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SKILL FORMATION OF ELECTRONICS ENGINEERS: COMPARING THE LEARNING BEHAVIOUR OF BRITISH AND JAPANESE ENGINEERS

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ABSTRACT

This paper argues that a task organisation approach, which sees the skill formation process and the learning associated with it as a **by-product** of the task organisation in which the work role is located, is necessary for understanding and interpreting the actual **effectiveness** of the skill formation process. The research reported here follows this approach by investigating the 'learning behaviour' of a small number of U.K. and Japanese engineers in the context of their actual day-to-day work experience, using a 'critical incident' self reporting system over 6 months, followed by tape recorded interviews on their work roles and actual learning experience. The comparison highlights the marked differences between the type of learning opportunities which occur for the U.K. and the Japanese engineers. It illustrates that learning can only be effective from the viewpoint of the organisation if it is seen by the individuals as **relevant** to their present work roles and future careers. The problem of under-utilisation as reported by many of the U.K. university graduate engineers needs to be interpreted in the context of their actual work roles which tend to 'waste' past learning and offer little incentive for 'effective learning' relating to the objectives of the task organisation.

SKILL FORMATION OF ELECTRONICS ENGINEERS: COMPARING THE LEARNING BEHAVIOUR OF BRITISH AND JAPANESE ENGINEERS

1. CONCEPTS AND DEFINITIONS

In this paper we shall use the term '**skill formation process**' to mean the whole process by which individuals acquire (and utilise) work-related cognitive, inter-personal and manual skills, theoretical and applied general knowledge and specific knowledge and information. This process therefore concerns skills and knowledge related to work roles.

Work roles may be seen as a set of expectations of task performance arising from the individual's perception of appropriate tasks which are involved in their occupational role, together with the expectations 'sent' by others in their role set. These include the demands of superiors, colleagues and subordinates within the work organisation. For some, it will also include demands from those who relate to the individual outside the organisation, e.g. customers, suppliers, government inspectors, etc. Such work roles may be dominated by immediate tasks which arise from the operation of a 'production system', (using this term to mean any type of task system which is producing goods and services). They may be dominated by managerial or organisational tasks, e.g. planning, controlling, monitoring, disturbance handling or evaluating. They may also be dominated by a focus on future or possible tasks, such as future products and services.

It follows that '**competence**' - a concept which is much debated at the moment - often cannot be defined in very specific terms, as there may be considerable differences in the expectations of tasks performed and in levels of performance from the various actors who interact with the individual in the course of his or her work. In particular, it is probable that there may be conflicts of expectation between occupationally defined tasks and the task demanded by superiors because of organisational requirements. There may also be demarcation disputes between different specialists as to the boundaries of appropriate tasks. Subordinates may also make demands on individuals which are in conflict with those demanded by superiors.

Qualifications for carrying out a work role therefore are likely to be of two types: general and formally recognised 'paper' qualifications, e.g. examinations passed, professional titles, etc., which are used to screen applicants for employment in the role, and specific job-related task competences which are demanded organisationally before the applicant is accepted as qualified to carry out the role. Qualifications are likely to be related only to a limited range of the actual tasks which the individual performs in the work role. The more the work role involves discretionary tasks, decided by the role holder, the smaller the proportion of tasks which will directly relate to any qualifications demanded. This is also true, the greater the degree of technological and organisational change.

2. MODELS OF VOCATIONAL EDUCATION AND TRAINING

The skill formation process can be analysed from several different perspectives. Each perspective implies a model of vocational education and training and four main models can be distinguished:

a. An education/training institutional model;
b. An individual learning model;
c. A labour market model;
d. A task organisation model.

a. An Education/Training Institutional Model

Most practititioners in this field and many administrators, civil servants and politicians assume, according to this framework, that vocational education and training is simply job-related education and practice in skills. It can be inculcated by investment in learning institutions, which 'process' individuals through a learning programme. The number trained and the quality depends on the resources invested in the institution and the design of the programmes, motivation of the staff, etc.

Historically, in Europe, skill formation was seen as a responsibility of the occupation itself through the institution of the Meister/Apprentice of the Guilds System, but since the nineteenth century special institutions were developed by the state, employers' organisations and the firm (Table One).

Table One Types of European Institutions for Vocational Education and Training

Occupation based	Governmental	Private	Company based
Meister/Apprentice (emulation model for individuals)	Technical College	Specialist School	Training Centre
Professional Association School	Grande Ecole	Correspond-ence School	Manufacturer Training Centres for Customers
	Vocational Training Centres	Employers Associations Schools	
	University Specialist Departments	Business Schools	

There are many varieties of types of institutions within Western Europe and Table One shows some of the complexity introduced by the development of a range of institutions, mostly concerned with 'qualifying' individuals for specific types of vocational jobs. There is a severe problem introduced by the concentration on the learning institution, as the learning is 'off the job'. It can easily be perceived by the individual as irrelevant to the actual tasks demands in the work role and is therefore 'wasted', if it is not translated into actual skill formation. Expenditure figures on institutional costs may therefore be a poor guide to the actual effectiveness of the skill formation process.

b. An Individual Learning Model

Learning theory in educational psychology starts with the problem of how best to design the 'learning situation' for individuals. The model of man used is clearly central to any prescription on educational and training policies. Behaviourist theory leads to an emphasis on the repetition of skills in practice and the reinforcement of 'learned behaviour'. Interactionist theory leads to small group exercises; cognitive psychology focusses on the need for 'student centred' learning in which the frameworks adopted by students and teachers govern the type of knowledge and skills acquired. Vocational education and training is treated as a branch of general pedagogics, i.e. as part of individual development.

This framework is too narrow by itself for understanding actual skill formation processes. The individual is treated apart from the work role. Motivation for learning is crucially affected by the nature of work roles and organisational relationships. Models of class-room dynamics cannot serve as a basis for an analysis of the effectiveness of skill formation.

c. A Labour Market Model

Economists use their central model of 'exchange' to depict vocational education and training as a market in which individuals acquire skills and knowledge and 'sell' these to employers. The neo-classical followers of Human Capital Theory (Becker, 1975) emphasise the decision to 'invest' in skills and knowledge acquisition in terms of individual choice of foregoing immediate consumption for future expected income and in terms of firms who have to decide what resources to devote to training in either specific or general skills in order to achieve acceptable levels of task performance. The internal labour market theorists qualify such arguments by emphasising the extent to which segmentation of labour markets prevents a full open market for hiring labour from operating. Within a 'closed' internal labour market, the return from investment in training is more certain and therefore more likely. Many Japanese economists have tended recently to interpret the reasons behind the alleged superior system of company training in Japan as lying with the life-time employment and seniority systems (Koike, 1983).

The 'market' approach to understanding skill formation is, however, also too narrow a framework for such a complex process. It is highly relevant to understanding the rationality behind the pricing of 'qualifications', but as we have seen this has only an indirect relationship to the factors affecting actual skill formation. It focusses on the decision to invest in Human Capital; it does not deal adequately with the process by which this takes place or its effectiveness. To treat education and training as a market for individuals and employers is, in fact, a considerable over-simplification, even if it is relevant to hiring behaviour.

d. A Task Organisation Model

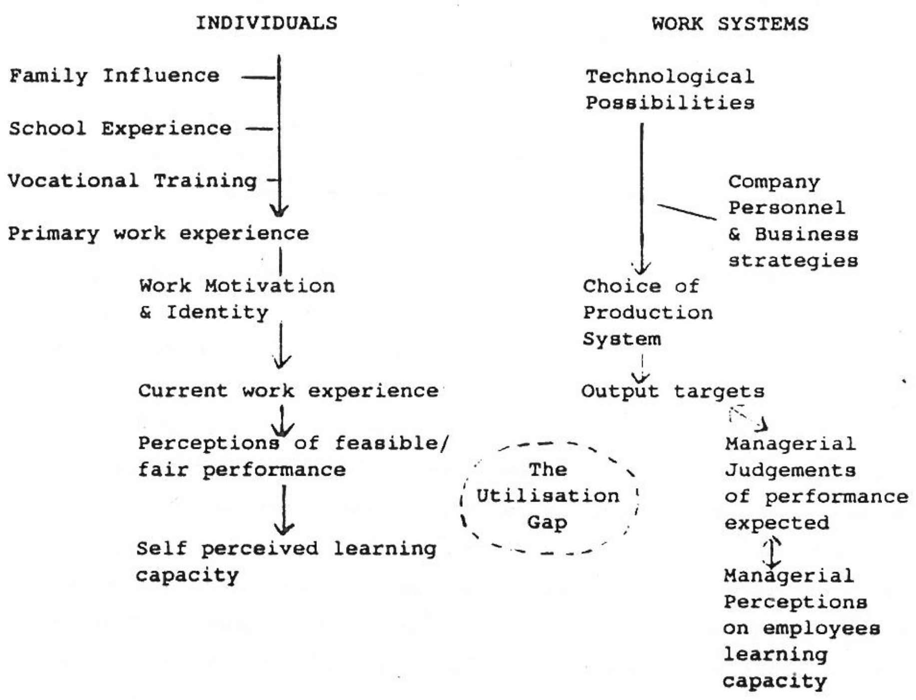
In this paper, we will follow a Task Organisation approach and this was the model used in the research described on the development of the skill formation of electronics engineers. This approach sees the skill formation process and the learning associated with it as a **byproduct** of the task organisation system in which the work role is located. It is misleading to view learning as being in a zero sum relationship with consumption or production activities; it is misleading to treat it as an investment process in human 'capital'. Learning requires motivation and is essentially an **active** response to a problem. Skill formation is firstly a response to demands on individuals from their work roles. Secondly, it only takes place if the learning is **'utilised'** or tested out. The utilisation of skills and knowledge learnt is the essential process by which learning is 'consumated'. This makes the process of effective skill formation similar to that of scientific method (Popper, 1963).

There are many reasons for expecting an 'utilisation gap' (Thurley, 1988) in that the original expectations of new employees are by no means necessarily related to the actual demands upon them (Figure One). Skill formation is seen in this model as a response to these demands. Without demands for task performance, knowledge and skills learnt are dormant and atrophy over time. Future oriented learning also requires demands from actors in the role set, for future task performance. Even learning in the course of basic research must be motivated by the expectations of the individual that it will be relevant to future task performance.

This model therefore directs attention to the daily work process of individuals, rather than to the number of courses attended. (The latter are relevant only if related to the work role). This means that the structure of the socio-technical work (task) organisation **actually experienced** by individuals is one main determinant of the skill formation process. Other crucial determinants are the 'culture' or values dominant in the task organisation and the rewards and sanctions related to learning; the perceptions and expectations of the individuals concerned on the relevance of learning to the work role; the learning skills and capacity of those individuals and finally, but not least, the degree of identity felt by them in their work roles. (If there is any sense of alienation from those work roles, it is difficult to see the relevance of learning which will be utilised.) In a word, skill formation is a process which fits into daily work behaviour and needs to be understood in that context. Different types of task organisation structures and cultures will produce different types of learning behaviour.

One implication of this model is that 'private' learning may be taking place which has nothing to do with the skill formation which is related to actual work roles. Such 'private' learning might be typical of employees who are secretly preparing to quit the organisation and are therefore preparing themselves for a new job outside the organisation. Organisations might be spending a great deal on sending their employees to outside courses, but the level of actual skill formation could still be low. Skill formation is 'effective' only in relationship to the norms and objectives of the task organisation itself. Some task organisations may demand only minimal and repetitive standards of performance in selected skills, but they could be effective in achieving these. Others may be experiencing continuous change in products and knowledge required and effectiveness here is a much more ambitious target.

Figure One A Model of Utilisation of Skills



3. THE RESEARCH PROJECT: COMPARING THE SKILL FORMATION OF ELECTRONICS ENGINEERS AND INFORMATION TECHNOLOGISTS IN THE UK AND JAPAN

Following Schumpeter (1943), it can be argued that large firm R & D investment is crucial for economic growth and that this is particularly so for the electronics industry (Freeman et al., 1982). The enormous success of the Japanese electronics industry in the past 20 years is usually judged to rest on the speed and quality of product innovation and the ability of companies to mass-produce such new products at a low unit cost and price. This has led to a large demand for electronics engineers and soft-ware engineers in Japan.

The current project reported here started with the idea that a comparison of the skill formation practices for engineers in R & D activities in large electronics firms in Japan with those in comparable firms in the UK might throw light on the reasons for growing shortages of specialist technical staff in the British companies. Previous research had, by 1986, already established that engineering graduates in such large companies appeared to be deeply dissatisfied with the level of utilisation of their skills and capacities in the jobs that they had been asked to perform. The graduates reported a lack of demanding tasks, poor organisation of time and a lack of effective technical training and education and career progression. High turnover rates for graduates appears to be common after the initial job training experience of 2-3 years.

American research with similar findings was also reported in 1986. The American Association of Engineering Societies surveyed 2318 of their members who were practising engineers and a further 1035 engineers from 22 high-tech companies (Jones, R.C. et al, 1986). They reported that 90% of their sample thought that excellent utilisation was personally very important or extremely important, but that only 33% of such engineers felt that it was extremely or very characteristic of their employing firms. Petroleum and civil engineering graduates rated the utilisation they had experienced significantly higher than other specialisations; electronics was low (31%). The opportunity to participate in managerial decision-making was one crucial factor affecting the level of perceived utilisation.

A LSE study mission in 1985 into the education and training practices of major Japanese electronics firms showed that acute skill shortages also existed, but that such companies relied on programmed OJT, self-development philosophies, the creation of internal company Technical Institutes and the fostering of long term project team identity to develop specialist skills. The context of such policies was the seniority system (*nenko*), the flexibility of Japanese job allocation, the strong support for development policies from the enterprise unions (where engineers have an increasingly large influence) and the use of contract labour for lower-skilled jobs.

A number of questions required answers, following these studies:

a) What are the real reasons for the UK graduate complaints on under-utilisation?
(Are graduate expectations unreasonable?)

b) What is the effect of the strong emphasis by Japanese companies on self-development and on the job training on the actual skill formation process of Japanese engineers?

c) What type of OJT actually takes place for British engineers?

4. RESEARCH DESIGN

It was decided to investigate these questions by designing a study of individual experience of skill formation focussed on engineers in research and development activities in large electronics manufacturing firms in both countries. As a considerable level of collaboration was required, each engineer had to be interested in the study and had to receive continuous feed-back of results. With support from the UK Institution of Electrical Engineers and the Japanese Federation of Electrical and Electronics Unions (*Denkiroren*), thirteen companies agreed to take part; (Table Two).

Table Two: Companies participating in the UK/Japan study

UK	Japan
GEC Plessy Telecommunications (3 sites)	Mitsubishi Electric
Marconi Communications Systems	Toray Engineering
Thorn/EMI Electronics	Toshiba R & D
Honeywell Bull	NEC
GEC Hirst Research Laboratory	Hitachi Research Lab
Marconi Research Laboratory	Sanyo R & D
	Meidensha

150 engineers agreed to take part in the study. They were mostly in their twenties and thirties. The sample was of volunteers, and therefore is not a random sample, but represents those engineers most interested in participating in such a study. It was hypothesised that this meant that they were probably most interested in self development.

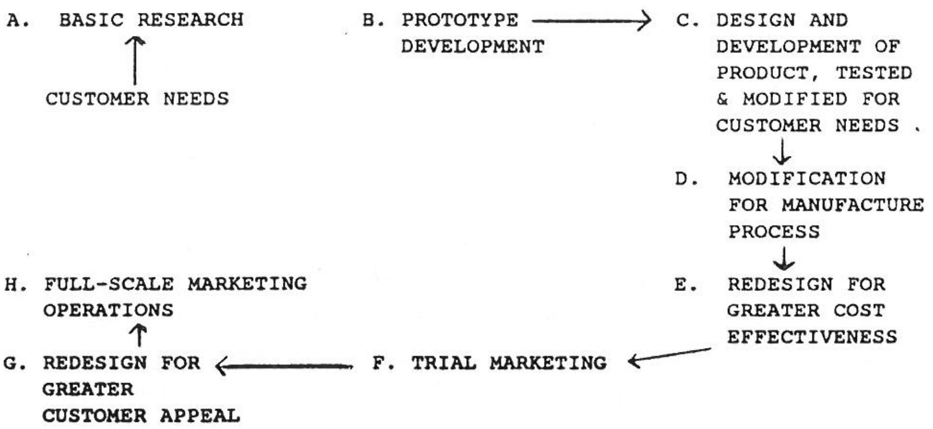
Four types of data collection were used:

1. Career questionnaires;
2. A Critical Incident self-reporting system over 6 months which focussed on 'learning opportunities' which had occurred in their work experience;
3. Tape-recorded interviews on their work roles, careers and actual learning experience;
4. Group discussions following feed-back of such data.

The study lasted from 1987 to 1989 and was completed by two workshops in Japan and the UK discussing the policy implications of the study (July, 1989).

The engineers were selected from research laboratories and development factories. This meant that they were nearly all engaged in work which could be classified as being in the first four stages of the product cycle (Figure Two). Most were in stages B and C.

Figure Two: Stages of the product cycle (Consumer electronics)



It should be noted that the study took place in two languages, with two sets of terms and concepts. An understanding of the results of the study has to reflect both cultures; this requirement was the reason for using workshops to try to stimulate debate and discussion on the findings.

5. FINDINGS

a. It appears that there is a strong contrast between Japanese and UK engineers in that the latter report learning technically specific skills for immediate problem solution, whereas the former report learning more technically general and theoretical knowledge, not directly related to present tasks but more oriented to future project needs (Table Three). 58% of the learning incidents recorded by the British engineers were focussed on present tasks, but only 28% of the Japanese incidents.

Table Three: Types of Knowledge/Skills acquired (Critical Incident analysis) (First Sample) (% of incidents)

	Japan		UK	
	OJT	Off JT	OJT	Off JT
Technical Specific	24%	9%	78%	26%
Technical/General	49	53	6	26
Non-technical/ organisation skills	24	9	13	4
Managerial	1	24	3	39
Others	1	5	-	4
(N = total no. of incidents)	(83)	(58)	(67)	(23)

b. The method of learning is also strikingly different. The Japanese tend to learn in groups, both for formal and informal OJT; the British claim that they learn individually by self-study. This difference may affect the speed and efficiency of the transfer of knowledge and skills within the work organisation. For formal off-the-job training, Japanese engineers tend to rely heavily on classes and seminars rather than formal courses. In most cases, the teacher or trainer is a specialist within the company, although university specialists are also invited to teach on internal company courses. Proportionately, British engineers tend to attend more formal courses both inside and outside the company. There were, however, complaints from British engineers that knowledge and skills acquired from these courses were not connected with their present tasks or career goals.

Table Four: Methods for Learning (Critical Incident Study)
First sample results. (% of incidents).

	Japan		UK	
	OJT	Off JT	OJT	Off JT
Spontaneous:				
Individual	21%		79%	
Pair	15		9	
Group	22		7	
Formal:				
Individual	-		-	
Pair	2		2	
Group	39		3	
Seminars:				
Internal		54%		52%
External		29		13
Courses:				
Internal		11		17
External		7		17
(N = total no. of incidents)	(80)	(56)	(67)	(23)

c. Managerial orientations and aspirations appear to be greater among the UK sample. There is much emphasis on learning to achieve a managerial post.

d. The supervisors' role in stimulating learning is reported to be crucial in Japan, but appears to be of little importance in the UK.

e. From the UK interviews, it appears that the most immediate causes for considering leaving the job were boredom (too little work), underutilisation (tasks too routine) and dissatisfaction with management style and behaviour (lack of organisational competence).

An example here was one UK engineer:

'I am not working under pressure. Don't really enjoy it. I am not getting much experience. Nothing like I expected to get. Well, I am contemplating looking for jobs elsewhere. The same sort of job but with different companies. Probably a small to medium company.'

f. Disillusionment with the technical role appeared to be common among UK engineers, due to the experience of lack of development, isolation, etc. Lack of involvement in decision-making and lack of recognition for technical achievement appears to be very important.

Engineers complained in the UK that:

'I don't think we're very well informed. I think that there's almost a direct policy of not informing the engineers what's happening.'

'I don't get any opportunity to talk to any other division or another department.... You are concentrated to meet your targets. You're forgetting that other people exist.'

g. Many UK engineers reported that initially at least they were engaged on small projects either individually, or with two or three in a project team. Many projects are sub-divided so that individuals are working on their own for a lot of their time. Japanese engineers tend to work in project teams of at least 5/6 people and young engineers work under the close supervision of more experienced members of the project team (on a one-to-one basis) for at least the first 3/4 years of their career. High motivation for learning among UK engineers seems to be associated with strong project team identity and recognition for technical achievement.

h. The emphasis by UK engineers was on increasing opportunities for gaining further qualifications; compared with Japan there were relatively few examples of private study groups, attendance at professional lectures.

6. WHAT CAUSES UNDER-UTILISATION?

a. The first and most obvious factor leading to perceptions by graduates of being under-utilised, is the 'gap' between expectations of being involved in creative problem solving, aroused by university education, and the realities of routine test and design modification work necessary for large standardised products such as telephone switching systems or mass consumer electronics products such as TV receivers or VTRs. It seems clear that corporate decisions to recruit more university graduates do not always extend to considering the exact nature of the tasks they should be employed to complete.

b. A second component of the problem lies with the effect of sub-dividing engineering work according to the various stages of the product development cycle (Figure Two) on job allocation and specialist career routes both within the large firm and between companies. There appears to be evidence that the higher academic performers tend to be taken directly into the first two stages and may stay with that type of work, whereas the lower academic performers gravitate to the more 'applied' stages ('C', 'D', & 'E') where there are fewer graduates employed. Dissatisfaction is probably greatest in 'C' type work as this is a boundary area, not involving research and only a limited amount of design work.

c. A third issue is the concept of 'project' typical in the UK firms studied. 'Projects' were frequently seen as highly specialised and limited, the responsibility of a Section Leader and one or two engineers. This has three consequences: the small project team may be isolated from other teams and functions, the work is fragmented into very small units and if there is a hold-up in the overall programme of work, the project team is literally idle and waiting for reallocation to other work.

d. Fourthly, and at the centre of under-utilisation, in firms with extremely complex R & D programmes, continuously being changed due to a highly volatile market situation, there is often no Human Resource Management function within the R & D organisation to constantly monitor individual learning and reallocate tasks in order to grow expertise. Needs for project completion take priority over skill acquisition. The IBM SkillMaster System shows that it is possible to operate such a function in the UK, but it does require a special set of institutions.

e. A fifth component is the absence of 'expressive' managerial leadership styles for motivating work teams. There seem to be few incentives for young Section Leaders and Project Leaders to take time to motivate and develop their own staff. Some examples did exist, but typically graduates reported minimal contact with intermediate management grades and almost no contact with top management in the Laboratory or Development Centre.

f. To summarise, young engineers' dissatisfaction stemmed from being allocated to individualised and fragmented tasks, often in an ad hoc fashion according to demand, and from lack of monitoring of progress and lack of recognition of achievement.

7. STRATEGIES FOR IMPROVING UTILISATION

a. There are no easy answers to this problem as the issues reported reflect practices which are deeply entrenched and are difficult to change. Research now going on in other European countries (Germany, France, Italy and Sweden) shows that the traditional engineering systems, which are different in each country, are all being subjected to the need for change.

b. At the community level, most advanced and many developing countries are beginning to experiment with the provision of facilities for continuous engineering education. Such schemes involve collaboration between the companies, local educational establishments, local and regional governments, professional bodies and trade unions. Even in Japan, it is beginning to be recognised that companies cannot handle the whole responsibility for the mass educational up-grading of their employees.

c. At the company level, any strategy for change has to arise from a long term business strategy around the development of new designated products. Japanese examples are paramount here.

d. What is needed is the adoption of a Human Resource Management (HRM) System within the R & D organisation and within Production and Customer Service. This clearly means that traditional Personnel Departments have to radically redefine their role.

e. At the work organisation level, it is necessary to move towards the restructuring of engineering work into multi-stage product teams, dealing with various stages of the product cycle. Such teams need to have a relative life span of 5-10 years and might have to be geographically mobile.

f. At the level of the individual work role, two changes could be envisaged: individuals could have more than one role simultaneously, to

allow routine and creative work to be mixed. Individual development and learning also needs to be recorded in a computerised data bank, as it occurs. This requires a regular update of personal CV files by the engineer himself, and is essential as so much valuable experience is 'lost' under the present system.

8. CONCLUSIONS

a. Shortages of technical specialists will persist and maintain a major constraint on economic performance unless the importance of developing technical specialist expertise is recognised. Major changes are required to present practice in large manufacturing firms in the UK.

b. **The** strategy of change required rests on the provision for continuous engineering education within and outside the firm; on acceptance of long-term business strategies around product development and on the stimulation of professional self-development through effective HRM and project team leadership.

In this way, the neglect of the past fifty years might be overcome.

REFERENCES

Becker, G. (1975) <u>Human Capital; a theoretical and empirical analysis</u>; 2nd edition. National Bureau of Economic Research, New York.

Freeman, C., Clark, J., Soete, L. (1982) <u>Unemployment and Technical Innovation: a study of long waves and economic development</u>, Francis Pinter, London.

Jones, R.C., Kaufman, H.G., Frey, C., Lebold, W.K., and Weinschel, B.O. (1986) <u>Enhancing Utilization of Engineers through Continuing Professional Development</u>, 1986 College Industry Education Conference Proceedings (Also Proceedings 1986 World Conference on Continuing Engineering Education).

Koike, K. (1983) 'Internal Labour Markets: workers in large firms', in Shirai, T. (ed) <u>Contemporary Industrial Relations in Japan</u>, University of Wisconsin, Wisconsin.

Popper, K. (1963) <u>Conjectures and Refutations: The Growth of Scientific Knowledge</u>, Routledge and Kegan Paul, London.

Schumpeter, J.A. (1943) <u>Capitalism, Socialism and Democracy</u>, Harper and Row, New York.

Thurley, K.E. (1988) <u>The Utilization of Human Resources: A Proposed Approach</u>, Suntory Toyota International Centre for Economics and Related Disciplines, London School of Economics (Discussion Paper No. CIR/88/182).

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Tawara, Jitsuo, (1987), *Senmon Nōryoku No Ikusei To Katsuyō* (Formation and Utilisation of Specialist Skills), Japan Management Association, Tokyo.

Thurley, Keith; Lam, Alice and Lorriman, John, (1988), *Development of Electronics Engineers: A Japanese/U.K. Comparison*, STICERD, London School of Economics and Political Science, London.

Tsuda, Masumi, (1981), *Jinji Kanri No Gendai Teki Kadai* (Contemporary Personnel Management Issues), Zeimu Keiri Kyokai, Tokyo.

Wersky, Gary, (1987), *Training for Innovation: How Japanese Electronics Companies Develop Their Elite Engineers*, unpublished report.

Westney, Eleanor and Sakukibara, Kiyonori, (1985), *Comparative Study of the Training, Careers and Organisation of Engineers in the Computer Industry in Japan and the United States*, Massachusetts Institute of Technology, Cambridge.