent studies will first be examined. I shall then discuss the key personnel policy issues confronting Japanese companies and explore some of the major adaptive strategies introduced in recent years.

## II. TWO RECENT STUDIES ON THE 'ENGINEERS PROBLEM'

### 1. The Japan Productivity Centre (JPC) Survey (1985)

This was an attitude survey on 828 engineers and 449 company directors in the R & D departments of large companies.<sup>2</sup> The main focus of the survey was on the attitudes of both engineers and company directors towards career development and reward structures. The results of the survey reveal the existence of a severe mismatch in expectations and perceptions between top management and engineers in the following areas:

#### (a) Desirable Career Patterns

The survey indicates striking differences in the opinions of top management and engineers with regard to the importance of age in job assignment and career progression. Top management show a strong preference for a seniority based (*nenko*-oriented) career pattern: they expect young engineers to spend the first 10 years of their careers in technical support roles; engineers are not to be given responsibilities for the core

specialist R & D duties until they reach their 30s and the role of project leader is to be taken up by those in their 40s. Among the 449 company directors, only 7 per cent of them think that age is not an important factor in job assignment.

Engineers have very different views from top management on the question of what type of career pattern would be most desirable. Over one-third of the engineers think that age should not be an important factor in job assignment. They would want young engineers in their mid-20s to be given specialist responsibilities rather than spending long years in technical support roles; those in their mid-30s should become project leaders and older engineers in their 40s should be assigned to technical support jobs. In general, they want to see a shift of the core R & D responsibilities to younger engineers.

(b) Reward Structures

Management tend to see up-grading (*shokaku*), assignment to high-level jobs and broadening of scope of work and authority, as the major methods for rewarding engineers with high achievement; whereas engineers want their rewards in the form of higher pay, more bonuses, a greater degree of freedom to carry out research and opportunity for further education. Figure 1 shows the gap between the present methods of reward for engineers and the type of reward desired by them in the future. The study also indicates that a high proportion of the engineers see the present *nenko*-based uniform wage structure as unfair; they would like companies to introduce a differential wage structure for the technical specialists. Top management, however, has strong doubts about introducing drastic reforms in the present wage structure. According to them, to put too much emphasis on individual merit and achievement and to reward the technical specialists differently would have a destabilising effect on work groups.

(c) Methods of Skill Development

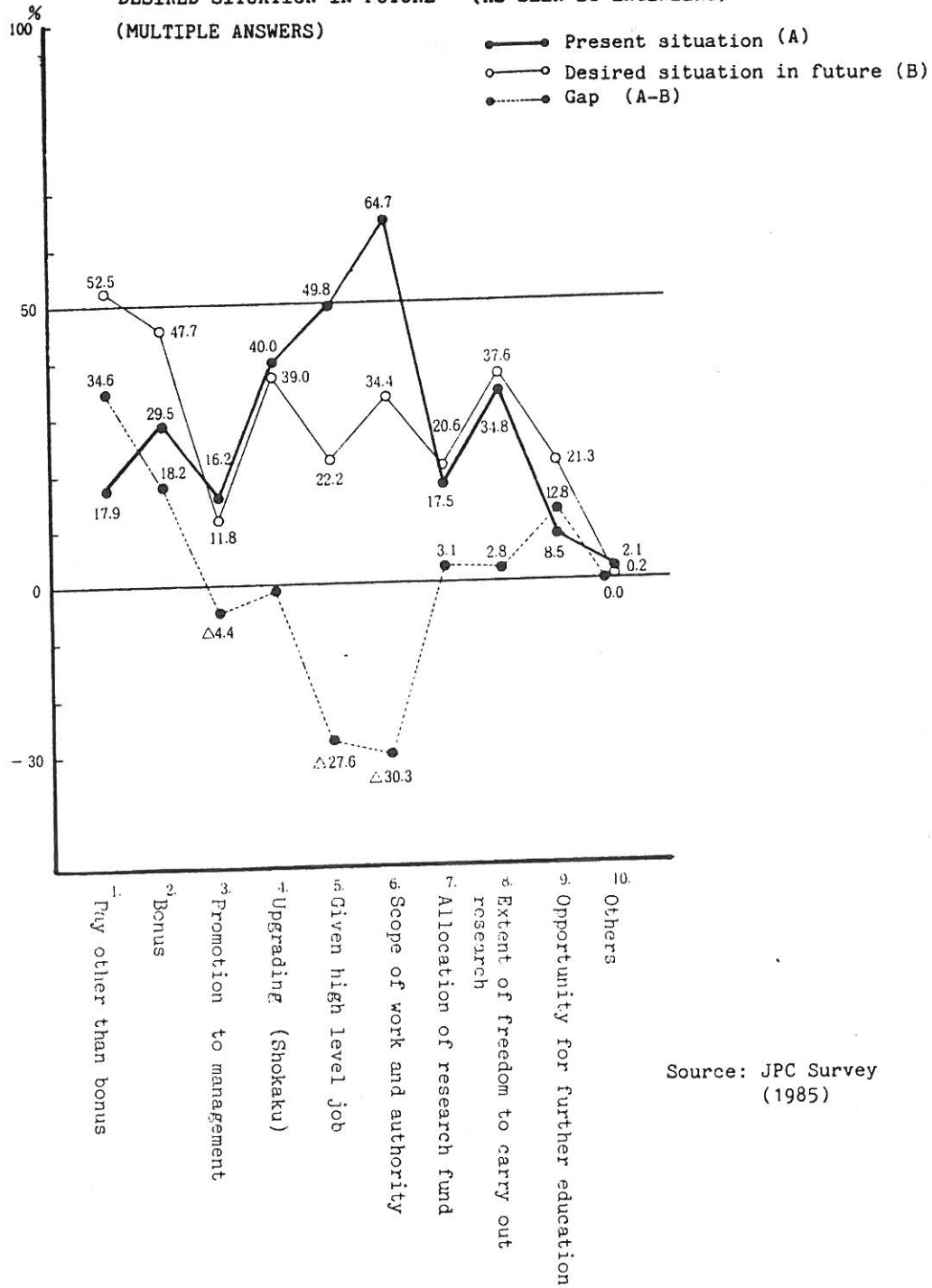
Management regard self-development (O-J-T), rotation to high-level jobs and broad experiences in a wide range of R & D duties as the key methods of skill development; there is a strong belief among top management that learning-through-the-job is the most effective means for acquiring skills and knowledge. The perception of engineers is quite different. Figure 2 shows the gap between the present methods of skill development used by engineers and their opinions with regard to more effective methods that might be introduced in the future. Very few engineers regard



FIGURE 1

METHODS OF REWARD FOR ENGINEERS : PRESENT SITUATION AND DESIRED SITUATION IN FUTURE (AS SEEN BY ENGINEERS)

(MULTIPLE ANSWERS)

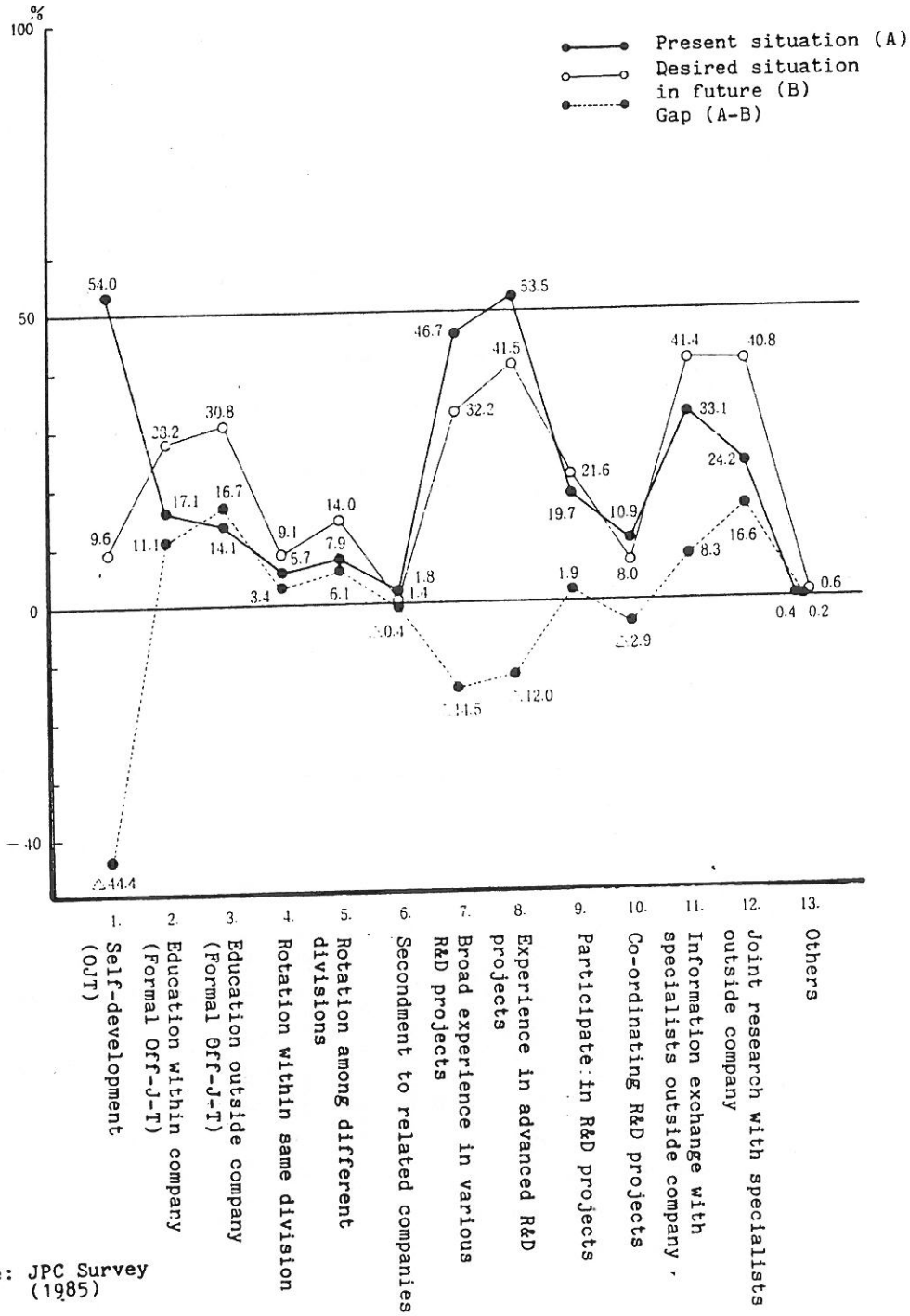


Source: JPC Survey (1985)



FIGURE 2

METHODS OF SKILL DEVELOPMENT : PRESENT SITUATION  
AND DESIRED SITUATION IN FUTURE  
(AS SEEN BY ENGINEERS ; MULTIPLE ANSWERS)



Source: JPC Survey (1985)

self-development as the most effective means of skill development. They tend to see formal off-the-job training, and more opportunities for information exchange and joint research with professionals outside the company, as the most effective means of skill development. These results indicate a strong orientation among Japanese engineers to seek more formal professional development opportunities outside the companies.

(d) Attitudes to Mid-Career Recruitment

According to the survey, both top management and engineers regard the absolute shortage of staff as the greatest problem they are now facing in the workplaces. Despite common recognition of the problem, management has strong reservations about increasing the number of mid-career entrants. They show a strong orientation towards maintaining the present internal manpower development policy. Engineers, however, would want the company to increase the number of mid-career entrants to cope with the problem of skill shortages.

2. The Denki Roren Survey (1987)

The problem of severe skill shortages facing the electronics industry and the need to introduce more effective ability development methods is further highlighted by the results of a recent survey on the attitudes and careers of 2,500 engineers conducted by Denki Roren (Japanese Federation of Electrical Machine Workers' Union).<sup>3</sup> The survey reveals a high level of dissatisfaction and professional insecurity among the engineers. Some crucial findings to emerge from the survey are: (a) 76 per cent of the sample complained about the absolute shortage of staff in their workplaces; (b) 70 per cent said they felt insecure about their professional future and a lack of capability to perform their present jobs satisfactorily; (c) 80 per cent said they needed knowledge and skills outside their own specialisation and (d) 90 per cent of them pointed out that self-development through reading professional magazines and journals and O-J-T were the major methods they used to acquire new skills and knowledge. Most of them felt that these methods were rather inadequate for keeping up with rapid technological changes. A comparison of these results with that of a similar survey conducted in 1979 shows a striking increase in the proportion of engineers complaining about shortages of staff, lack of proper skill development opportunities and inability to perform jobs satisfactorily. Given the fact that these are engineers working in large companies and they are a group of people with skills and knowledge which

are rising in demand, one would expect them to have an optimistic outlook regarding their professional career. Evidence indicates the contrary; the proportion of engineers saying they felt insecure about their professional future has in fact increased over time (Table 2). These results further highlight the constraints and limitations of the current personnel management system in the face of increasing specialisation of the workforce and skill shortages.

Table 2

Proportion of R & D Engineers Feeling  
Insecure About Their Professional Future

	<u>1979</u>	<u>1987</u>
Company A	53.5%	63.0%
Company B	66.9%	71.8%
Company C	61.0%	77.5%
Company D	65.5%	64.2%
<hr/>		
(Average)	61.7%	69.1%

Source: Denki Roren Survey (1979 and 1987).

### III. KEY POLICY ISSUES AND STRATEGIES FOR ADAPTATION

To sum up, there are four major personnel policy issues with which Japanese companies have to grapple in the coming years: (1) recruitment patterns; (2) utilisation and career structures; (3) reward structures and (4) manpower (skill) development strategies. To state the conclusion first: it seems unlikely that major firms will introduce drastic transformation in these policy areas; the basic pattern of personnel management strategy for the core engineers and technical specialists will remain the same. However, major Japanese companies are well aware of the rising importance of technical specialists; special adaptive strategies are being introduced. The pages that follow explore these issues.

#### 1. Recruitment Patterns

The key debate on this issue is whether skill shortages and the increasing demand for high level technical knowledge will force the companies to recruit more mid-career entrants or even to 'poach' qualified individuals currently working in other companies. At present, there is very little evidence of major firms increasing the number of mid-career employees or 'poaching' technical specialists from other companies. A study conducted by the Japan Productivity Centre on the mobility of R & D and software engineers (1987) indicates that there has only been a very slight increase in mid-career recruitment in recent years. Most of the large firms still hold a rather negative attitude towards mid-career recruitment; they would recruit technical specialists from the external labour market only when it is absolutely necessary. The mid-career entrants are often seen as 'problematic people' by top management; they are regarded as 'yoso-mono' (people from outside) and are considered unable to fit into the company culture.

Even in the computer industries where skill shortages are most acute, large firms show strong reluctance to introduce changes in their recruitment practice. A recent survey by the National Institute of Employment and Vocational Research (Dateki, 1987) on the 'Career Formation and Ability Development for Software Engineers' also indicates that the basic personnel policy common to all large user companies of computers, computer manufacturers and software production companies is a traditional internal labour market type, recruiting new graduates and training them within the company. Mid-career recruitment practice does not have much importance in

their personnel policy. These companies point out that 'scouting' (head-hunting) engineers from other companies might disrupt their own personnel management policy, especially in terms of compensation.

How then, do major firms in these industries cope with the problem of skill shortages? It appears that one major adaptive strategy is to contract out specialist services by increasing the utilisation of specialists from subcontractors and manpower agencies. This tendency is most obvious in computer software services where a multi-layer subcontracting structure is emerging. The chief reasons for contracting out computer specialist services, as pointed out by the firms, are 1) to cope with an excessively busy situation and 2) to cope with the lack of sufficient skills in the internal labour market. (Dateki, 187, p.59). The subcontracting of specialist services enables the major firms to have a more or less guaranteed supply of specialist manpower and yet allows them to maintain the stability of the personnel management system for the core employees. However, in the long-term future, it still remains to be seen how far major firms in the high-tech areas can maintain an adequate supply of specialist skills and knowledge without increasing the number of mid-career entrants. In the JPC Survey (1987) on the mobility of R & D engineers, 70 per cent of the companies pointed out that in the future they would inevitably have to increase the amount of mid-career recruitment, but the basic policy orientation is to keep the number of mid-career people to the minimum.

## 2. Reward Structures

The greatest problem to be solved in this area is how to reward the 'high-flyers', without disrupting the company-wide uniform wage structure. At present, very few companies have introduced a separate wage structure for the technical specialists. The majority of the firms have, however, introduced a special compensation system (*hyosho-seido*); a special lump sum payment to be given to technical staff with special achievements or contribution. Recent survey data (JPC, 1987) indicate that, in the future, there will be an increasing tendency for firms to introduce a separate wage structure for the technical specialists (Table 3). There is, however, little evidence that companies will introduce drastic reforms in the *nenko*-based wage structure. The major reasons for maintaining the *nenko*-based wage structure, as pointed out by top management, being that 1) the difficulties in having common criteria for evaluating the performance of different areas of specialisation; 2) achievements and contributions in

the R & D areas need to be evaluated on a long-term basis and 3) given the importance of teamwork in R & D projects, it is undesirable to put too much emphasis on individual merit (Imano, 1986, p.64-5). Despite a generally accepted view that the Japanese wage system is undergoing transformation due to the ageing of the workforce and technological innovations, it is rather surprising that top management have strong reservations about introducing a merit based wage structure for technical specialists.

**Table 3** Present and Proposed Future Wage System For R & D Staff  
(As indicated by company top management)

	<u>Present Situation</u>	<u>Future Plan</u>
Company-wide uniform wage system	93.0%	44.1%
Separate wage system for all technical staff	3.8%	19.9%
Separate wage system for R & D sections	1.1%	24.7%
Separate wage system for research laboratories	0.5%	0.0%
R & D as independent establishment with own wage system	0.5%	7.0%
No response	1.1%	4.3%
<b>Total:</b>	100.0	100.0
<b>Number of companies surveyed:</b>	(186)	(186)

Source: JPC Survey (1987)

### 3. Utilisation and Career Structures

The crucial issue in this area is how to utilise the increasing number of key technical specialists effectively and design an appropriate career structure for them in an organisation where the general management strategy is to encourage generalists. In recent years, an increasing number of firms employing a large number of technical specialists have introduced a specialist career route.<sup>4</sup> The distinction between managerial/specialist career routes is becoming increasingly important. However, despite a formal equality in their rewards and career structures, the managerial career route still enjoys far higher organisational status than the technical one. The JPC Study (1985) found that the majority of R & D engineers regard the present specialist system as rather 'unsatisfactory' and 'problematic'. Over one-third of the engineers complained about the fact that their companies assigned too many middle-aged employees to specialist positions.

In Japanese companies, the term 'specialist' (*Senmonshoku*) has diverse meanings. There is no well-defined or commonly accepted meaning of the status of 'specialist'. At one time during the 1960s, some companies attempted to introduce a specialist career route for their technical staff. Most of the attempts failed because the specialist career route was seen as a secondary career route created for middle-aged employees who could not make their way into management. Until the present day, the role and career of 'specialist' still carries a negative image of someone who has failed to enter mainstream managerial positions. Masumi Tsuda, an expert on personnel management in Japan, points out that the nature of Japanese personnel management is not conducive to the formation of 'specialists' or 'professionals' in the European sense (Tsuda, 1981, p.195). A strong emphasis on the collective performance of the work group and task flexibility based on frequent job rotation means that individuals are not encouraged to identify with a specific task or specialist work role for a long period of time. Tsuda proposes that one possible way to develop specialist work roles in Japanese companies, without causing major disruption to the overall personnel management system, is to create a 'Japanese type' of specialist, which he refers to as 'multi-skilled specialist' - a person with a high level of competence in a specialist area who, at the same time, possesses a wide range of versatile skills developed through on-the-job-training and systematic job rotation (Tsuda, 1981, pp.209-210). This proposal has the advantages of allowing the company to maintain a high degree of organisational flexibility and technological



adaptability and, at the same time, reducing the danger of marginalisation of specialists in a generalist oriented work organisation. The systematic formation of this new type of 'multi-skilled specialist', however, requires a new approach to training and skill development.

#### 4. Training and Skill Development Strategies

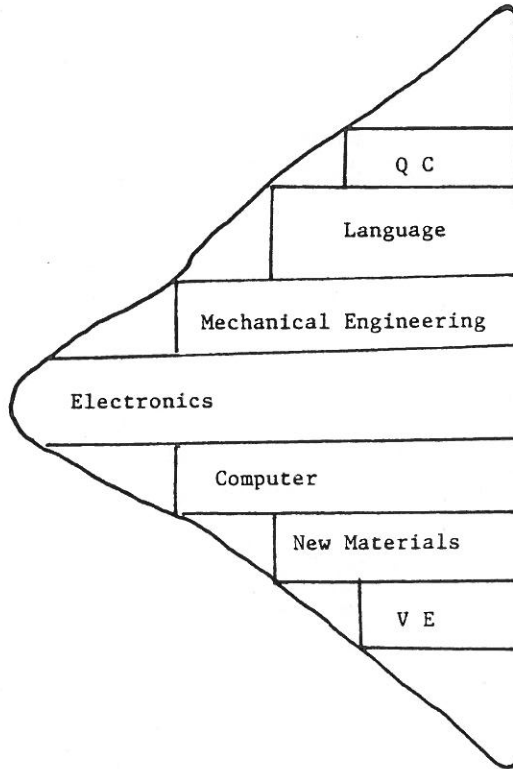
Rapid technological advance has brought into doubt the adequacy of the traditional approach to skill development based on long-term O-J-T and self development. Increasing convergence of new technologies implies that there is an increasing need for multi-skilled technical specialists. In recent years, some major companies in the electronics industry have already shifted their manpower development strategies from the traditional egalitarian type of O-J-T to more systematic formal training for selected groups of elite engineers. The new approach reaffirms the importance of continuous self-development but this is supplemented by the introduction of more extensive (and intensive) off-the-job forms of learning (Wersky, 1987, p.14). Not all engineers will benefit from the new approach; only a small minority of key 'system innovators' will be selected for this special type of training.

A typical example is the Mitsubishi Electric Corporation's Engineering School (*Jiku*) (introduced in 1985). The purpose of the Engineering School is to train a small number of 'multi-skilled engineers', who will act as key system innovators and project managers in the future. Each year, 20 engineers in their early 30s are placed on an intensive one-year training course at their Kobe Training Centre. The training course is deliberately designed to equip the engineers with a broad range of skills and knowledge outside their own specialisation. This is based on the company's belief that the type of engineer needed most in an era of rapid technological innovation is not the traditional type of specialist, but someone with a wide range of technical skills and knowledge (in addition to their own specialisation) who can cope with rapid change and the increasing convergence of new technologies. The company describes this type of engineers as 'Fuji-Mountain Engineers' (*Fujiyama-gata Jinzai*) (see Figure 3).

On the basis of the author's interviews with the personnel staff of major electronic firms, it appears that company-based long-term education and training will remain the key manpower development strategy for the core engineers. However, the shift towards a greater emphasis on more systematic

formal training for selected groups of engineers implies that in Japan in the future there will be a clear-cut polarisation between the 'elite engineer' and the ordinary type of engineer (Imano, 1986, p.67).

FIGURE 3  
Mitsubishi Electric Corporation's Concept of 'Fuji-Mountain Engineer'  
(An Example of a Mechatronics Engineer)



#### IV. CONCLUDING REMARKS

The increased need for specialist technical knowledge and expertise underlies the emergence of a new type of engineer and technical specialist in Japanese companies. These people aspire for more autonomy in their work environment and more opportunities for professional development, which has brought into question the effectiveness of the existing personnel management system in maintaining the innovativeness and morale of this group of employees. The question raised in this paper is how far Japanese companies will introduce changes in their personnel management systems in the face of these new challenges. Our analysis indicates that major companies are rather reluctant to introduce drastic reforms in the existing personnel management system for their core engineers. Top management are well aware of the fact that the main source of engineering strength in Japan is to have a core group of highly committed, organisationally-minded engineers. The adaptive strategies introduced in recent years, function to preserve the existing personnel management system more effectively for a smaller number of key engineers and technical specialists. However, the conflict between the need to encourage the innovative endeavours of talented young engineers and the need to preserve a seniority (*nenko*) element in career hierarchies and in the distribution of rewards still awaits resolution.

Finally, there is the question of whether a system which puts heavy emphasis on group performance and appraisal on a collective basis operates to suppress individual creativity and innovativeness. Up until the present, there is little evidence that Japanese engineers are less creative than their counterparts elsewhere. On the contrary, in the electronics and computer industries, Japan is rapidly becoming a world leader in technological innovation.<sup>5</sup> Results from the current STICERD comparative research on the learning behaviour of Japanese and British engineers suggest that the Japanese organisational system tends to encourage more effective learning on a collective basis which facilitates faster and more effective transmission of knowledge and skills within the work organisation (Thurley, Lam and Lorrinan, 1988). The emphasis on group achievement and appraisal on a collective basis means that engineers have little to gain by keeping scarce knowledge and skills to themselves; rather it is in their professional interest to pass on knowledge and skills to members of the work group.<sup>6</sup> Further, in a period of rapid technological progress, the capacity to cope with technological uncertainty is crucial to the

competitive strength of companies. The Japanese system, which encourages engineers to acquire a broad range of versatile skills and knowledge through regular job rotation and a continuous process of 'collective learning', appears to have the advantage of breeding a core group of engineers who are highly flexible and adaptive to technological change.

If Japanese companies continue on the path of increased utilisation of technical specialists, modifications in the traditional personnel management system are clearly necessary. However, it appears that top management at major companies will attempt to ensure that such modifications will not completely eliminate the longstanding unique features of Japanese management which have the merit of producing a core group of technical specialists who are highly committed corporate organisational members, but not specialists seeking their identity through individual professionalism.

FOOTNOTES

1. In Japan, the term 'engineer' or 'technical specialist' (*Gijitsusha*) is used in a broad sense to refer to any person deemed to be qualified to work on 'technical' problems. The group or profession of engineers seems to be defined by their tasks and work roles within the production process rather than by their education. In Japan, there is no assumption of being 'professionally qualified' in the U.K. sense. For more detailed discussion of the meaning of 'engineer' in Japan and the U.K. see, Thurley, Lam and Lorrinan (1988).
2. The sample was taken from the central research laboratories, R & D departments or technological development sections of 1,326 large companies (with an average size of 4,509 employees).
3. The survey was carried out in cooperation with 8 workers' unions affiliated to Denki Roren. These include local unions of Hitachi Central Research Laboratory, Institute of Research and Radio of Matsushita Electric Workers' Union, Toshiba R & D Centre, Fujitsu Information Processing Systems Laboratory, New Media of Sanyo Electric, Numazu Works of Meidensha and Tokyo Computer Service. The Survey covers employees who are engaged in technical, development and research jobs and at the same time are local union members.
4. In the JPC survey (1985), about half of the companies have introduced a specialist career route for their staff in the R & D departments.
5. One important indicator of technological innovation is the number of patents registered by engineers. The rapid development of Japanese industry into a world leader in technological innovation is confirmed by a recent joint study by Venture Economics and Computer Horizons, two US industry research groups. According to the study, Japanese patents have risen from 8.8 per cent of all those granted in the US in 1975 to 19.3 per cent in 1987, when their number exceeded the total granted to British, French and West German inventors combined. Equally striking was the quality of the technology concerned, as measured by the frequency with which Japanese patents were cited subsequently by other companies patenting inventions. The study finds that, overall, Japanese patents in the US were cited more frequently than those of any other country, including the US itself. *The Japan Technology 50 Report*, Venture Economics, London 1988. (Quoted in the *Financial Times*, April 14, 1988).
6. The effectiveness of the collective approach in encouraging mutual learning and rapid diffusion of new knowledge in Japanese work organisations is also pointed out by Nohara (1987, pp.21-2) in his Franco/Japanese comparative study on technological innovation in the machine-tool industry: "... in contrast to France, where scarce knowledge possessed by a few engineers serves to enhance an individual's career strategy, Japanese engineers, who have a collectivised concept of their careers, have nothing to gain from keeping their knowledge to themselves. On the contrary, it is part of their professional career to make their knowledge public and to transmit it to others."

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