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Special Edition

Treatment of Professionals

Contents

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CONTENTS

Treatment of Professionals

NEXT ISSUE (Autumn 2008)
The Autumn 2008 issue of the Review will be a special edition devoted to **Economic Disparities, Poverty and Labor**.

Introduction

Treatment of Professionals

Research interest in "professionals" has burgeoned in recent years. Classified occupationally as those engaged in specialist and technical lines of work, they have grown in number and are projected to continue to grow in number in the future, and three main areas of research interest may be identified.

The first is the question of how professionals should be treated in terms of pay and other incentives. Due to rising expectations of this class's role as an enterprise's source of creation of value added, Japanese companies have grown more interested in technology management strategy since the start of the 21st century. This has been accompanied by conspicuous moves to develop methods of human resource management that are suited to R&D engineers, such as by reviewing conventional remuneration and career management methods to stimulate the development of in-house professionals and rethinking ways of rewarding employees who make major contributions to the company, and underlying these developments has been rising interest in the treatment of professionals.[1]

The second issue concerns the propensity to move and career management of professionals. In terms of their occupational awareness, professionals are considered to be more committed to their work than to organizations, and also to have greater mobility. Under conventional Japanese employment practices, however, professionals' frequency of movement between enterprises has been low, and they have traditionally been internally transferred and promoted while employed long-term by a specific enterprise. Now, though, this Japanese-style

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1 A recent topic that has had a major impact on us in this context is, above all, that of the fairness of the compensation paid by companies for inventions made by their employees, as highlighted by the lawsuit brought by Shuji Nakamura against his former employer, Nichia Corporation. In its first ruling on January 13, 2004, the Tokyo District Court ordered Nichia to pay Nakamura 20 billion yen as compensation for the rights to his invention. This amount was appealed and a settlement worth in excess of 800 million yen, including delayed damages, was reached in January 2005. Due partly to the large difference between this settlement and the first ruling, this case drew considerable coverage in the media, setting a landmark for consideration of the question of how professionals should be rewarded in Japan in the future.

model of career development is showing signs of crumbling in the face of globalization and intensifying market competition, and more research is needed on how inter- and intra-enterprise transfers are related to the results of R&D.

The third issue of interest concerns professionals' occupational ethics. Because of their advanced expertise and discretionary authority, the professions were originally occupations that needed personal discipline. Recently, however, there has been a rash of incidents involving a loosening of such discipline, such as cases of window-dressing by certified public accountants, heightening concern about how human resources should be managed to ensure that the occupational ethics expected of professionals are followed.

From this albeit brief glance at recent areas of research interest concerning professionals, it should be obvious that more research needs to be pursued following a variety of approaches in order to deepen understanding on this theme.

Addressing the first two areas of interest, therefore, this special issue contains (A) one paper on the role and design of human resource and personnel management as a means of managing R&D personnel in association with technology management strategy (specifically, Fukutani's paper entitled *Changes in Human Resource Management with the Transformation of Technology Management Strategy*), and (B) one paper dealing with the relationship between movements of R&D engineers likely to play an important role in raising corporate competitiveness and R&D results (Aoshima's paper entitled *Mobility of R&D Workers and Technological Performance*) and another paper exploring the pay and other recompense of scientists and engineers (Fujimoto's paper entitled *Employment Systems and Social Relativity from the Perspective of Pay and Benefits for Science and Technology Researchers and Engineers*). On the third area of interest, we include (C) a paper that explores the issue of conflict arising from professionals' having their own peculiar professional ethics while at the same time being located within organizations, i.e., the "local" and "cosmopolitan" problem (Chae's paper entitled *Scientists and Engineers' Occupational Community and Organizations: Their Partial Inclusion and Role Conflict in Organization*).

In his paper, Fukutani demonstrates that, while the prevailing technology strategy pursued by Japanese enterprises to date has been one of improving technologies and playing catch-up, growing globalization, rapid technological innovation and paradigm shifts, and shortening product life-cycles present them with new challenges necessitating the training, utilization, and evaluation of human resources as "developable knowledge assets" with the purpose of developing new products, exploiting new markets and generating new value added. He therefore proposes that forms of management of R&D personnel be developed in order to effect (a) a transition from uniform group-based management to individual multi-dimensional management, (b) a shift to emphasizing work performance rather than length of service as a determinant of remuneration, (c) active use of "technology personnel mapping," and (d) moving from general to individual employment contracts.

The papers by Aoshima and Fujimoto explore the treatment of R&D personnel by focusing on their movements and transfers. Using survey data, Aoshima analyzes the interrelationship with movements within and between organizations to determine whether the movement of R&D personnel encourages innovation. He finds (a) that inter-organizational movements do not always lead to greater technology results and that transfers of implicit knowledge due to movements may not be sufficient, and (b) that inter-departmental rotations do not necessarily increase technology results, and in particular that making engineers move between departments during the initial stages of their careers has a negative effect on subsequent results. Finding (a) suggests that evaluation, pay, and promotion systems can be modified to incorporate engineers who move between organizations smoothly into internal human and information networks.

In her paper, Fujimoto observes (a) that science and technology researchers and engineers in manufacturing receive lower pay than in finance and insurance, but higher than in other industries, and (b) that an international comparison of the treatment of researchers and engineers shows that pay scales tend to be defined more by age at Japanese enterprises than at American and British companies, and that promotion to management positions tends not to serve as a strong motivator, the main motivators instead being increases in research spending and freedom of research. Science and technology researchers and engineers in Japan generally exhibit a low propensity to move, underlying which is their integration with other employees and determination of treatment emphasizing their social relativity among them, rather than their receipt of special treatment.

What then of the relationship between professionals and occupational ethics? On this subject, Chae considers what form the management of human resources should take in order to establish appropriate occupational ethics for the future, with a particular focus on the scientists and engineers who comprise one archetype of the professions.

Chae stresses that in order to understand and predict the attitudes and behavior of professions—and in particular scientists and engineers—working in organizations, it is necessary to employ the lens of the occupational community, i.e., the communities formed by scientists and engineers' sharing of the same specialist field. Thus while scientists and engineers belong to the organizations by which they are employed, they at the same time belong to horizontally-organized professional communities. Focusing on two problems arising from this dual membership—specifically, the issue of inclusion in an organization arising from belonging to an organization, and the problem of role conflict arising from having a role as a scientist and a role as a member of an organization (a conflict tellingly captured by a certain manager's once telling an engineer, "take off your engineer's hat and put on your manager's hat")—he explores the role of human resource management in corporate organizations, which have in recent years been growing more dependent on scientists and engineers, and what form the relationship between professions and corporate organizations should take. He argues as a result that the values and needs of scientists and engineers' groups—in other words, their contributions to their specialist fields, autonomy in research and development, respect for authority, and their external activities as specialists—should be recognized and actively encouraged.

We hope that this special issue provides overseas readers with a useful introduction to recent findings in the Japanese context of research interests concerning professionals.

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Changes in Human Resource Management with the Transformation of Technology Management Strategy

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I. Introduction

The transformation of business strategy will necessitate a realignment of corporate policy on organizational structure and human resources. This paper describes and analyzes how human resource management will need to change and what issues will be encountered as a result of the transformation of technology management strategy. Section II outlines this transformation, Section III describes how the roles that researchers and engineers are expected to play are changing in parallel with the transformation of management strategy, and Section IV puts forward new approaches in human resources regarding the evaluation, pay, and other treatment of researchers and engineers.

II. Transformation of Technology Management Strategy

1. Technology Management Strategy

(1) "Catch-up" Technology Management[1]

One form of economic development policy pursued by developing countries has been "catch-up industrialization." Japan, too, adopted such a policy following World War II, when it adopted basic technologies from advanced industrial countries and concentrated on researching and developing commercial products, developing trial production, and production technologies, and improving and upgrading manufacturing technologies. It pursued development of a system of economic growth that realized rapid industrialization by taking advantage of the technologies that were introduced. The "late development effect" of industrialization functioned effectively.

This mechanism for management of technologies allowed Japan to enjoy favorable conditions in internationally competitive markets. When deciding what areas of research and development (R&D) to invest in, the reliance on developed countries for hard to develop basic technologies made it unnecessary

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1 Fukutani (2007), 7.

for Japanese enterprises to invest in highly uncertain areas of technology for themselves, allowing them to concentrate on achieving incremental innovations in technology instead. Investment in fundamental "breakthrough" innovations opening up new and unexplored fields could as a result be avoided. Focusing organizational efforts entirely on the attainment of known objectives was tied to the performance of the organization's members, and the role of technology development officers at Japanese enterprises has been that of procuring model products and functions and providing goals for improving and reducing the price of such functions.

(2) Intellectual Property Disputes

R&D in Japan consisted of introducing basic technologies from advanced Western countries and focusing on applied research and product development. Technology development aimed at "catching up and overtaking" consequently made Japanese enterprises competitive at raising the quality and lowering the cost of products, and maximum effort was expended on achieving innovations in production technologies and developing applied technologies.

In industries such as the textile, iron/steel, shipbuilding, electrical equipment, audio product, precision instrument, machine tool, automobile, and semiconductor industries, there emerged fields in which Japanese manufacturers surpassed their counterparts in developed economies in the West. From the latter half of the 1980s in particular, Japanese enterprises made striking gains in their shares of markets for "high-tech products," while American enterprises faltered conspicuously, causing trade friction between Japan and the U.S. to intensify.

In order to regain its industrial competitiveness, the U.S. government turned to a policy of strengthening protection of intellectual property, resulting in the introduction of the Bayh-Dole Act.[2] International disputes over patents and copyrights grew more wide-ranging and complex as they came to involve

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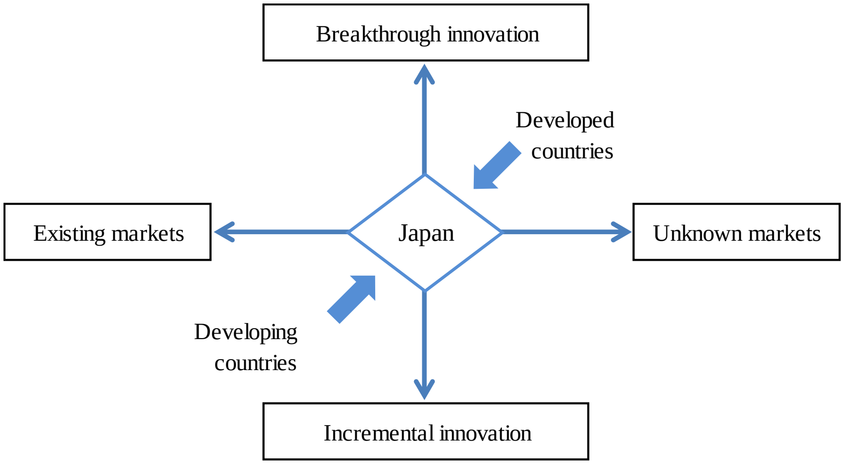
2 The Bayh-Dole Act, as the University and Small Business Patent Procedures Act is more commonly known, is a piece of U.S. legislation enacted in 1980 that allows ownership of patents arising from federally-funded university R&D, which formerly belonged to the government, to be pursued by universities and researchers. The Japanese equivalent of this law, known unofficially as the "Japan-style Bayh-Dole Act," is the Special Measures Law to Revitalize Industry and Universities, which entered effect in 1999 and was amended in 2003.

Figure 1. Pincer-type competitive environment



developing and semi-developed countries as well as developed countries.

International competition to develop technologies is growing fiercer, and there are limits to the extent to which enterprises can dominate world markets by cheaply adopting technologies from developed countries in the West and specializing in product development. Developed countries are now entering an age of cross-licensing, and Japan is involved in global competition to develop advanced technologies, the results of which, it is hoped, will be shared and also granted to developing countries. In the background to intellectual property disputes can be discerned declining enterprises that lack promising technologies for cross-licensing. Japan has been thrust into an age of breakthrough innovations, requiring that it develop its own original technologies (Figure 1).

(3) "Front Runner" Technology Management[3]

Japan has a surplus in the technology trade balance resulting from patent registrations, and is regarded as having almost completely caught up technologically with developed Western countries in certain fields. Japanese enterprises will consequently be unable to continue to growth unless they carve out new frontiers for themselves. If the basic factors of production behind

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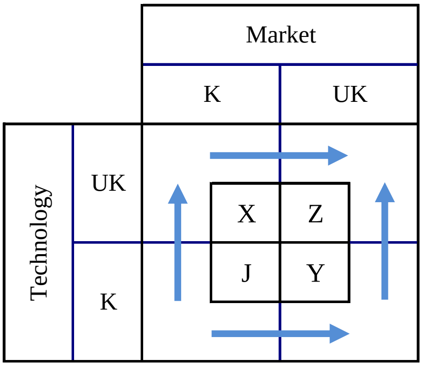
[3] This is an amended and expanded version of Fukutani (2007), chap. 1, sec. 2, "Senryaku Tenkan to Gijutsu Keiei [Strategy change and technology management]".

Figure 2. Technology-market matrix



K: Known
UK: Unknown
J: Japan
X: Development of new products
Y: Development of new markets
Z: Business creation

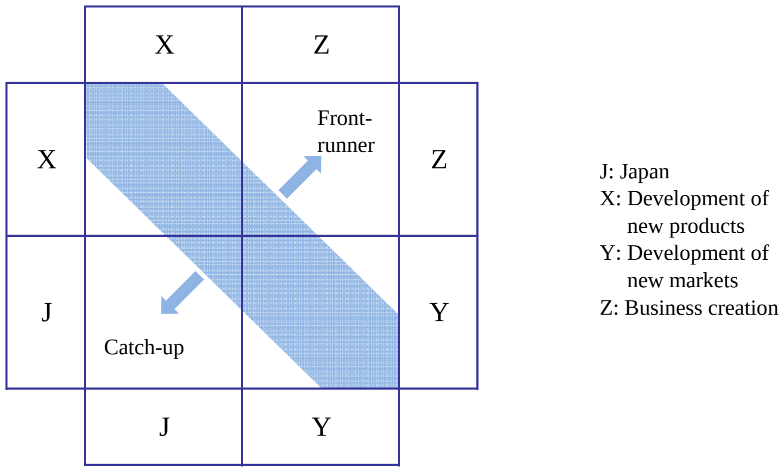
economic growth, such as the supply of labor and capital, are not going to grow as in the past, then it is essential that they secure an advantage in developing technologies in order to attain a certain degree of growth and development (Figure 2).

The key to competitiveness in business is not the development of systems for mass producing low-priced products of uniform quality to meet the needs of mass production and distribution, but rather policy to differentiate and create, and enterprises must abandon the conventional basic paradigm of low-margin, high-volume management in favor of knowledge and know-how driven value-added management.

In the semiconductor industry, for example, the enterprises that generate high revenues are those that develop and manufacture microprocessors according to special specifications and chips based on customer specifications in order to meet customer-specific needs. Their pursuit of unrivalled uniqueness is a form of strategic management that enables them to survive the competition with other enterprises.

Realizing value-added management necessitates developing a domain identity and focusing business resources on creating strong core competences. Only enterprises that can escape the framework of existing competition, generate innovation (technologically and socially), plan and propose new business, and create new markets will be able to survive in the post-industrial knowledge-information society. What decides whether an enterprise rises or falls? It is the enterprise’s strategic imagination and the abilities and resourcefulness of the core human resources that turn this imagination into

Figure 3. Paradigm shift in management



reality. In this age of uncertainty in the business environment, the uniqueness of business development and productivity hold the keys to securing an advantage in competition with other enterprises (Figure 3).

2. Strategic Alliances[4]

(1) Network Formation

The stage on which Japanese enterprises do business is changing significantly as globalization proceeds, enterprises seek to develop original technologies, and measures are adopted to protect the global environment. In order to respond to these changes, enterprises will have to cooperate with multiple partners instead of relying on their own resources alone. Gaining access to new market opportunities will require broad-ranging strategic alliances to enable multiple enterprises to share their respective resources, and this will require the development of network-building strategies.

Corporate organizations seeking to generate customers will have to move from vertical integration to horizontal dispersion of management functions and form loose-knit alliances. Front-runner systems will have to be adopted to gain access to business opportunities from a greater number of more related

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4 For further detail, see Fukutani (2007), chap. 1, sec. 3, “Gurobaru Nettowaku [Global networks]”.

Table 1. Dimensions of transformation of technology management

	Front-runner	Catch-up
Innovation	Knowledge and services	Heavy, chemical, and processing/assembly industries
Technology innovation	Original technologies and breakthroughs	Mass-production technologies and incremental innovation
Organization	Network-type (horizontal/dispersed)	Pyramid-type (vertical/integrated)

Source: Modified from Fukutani (2007), 10.

enterprises and organizations, and to quickly process information, formulate plans, and embark on commercialization.

Operations and functions such as R&D, design and trial production, manufacture and production, sale and after-sales service, and distribution will have to form as independent organizations within a network, with each dispersed organization maintaining flexible partnerships and steadily forming a loose-knit network structure.

(2) Changes in Innovation and Reorganization

Having evolved from beneficiaries of the catch-up age to contributors in the front-runner age, Japanese enterprises must carve out new business in unknown fields and provide new goods and services. The enterprises that play a leading role in the 21st century cannot be at the mercy of the waves of internationalization, but rather play a leading role as innovators, and this means making a switch in business management to a front-runner system.

In developing their operations, organizations must adopt a flexible, flat structure that encourages individual creativity in unknown fields, rather than a pyramid-type organization in which employee groups work together efficiently on known technologies. The barriers separating research functions from other divisions will have to be lowered, and arrangements put in place to form project teams and establish opportunities for interaction among personnel. Instead of pyramid-type organizations suited to top-down communication, enterprises must be reorganized into network-type organizations that encourage individual thinking (Table 1).

Table 2. Industrial division of labor

	Capital intensive (low wage)	Labor intensive (high wage)
Business planning		○
Technology development		○
Design creation		○
Parts production	○	
Assembly	○	
Delivery	○	○
Advertising strategy		○
Financial Management		○

Source: Sakaiya (2005).

(3) International Distribution of Manufacturing Processes

The division of labor in trade on world markets developed into a vertical division in accordance with comparative cost theory. This was based on the idea that the exchange of manufactured products made using developed countries' capital and technology for raw materials and foodstuffs produced using developing regions' natural resources and labor profits both sides.

There subsequently arose a horizontal international division of labor, with industrialized countries engaging in the mutual exchange of manufactured products and conducting in mass production and mass distribution on world markets to worldwide benefit. As a result of the development of computer technologies and advances in the financial markets, capital and technologies were targeted at the optimum locations determined on a global basis.

With globalization, there has occurred an international distribution of manufacturing processes as enterprises have transcended national borders and located their production operations around the world, performing each process in a different region. In the case of large international operations, there are processes at the upstream stage (planning, technology development, and design creation), the midstream stage (production of parts, assembly, and delivery), and the downstream stage (logistics, advertising, financial management), and the processes at the most capital-intensive midstream stage will move to Asia and Eastern Europe (Table 2).

Labor-intensive upstream and downstream processes, on the other hand, which depend heavily on "knowledge human resources,"[5] will become concentrated in the high-wage cities of Europe and North America. While some information software development and video production work will move to developing countries, for example, little planning or scenario development in the film industry will leave Hollywood. Advertising and finance, too, will be concentrated in New York and London.

In the world economy of the 21st century, the growth of the EU and expansion of the U.S. free trade zone to South America will be accompanied by a transplantation of capital-intensive processes to low-wage developing countries to supplement the knowledge-creation processes in advanced, high-wage regions. Hesitating in fear of an influx of cheap agricultural imports, Japan is stuck in the traditional paradigm of a vertical division of labor. In order to maintain its prosperity as a high-wage country, Japan will need to establish the conditions to perform upstream and downstream knowledge-creation processes (Sakaiya 2005).

In the computer industry, a vertical form of organization used to prevail, with one company combining all functions—from the production of semiconductors to assembly of computers, development and sale of software, and provision of after-sales service—as in the case of the industry's standard-bearer, IBM. Naturally, Japanese manufacturers followed suit.

Now, however, business entities occupying world markets are divided up. Microprocessor units are made by Intel, operating systems by Microsoft, and personal computers by Lenovo, for example. Industries are organized horizontally, in other words, with enterprises sharing dominance at each stage. The globalization of markets and manufacturing processes means that neither central control by the parent company nor localized control structures may function properly. Enterprises will therefore need to pursue a transition to network-based organizations that connect the two structures organically.

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[5] For a report of a survey of Asian enterprises concerning the concept, qualities, ability requirements, development, and use of knowledge human resources, see Fukutani (2008).

III. The Next Generation of Core Researchers and Engineers

1. Leading Players in Development of Original Technologies

(1) Exploration of New Fields

The key goal of next-generation R&D by Japanese enterprises will be the creation of new products, technologies and functions. Japanese enterprises traditionally competed on the basis of how efficiently they could manipulate these processes toward achieving a given goal. Cheaply mass-producing general-purpose products was considered important to competitiveness. Standardization, simplification, and specialization were therefore exhaustively pursued and mass-production systems formed through divisions of labor, and cost reduction were adopted as the top priority. Manufacturers in particular depended heavily on accumulation of the “experience effect of mass production” in order to achieve their objectives ahead of their competitors.

This did not of course mean that there was no need to explore unknown fields in the course of improving production processes and reducing costs, and there were cases in which Japanese enterprises succeeded where Western ones had failed in turning basic product development concepts into commercial products. Japanese enterprises have made world-class contributions in applied technology fields, and their *kaizen* activities, designed to achieve continuous improvements in manufacturing processes based on production technology through the collaboration and cooperation of factory workers and engineers, also underlay the high regard in which Japan was admired as the “workshop of the world.”

Superiority in applications, development, and production technology fields will remain an important source of international competitiveness for Japanese enterprises. From the latter half of the 1980s, however, marked changes in the business environment have indicated that enterprises can no longer depend solely on catch-up application, development, and production technologies. They have entered a situation in which they have to achieve comparative advantage through non-price means, such as the development of proprietary technologies and the formation of strategic partnerships, e.g., joint development projects and cross-licensing, as well as through manufacturing cost competitiveness.

In order to survive in the future, Japanese enterprises will have to place an emphasis on creating things that enterprises in other countries cannot make through the development of proprietary technologies.

(2) Encouraging "Individuality"

In order to create new things, individuals with advanced expertise must be allowed to exhibit their abilities to the full. The way out of an impasse often comes from an individual's inspiration.

Japanese enterprises have traditionally focused on raising the homogeneous abilities of their employees as a group; in other words, on raising the general level of skills. In mass-production systems, making organized and effective use of comparatively homogeneous workers made the most sense.

In a corporate culture where the focus is on raising the organized strength of groups of employees, individuality can potentially be suppressed, and it is by no means uncommon for people with particular expertise to find themselves without an outlet and to be buried away inside the enterprise.

The source of an enterprise's competitiveness is shifting away from the homogeneous organized strength of the group and toward the brilliance and inspiration of the individual, and methods of hiring, developing, and rewarding human resources must change accordingly.

Change is required on the hiring side, too, where enterprises have tended to rely on regular batch hiring of fresh graduates and sometimes hiring only from specific schools, faculties, or institutes, all of which can contribute to the trend toward homogeneity.

Post-hiring training has also not always contributed to the development of diverse individuals' abilities. Japanese enterprises typically employ a system of promoting generalists who have gained experience in a variety of work over a period of 10-15 years following their being hired. This horizontally egalitarian method of assigning and treating workers uniformly as a single cohort was certainly a rational approach to developing personnel for promotion to management positions.

When dealing with heterogeneous human resources with special talents, however, it can sometimes be more effective to assign them permanently to a specific field rather than to rotate them around a number of positions. A more varied and flexible approach to allocating and rewarding human resources therefore needs to be employed in order to determine career paths in a manner suited to the aptitudes of the individual.

The single-track career path for developing "future managers" has had a negative impact on the evaluation and development of heterogeneous human resources with special talents, as people who have made their mark in R&D fields also end up being promoted to management positions when they reach a certain age. This is because enterprises have tended not to have any way for their employees to receive higher pay and promotion except by promotion to management positions. The abilities required of a manager do not always coincide with the abilities needed by a top-level R&D engineers. Just as top athletes do not always make good coaches, top R&D engineers are not always necessarily cut out for management.

Japanese enterprises to date have put personnel with a specialist orientation on a management track due to being unable to provide better treatment except by promoting them to management positions. While this is all well and good in the case of people who can display their abilities in such positions, many have found themselves unable to display their specialist abilities as engineers properly due to being exhausted by the task of supervising subordinates.

2. "Concept Creator" Human Resources[6]

(1) Transformation of Research Institutes

In the late 1980s when the U.S. and other developed countries were employing a strategy of boosting industrial competitiveness using intellectual property such as patents and utility models, semi-developed countries in Asia and elsewhere were taking advantage of their relatively cheap labor and energy costs to catch up through a process of capital accumulation, introduction of

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6 This section is based on the results of a "Survey of Goal Setting and Conception Development Skills for Innovative Research and Development" conducted by the Management of Technology Working Group (MOT-WG1) of the Japan Society for Science Policy and Research Management, in which the author was involved. These results were analyzed by MOT-WG1 to determine what kind of core R&D human resources would be needed by enterprises in the future, what roles they would be expected to play, and what methods and conditions could be developed to train such human resources. This survey asked members of the Japan Society for Science Policy and Research Management who belong to enterprises about the roles, functions, and skills development needs of core R&D human resources responsible for innovative R&D. "Core R&D human resources" are here defined as "concept-planning human resources" who establish R&D objectives, devise concepts, and lead the realization of R&D projects.

Table 3. Main roles in innovative R&D

	Past	Future
I. Formulation of basic concepts		
1. Information gathering and discernment of long-term trends	77	60
2. Integration with business strategy and formulation of technology strategy	83	49
II. Creation of R&D proposals		
3. Generation and gathering of ideas	92	73
4. Establishment of R&D objectives (product concepts)	95	81
5. Establishment of R&D plans (basic specifications)	91	40
6. Creation of written proposals	77	18
7. Assessment of written proposals	50	11
III. Performance of R&D		
8. Proposal to and negotiation with concerned parties inside and outside company	91	41
9. Procurement of R&D resources	84	31
10. Formation of teams/members	83	39
11. Pre-marketing	53	26
12. Performance of R&D (invention and product development)	92	48
IV. Commercialization		
13. Production	56	17
14. Sale	52	20

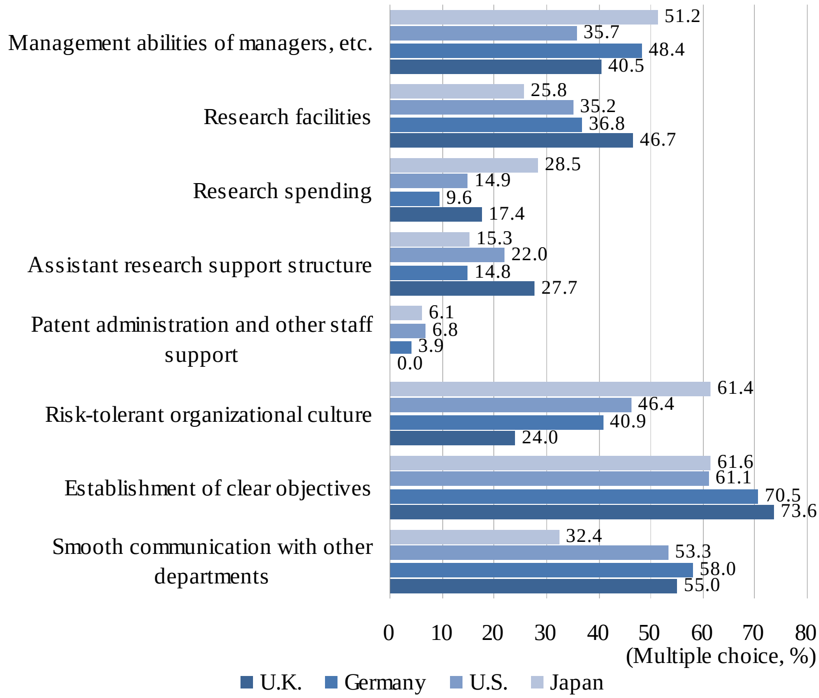
Note: Figures indicate the percentage of valid respondents who circled the response concerned.

technologies, and raising of education levels. As Figure 1 showed, Japan is caught between the patent strategies of developed countries and factory production in developing and semi-developed countries, necessitating a change in business strategy.

The focus of business strategy is shifting to the development of new products and new services. In conjunction with this, it is hoped that R&D departments will escape from being providers of technical support to the business and manufacturing divisions to become strategic divisions in their own right that enhance an enterprise's own core competences and secure competitive advantage.

The Management of Technology Working Group (MOT-WG1) of the Japan Society for Science Policy and Research Management carried out a questionnaire to analyze the roles at each stage of the functions played by core human resources involved in "conventional" development of innovative new

Figure 4. Conditions for successful R&D



Source: *Hatsumei* (May 1993), 65.

products and technologies.

This found that, among the items shown in Table 3, the respondents stressed "creation of product concepts," "generation and gathering of ideas," "invention and product development," "R&D planning," and "proposal to and negotiation with concerned parties within and outside company." It may be observed that roles in realizing the development of innovative new products are dispersed into two phases: II. Creation of R&D proposals, and III. Performance of R&D.

Responses concerning important functions in the development of innovative new products in the future, on the other hand, clustered around a smaller of items.

This indicates that enterprises intend to continue to emphasize the R&D proposal creation stage, and in particular the two steps of "product concept creation" and "generation and gathering of ideas." In contrast, there is a

Table 4. Functions required of concept creators

1.	Information gathering and discernment of long-term trends	3
2.	Integration with business strategy and technology strategy formulation	18
3.	Generation and gathering of ideas	16
4.	Establishment of R&D objectives (product concepts)	39
5.	Establishment of R&D plans (basic specifications)	4
6.	Creation of written proposals	1
7.	Evaluation of written proposals	0
8.	No response	19

Note: Figures indicate the percentage of valid respondents who circled the response concerned.

decline in the importance of the R&D performance stage, and in particular the "invention and product development" and "proposal to and negotiation with concerned parties inside and outside company" stages.

As a result of the survey, it was found that the primary function of human resources in innovative R&D in the future will consist of identifying "product concepts" and setting R&D goals, followed by "generation and gathering of ideas" and "information gathering and discernment of long-term trends."

The Cross-National Survey of Career and Ability Development among R&D Engineers (1988-90) conducted by the Japan Productivity Center for Socio-Economic Development (formerly the Japan Productivity Center) similarly revealed that greatest emphasis was placed on "establishment of clear objectives" as a condition for successful development in the future (Figure 4).[7]

While the key functions in the past were "creation of R&D proposals" and "performance of R&D," the future will see a concentration on the former, and in particular a focus on conceptual planning, exemplified by "creation of product concepts" and "generation of ideas."

(2) Functions and Qualities of "Concept Creator" Human Resources

Next we consider what roles core R&D human resources are most expected to play as concept creators. As Table 4 shows, "establishment of R&D objectives (product concepts)" was found to be the most sought-after role, indicating

[7] For a detailed analysis, see Japan Productivity Center for Socio-Economic Development, (1990a, 1990b, 1991).

Table 5. Reasons for the need of concept creators

Commitment and enthusiasm of individual	80
Intermediary between innovative themes and development of commercial product	42
Acceleration of commercialization	64
Determination of themes by consensus	18
Concentration of authority among certain personnel	15
Clarification of accountability for results	45
Other	3

Note: Figures indicate the percentage of respondents who circled the item concerned.

that core R&D human resources will in the future function as creators of product concepts.

"Concept creators" here refers to the human resources who play the leading role in generating differentiation-based competitiveness through the creation of novelty and distinctiveness, rather than relativized competitiveness in the form of comparative advantage.

As can be observed in Table 5, the results of this survey show that individuality based on the commitment and enthusiasm of the individual is expected to play an important role in the identification of areas for innovative R&D, such as the development of new fields, and the leadership skills of their leaders will accelerate commercialization. It can also be seen that certain individuals will become more clearly accountable for results and the sense of responsibility of those involved will be strengthened.

Conversely, the selection of themes by consensus among those involved in specific projects is prone to lead to obsolescence and can also result in advantages being diluted. These results suggest that decision-making by group consensus, traditionally considered a feature of Japanese-style management, is not suited to more innovative R&D activities.

A questionnaire survey of its members was also conducted by the Japan Society for Technology (JST) regarding the qualities expected of R&D human resources (December 1998). The results showed that the most sought-after quality of personnel who will play a leading role in R&D activities to create new business in the future was "originality." The results of this survey of management-class personnel at 158 listed companies in Japan (mostly in the manufacturing and construction industries) were compiled into a report by the

Investigative Research Committee of the JST, which was chaired by Tsuneo Nakahara, Executive Technical Adviser of Sumitomo Electric Industries, Ltd., and consisted of experts in the fields of science and technology in Japan (Japan Society for Technology, Survey Committee 1998) .

A questionnaire survey conducted by the Japan Research Industries Association concerning what kind of human resources were now sought similarly found that “creative human resources capable of making new proposals” came out on top, followed by “human resources capable of formulating business strategy, “human resources capable of flexible thinking,” and “human resources with strong expertise” (Japan Research Industries Association 2005, 219) .

However, “originality” and “creativity” are qualities whose importance has been noted since the high-growth period of the 1960s. The JST therefore recommends that in the event that R&D personnel in an enterprise produce original research resulting in a patent, for example, the individuals concerned should be specially rewarded. While the results of research in the form of patents and so on belong to the corporate organization by which researchers are employed, Japanese enterprises, too, have begun to realize that individual R&D personnel should be recognized as occupying an irreplaceable position, and that unless they develop climates that recognize and honor their intellectual achievements, they will be unable to foster true originality.

Recent court cases regarding inventions by employees will no doubt prompt a reconsideration of the nature of the relationship between R&D engineers and corporate organizations. While the qualities of “commitment and enthusiasm of the individual” and “originality” are expected to be important to R&D activities, this also means concentrating authority in the hands of certain individuals. Enterprises must therefore be prepared to rely on the “go it alone” mentality of individual R&D personnel. Consequently, executives (especially chief technology officers) responsible for combining group cooperativeness with respect for individuality will have to exhibit leadership, and policies will be needed to fairly assess and reward personnel for their research results.

IV. New Dimensions in Human Resource Management

The corporate environment is steadily changing. Enterprises face growing globalization, a paradigm shift and acceleration of technological innovation, and shortening product lifecycles, and the challenge they face is how to encourage the dynamism of creative destruction. Enterprises' survival and development will depend on developing new products and exploiting new markets. Generating this new added value will depend on how human resources are developed, utilized, and evaluated as developable knowledge assets.

1. Perspectives on Use of Present Human Resources

(1) Changing Management of "Core Human Resources"

Human resource management at enterprises in industrialized societies is characterized by (i) standardized management, (ii) group management, and (iii) top-down management. These three elements of human resource management were developed premised on raising the efficiency of large-scale organizations, such as leading manufacturers and distributors. Japanese enterprises, too, have employed "traditional human resource management" methods suited to doing business in an industrialized society, such as regular batch hiring of fresh graduates, internal training involving the entire workforce, seniority-based promotion and pay, unilateral evaluation and transfer processes, single-track promotion to management positions, and compulsory retirement at a uniform mandatory retirement age.

The effectiveness of human resource management functions in Japan is internationally recognized. In a country-by-country study of labor force policy in Japan, conducted between November 1969 and June 1972, the Employment, Labour and Social Committee of the Organisation for Economic Co-operation and Development (OECD) observed that underlying the Japanese economy's astounding development and high level of growth were its unique employment system, wage structure, and labor union organization. In the latter half of the 20th century, Japan pursued industrialization and achieved rapid economic growth based on the development of its heavy and chemical industries. As socioeconomic institutions, Japan's peculiar industrial relations and human resource systems—the three "sacred treasures" that were the pillars of its development, i.e., lifetime employment, seniority-based pay, and enterprise labor unionism—appeared effective (Organisation for Economic Co-operation and Development 1972).

In industrialized societies, it was important that enterprises organize large numbers of workers under the direction of small numbers of supervisors in pursuit of mass production and distribution, and that these workers perform, without error, work broken down into smaller tasks in accordance with work manuals. The main targets of human resource management were those employees responsible for standard tasks, such as those involved in production, transportation, safety, sales, and back-office operations.

At Japanese enterprises, "professionals" and "knowledge workers" responsible for non-standard tasks, such as planning and development, and technology and research, used to be few in number, and were treated on an exceptional basis beyond the normal scope of human resource management. In the knowledge-information society, however, "intellectual talents" such as professionals and knowledge workers (Drucker 1999, 83-84) will become a key concern of human resource management.

Morishima (2001) distills the characteristics of human resources needed at the start of the 21st century as a source of knowledge competitiveness down to the following three points: firstly, the ability to reason analogically; secondly, the ability to formulate a clear vision; and thirdly, the ability to share experience. By the first is meant the ability to think about the causes of problems and how to solve them under uncertain conditions, though not in the conventional sense of problem-solving ability. Instead, Morishima is concerned with the ability to devise hypotheses according to new situations and to act in accordance with past good practice. The second refers to the commitment and motivation to achieve a desired end, which depends to a large extent on the involvement of the individual to serve as the driving force. And the third point refers to the ability of leaders to reflect on their own experience and to explain it to their followers, and it is leaders' reproducibility that maintains and develops organizational strength (Morishima 2001, 99-101). This form of strategic human resource management comes down to using the human resources that are an enterprise's knowledge assets: professionals and knowledge workers.

(2) Innovative Response

As they enter the age of mega-competition, both at home and abroad, Japanese enterprises face an urgent need to change their rigid cost structures and to adapt to changes in the economic structure wrought by the rise of knowledge and information technology and software. Their success in responding to deregulation and market liberalization, and in developing original technologies and creating new business, will depend on the development and use of new human resources.

Sato (2001) analyzes the features and job behavior found in creative workplaces. Examining the differences in job management between standard departments and creative departments at large enterprises in Japan in terms of the degree of freedom and flexibility that employees enjoy in their work, he finds greater freedom to be permitted at the latter. In creative departments, patterns of management were observed that were suited to the nature of the work, indicating that work was managed in a fundamentally different manner from the "one-size-fits-all" management found in factories. Working hours were also found to be managed more flexibly in creative departments, where use of free time systems was observed. Occupationally, specialist and technical personnel had the characteristics of creative departments, and there was a strong tendency for work in pioneering new fields to be performed by dynamic work groups given discretionary leeway and formed around specific areas of expertise (Sato 2001, 58-59).[8]

In a study of R&D human resources pursuing original R&D from the perspective of professionals, Fukutani (2001) identifies their defining features and suggests incentive policies suited to the expertise, autonomy, and social nature of professional labor. He proposes that the relationship between corporate organizations and professionals will move away from conventional status professionalism to become institutionalized as employed professionalism. Envisaging the creation of an environment in which R&D human resources belong both to enterprises and vocational associations, Fukutani describes possible ways of providing incentives to promote the acquisition of professional qualifications, formation of occupational careers, and resultant membership in social vocational associations (Fukutani 2001, 154-57).

Miyashita (2001) treats white-collar workers employed by corporate

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8 These survey results are cited from Ministry of Labour, Minister's Secretariat, Policy Planning and Research Department (1996). Sato was also a member of the Sanwa Research Institute Investigative Committee on the Knowledge Intensification of Labor commissioned by the Japanese Ministry of Labour and chaired by Takeshi Inagami, then Professor of University of Tokyo. These results are drawn from this committee's findings. It should also be borne in mind, however, that it was assumed that there would be no major collapse of Japan's long-term employment practice as a result of an increase in knowledge labor, and that a combination of long-term stable employment and company-wide conventional human resource management would apply to creative workers as well.

organizations, whose work expertise has not until now come under the microscope, as a new type of professional that he dubs the "in-house professional," and examines how this new type of human resource should be managed. He finds that in the knowledge-information age, administrative white collar workers are treated as in-house professionals and serve as a source of creation of strategic business. Their management is sought through human resource management capable of accommodating the individual and allowing a two-way relationship between the individual and the organization premised on diverse human resources. Stressing in particular management to support expertise and independence, he points to a number of factors, including hiring according to job type, the establishment of in-house professional systems at each stage of evaluation, and self-managed education and training (Miyashita 2001, 153-56).

The features of the workplace in creative departments, the application of discretionary work systems, the employment and treatment of R&D human resources as employed professionals, and way forward in human resource management of administrative white collar workers as in-house professionals must be explored. The challenge now faced is thus one of using knowledge workers, as knowledge assets, and translating this into the creation of new "knowledge," i.e., the development of new business. Management of human resources to meet this challenge therefore needs to be explored.

2. Design Concept for New Human Resource Systems

A design concept for human resource systems attuned to new business strategy must incorporate the perspectives shown in Table 6. These are (i) a redesign of reward structures, (ii) a switch in job evaluation from time management to results-based management, (iii) an emphasis on personal responsibility for career development, and (iv) mapping of human resources as knowledge assets (Miyashita 2001, 206-208).

In order to create the setup for this form of new human resource system, the following strategic changes are needed.

Firstly, there must be a change from uniform group-based evaluation to individual multi-dimensional evaluation. Getting ideas through interaction with people of special talents and generating diverse ideas and concepts in an open environment lead to the nurturing of individual creative abilities.

More emphasis should be placed first of all on giving free rein to

Table 6. Design concept for new human resource systems

	Past	Future
Pay	Length of service	Performance based
Working hours	Fixed, uniform	Flexible, discretionary
Career	Company-dependent	Personal responsibility, career moves
Promotion path	Single track to management position	Professional/multi-dimensional
Promotion criteria	Seniority based	Ability, selection
Transfers	Company order	Company order, advertised internally
Evaluation	Process	Results and process
Qualifications	Vocational qualification system	Intellectual asset human resource map

individuality based on individual commitment and enthusiasm, rather than group consensus. This means orchestrating the results produced by individuals to raise the dynamism of the organization (Fukutani 1999, 133-35).

In particular, if the focus of work shifts from precisely processing known tasks to creating new value in unknown work, the focus of attention will turn to leveraging the individuality of knowledge workers who will be responsible for achieving this. In order to bring out individualism, approaches to personnel matters, employment, pay, and other treatment will diversify. Employee categories such as generalists, in-house specialists, and professionals will be established, for example, and multiple career routes suited to them will be designed.

Secondly, the grounds for determination of remuneration must change from length of service to results. During the catch-up age, continuous long-term employment meant that a balance was maintained between improvement in the individuals' vocational abilities and his/her contribution to the enterprise. In the knowledge-information age in which special skills built up in an enterprise can rapidly become obsolete, however, the correlation between lifetime employment and age-based pay is disappearing, both for the enterprise and for the individual. One method of overcoming this challenge that will attract attention is through the use of an annual salary system as a performance and results-based pay system.

Thirdly, use will have to be made of "technology and human resource maps.” Human resource departments could also accurately track human resources’ areas of expertise and suggest policies on their development in response to business challenges such as changes in operational structure, the creation of new business, and development of new fields. Mapping technologies and human resources will provide enterprises with the basic materials for evaluating the expertise of human resources, effecting transfers in a planned manner, and practicing management by objective. For employees, on the other hand, they will also serve as guidelines for skills development, and concrete objectives for self-assessment and responding to positions advertised internally. In regard to personnel evaluation as well, job criteria will be made explicit, and the making of objective judgments will be made easier and more acceptable to those being evaluated. It will become possible to evaluate the specialist abilities of human resources as if they were items in an asset account.

One area of concern is how the gap between self-assessment and the organization’s recognition of specialist abilities can be closed. Secondly, maintaining and checking human resource maps takes effort. Revision of maps to take into account the appearance of new fields and technologies, for example, requires constant amendment. Human resource maps are measures for objectively visualizing employees’ specialist abilities and form the basis of skills development, allocation, and use, and maintaining their reliability is a key concern of human resource management.

Fourthly, there has to be a shift from general to individual employment contracts. One emerging method of respecting the independence of the employee and bringing out individuality is through the use of a new form of employment contract. The parties to these contracts are multi-channel workers, i.e., workers who have employment contracts with more than one enterprise.

Instead of the traditional “organization man” who signed a job contract, the professional of the 21st century will be a free agent: someone who, instead of working under one specific manager, will escape from the yoke of a large organization to work independently under the conditions that he/she desires for a number of clients. The U.S.’s largest private sector employer is not General Motors or Microsoft, but the employment agency Manpower. The migration from organization man to free agent will be accompanied by a shift from the organization to the individual as the principal economic actor. Figuratively speaking, society and the economy will become like the “world of Hollywood,” where diverse human resources and small enterprises come together for each specific project and disperse when the film is finished (Pink 2002, 24-25).

In the knowledge-information society, the specialists and free agents who appear in virtual corporations and various network partnerships to share knowledge and information will blur the line between working as an employee and engaging in activity as an individual.

For advanced enterprises, the way forward to survival depends not only on experience and know-how accumulated as the past, but also on making full use of new concepts and ideas. Rather than entering employment contracts with experts and entrepreneurs in Japan and overseas, effective use must also be made of flexible frameworks, such as service contracts for subcontracting work to individuals. Multi-channel workers will represent a new style of work, and we can expect the dawn of a new era: that of the free agent. This points the way to a new relationship between the corporate organization and the individual.

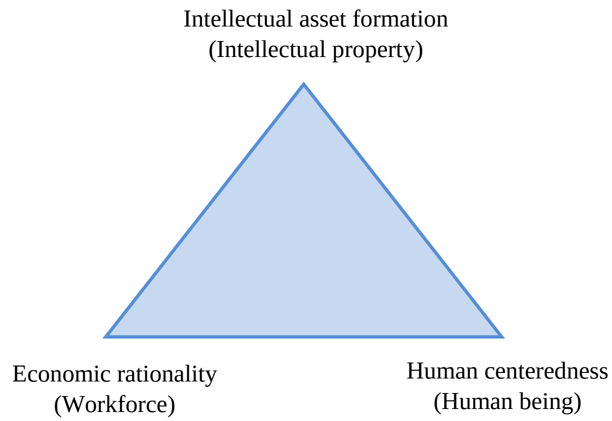
V. Conclusions

The advent of the knowledge-information society will be accompanied by professionals and knowledge workers taking center stage as the human resources who ensure the competitive advantage of both nations and enterprises. The objectives of business strategy will similarly be seen in terms of developing unknown markets and new products, and generating new technologies and services.

Rather than developing systems of division of labor that standardize, simplify, and compartmentalize into specific parts using a comparatively homogeneous manual workforce of the kind needed in industrializing societies, neo-industrial society will involve professionals and knowledge workers sharing expertise with a diversity of experts, devising novel ideas, and creating business plans (Figure 5).

In the knowledge-information society, corporate organizations, the types of human resource needed, and methods of management will be transformed, forcing enterprises to drastically modify their traditional methods of human resources management. Use of these human resources will necessitate firstly diversification of the design and skilled implementation of human resource systems, secondly respect for individuality and the exhibition of independence

Figure 5. Human resource management triangle



Source: Fukutani (2007), 205.

by employees, and accordingly finely tailored and individualized human resource management in order to achieve this, and thirdly the development of systems for utilizing and evaluating human resources as knowledge assets.

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Mobility of R&D Workers and Technological Performance*

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I. Introduction

If knowledge essential for innovation is assumed to be embodied partially in individuals, the "transfers" and "reassignments" engineers and researchers experience in society and among organizations can be surmised to affect the emergence of innovations. This reasoning springs from the fact transfers are linked with meeting new individuals, which in turn is thought to raise the probability of the knowledge integration necessary for innovation. Moreover, the probability of various technological information flowing to the sources of innovation increases if human networks are extended across organizations and departments by means of transfers. This also provides a rationale supporting the validity of the hypothesis that transfers encourage innovation.

Research to clarify the patterns of knowledge spillover that originate in R&D engineer transfers has been carried out based on such thinking as a premise (Almeida and Kogut 1999; Appleyard 1996). As the spill-over effects from a high level of worker mobility and unique local knowledge in a concentrated area—best exemplified by Silicon Valley—has been clarified since the 1990s in particular (Almeida and Kogut 1999; Angel 1989; Saxenian 1994), voices propounding the necessity of increasing R&D worker mobility as a factor to stimulate innovation have risen to a roar even in Japan. Arguments have been put forth linking the low degree of R&D worker mobility in Japan and the nation's economic slump since the 1990s, claiming there is a need to improve the mobility of specialized human resources in order to spur business recovery.

Certainly compared with the United States, the mobility of R&D workers

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* The questionnaire survey for this research was conducted as a research project of the National institute of Science and Technology Policy. The series of activities from preparation of the questionnaire form through to collection and initial analysis of the data was undertaken with the collaboration of Professor Akira Takeishi and Associate Professor Masaru Karube of the Hitotsubashi University Institute of Innovation Research and Associate Professor Ken Kusunoki of the Hitotsubashi University Graduate School of International Corporate Strategy. However, the contents of this paper are solely the responsibility of the author.

in Japan can be said to be low (Lynn, Piehler and Kieler 1993; Shapira 1995; Appleyard 1996). On the other hand, however, interdepartmental transfers within organizations occur frequently in Japan—a fact that has been noted as one source of Japanese manufacturing competitiveness (Kusunoki and Numagami 1998). This is the argument that cross-functional integration required for new product development is being promoted effectively by the interdepartmental rotation of engineers. If the size of a firm is sufficiently large, transfers of workers across different functions and technical fields, in the sense of integrating different knowledge, offers the possibility of having the same effect as interorganizational transfers (Jervis 1975). Perhaps in response to such arguments, since the 1990s the tendency to reassign engineers and researchers to business divisions or manufacturing departments has increased even among the largest Japanese firms.[1] The fact R&D productivity was viewed as a problem at firms that were struggling due to depressed operating results following the collapse of the bubble economy is thought to be related to such human resource policies.[2]

Consequently, as the idea that engineer and researcher transfers promote innovation has become generally accepted, facilitating transfers has been recognized as an important issue for both government policy and corporate management. However, very little research exists which systematically verifies the hypothesis that R&D worker transfers promote innovation. Although both interorganizational transfers and intraorganizational transfers tend to be carried out as measures that will implicitly have a positive affect on innovation, this has not always been clarified empirically. Nor is such a result self-evident. Given such circumstances, the research reported here was conducted to empirically examine the relationship between interorganizational and intraorganizational transfers of engineers and researchers and technological performance, based on data concerning semiconductor engineers in Japan.

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1 This tendency is also shown clearly from the semiconductor engineer data analyzed for this research, which is described later in this paper. Engineers who joined companies in the 1980s and 1990s have experienced interdepartmental transfers more frequently than engineers who joined companies in earlier years, with early reassignment to manufacturing departments or business divisions being particularly remarkable.

2 There also is the aspect that as criticism of research activities not immediately related to earnings rose, researchers and engineers were reassigned to activities closer to business operations.

II. Existing Research Approach Concerning the Relationship between Engineers' Transfers and Performance

1. Interorganizational Transfers and Innovation Performance

The foundation of the thinking that R&D worker mobility between firms encourages innovation lies in the recognition that workers themselves are the most effective means of communicating important technological information. Much of the important information in the worlds of science and technology exists as tacit knowledge that has not been formalized (Kogut and Zander 1995; Cohen and Levinthal 1990; Von Hippel 1988). To transfer such knowledge, the human resources themselves that possess this knowledge must move.

Moreover, human resources who transfer to another firm bring with them more than just the technological knowledge they possess individually. The human networks formed in their previous workplaces also offer an important source of information for promoting innovation. As engineers with transfer experience can access external technological information that crosses organizational boundaries, such individuals can also be expected to fulfill a role as technological information "gatekeepers" (Allen 1977).

Appleyard (1996), for example, compared semiconductor design engineers in Japan and the U.S. It demonstrated that in contrast to a sample of Japanese engineers with no experience of mobility between firms and who relied on public information resources such as scientific publications and academic conference presentations, engineers in the United States who had more extensive transfer experience utilized engineers at other firms as an important information source. Similarly, Lynn, Piehler and Kieler (1993) demonstrated that compared with engineers in Japan, engineers in the United States with extensive transfer experience have more frequent contact with external specialists. This is because as it is conjectured that engineers moving among firms will engage in vigorous activities within their professional community to enhance their own market value, the knowledge obtained through their efforts is expected to produce a positive effect for the organization as well.

The formation of innovation in Silicon Valley, which attracted significant attention in the 1990s, is frequently explained indirectly by the knowledge spillover effect from frequent worker transfers (Angel 1989; Almeida and Kogut 1999; Saxenian 1994). For example, Almeida and Kogut (1999) surveyed the interfirm mobility of patent holders and frequency of patent citations, and clarified that in Silicon Valley there exist numerous mutual patent citations as well as large numbers of interfirm transfers of engineers in the region. This indicates the transfer of knowledge as a result of worker mobility within a region is linked to concentrations of innovation. Similarly, Angel (1989) also clarified the frequent transfers of human resources between universities and firms in the region, and highlighted the possibility of this phenomenon influencing the emergence of flexible manufacturing and innovation by analyzing the career histories of semiconductor production engineers in Silicon Valley. Nevertheless, such research has focused on clarifying the patterns of worker mobility based on the extent of innovative activities in Silicon Valley as a given. However, the research has not necessarily proven a causal relationship between worker mobility and innovation performance.

Consequently, while the research in recent years tends to assume a positive relationship between the interfirm mobility of engineers and innovation, there remains a sufficient probability that interfirm transfers do not stimulate innovation. It may be, for example, that engineers with interfirm transfer experience and who could become an important source of external technological information are not necessarily the most appropriate individuals from the standpoint of communicating external technological information within the organization. We cannot dismiss the possibility that, to the extent individuals who join an organization from another entity are treated within the organization as interlopers, intraorganizational communication problems might occur, or that individuals with little commitment to the organization might lack sufficient motivation to impart their knowledge. The danger of such problems occurring is thought to be especially great when organizational systems for evaluating, compensating and absorbing such engineers into the organization have not been established.

Ettlie (1980, 1985), who empirically studied the relationship between the inflow of new personnel and innovation activities, clarified that while inflows of new engineers have the effect of encouraging innovation, this relationship is not a monotonic increase. Based on a questionnaire survey of 56 food processing firms, Ettlie (1985) reported that a certain amount of external worker inflow has an innovation-stimulating effect, but that too large a personnel inflow oppositely exerts a negative influence on innovation.

2. Intraorganizational Mobility and Innovation Performance

Very little of the research literature addresses intraorganizational transfers of engineers directly from the standpoint of the effect on innovation activities. Rather, research that looks at intraorganizational transfers tends to focus on the influence such transfers have on the career formation of individuals. According to this research, intraorganizational transfers contribute to the acquisition of skills and accumulation of experience, and have a positive influence on promotions and upgrades in pay scale (see, for example, Campion, Cheraskin and Stevens [1994]). Such research also notes that intraorganizational transfers, in the sense that they are assignments to better responsibilities, have an uplifting affect on motivation and work attitudes (Campion, Cheraskin and Stevens [1994]; McElroy et al. [1996]). This research does not, however, clarify what affect such career formation through transfers has on an engineer's innovation performance.

On the other hand, despite the fact that research focusing on technological development and new product development activity does not look directly at the effect of intraorganizational transfers, the research does offer important suggestions concerning the relationship between intraorganizational transfers and innovation (Allen 1977; Clark and Fujimoto 1991; Henderson and Cockburn 1994; Ancona and Caldwell 1992; Eisenhardt and Tabrizi 1995; Hansen 1999). Common to such research is the discovery that the sharing of knowledge or combinations of different information across organizational unit boundaries is vitally important for technological and product innovation. When knowledge sharing across departments is achieved by direct interdepartmental communications but the knowledge has a tacit, specific character, there is a danger communications costs will increase substantially due to the problem of differing interpretations of the information between departments (Hansen, 1999). In such cases, directly transferring engineers between departments is more effective (Allen 1977; Roberts 1988; Aoshima 2002; Kusunoki and Numagami 1998). Kusunoki and Numagami (1998), for example, analyzed data on personnel at Japan's large chemical firms and discovered engineers are transferred frequently among departments; they argue that such transfers have the effect of promoting integration across functions and technical fields. Many case studies examining product development at Japanese firms also suggest that transferring engineers from the lab to an operating division or even the manufacturing department will promote product innovation.

Experience in various departments certainly might work effectively for commercializing technologies or turning them into a business. Moreover, utilizing experience gained in different departments is conceivable from the standpoint of fostering technological ideas as well. On the other hand, there is a danger frequent interdepartmental transfers will hinder the accumulation of expertise. This danger is particularly acute when transfers are made during the early stages of an individual's career as an engineer. On this point, the problem of the trade-offs arising from intraorganizational transfers is believed to be greater for technical human resources than in the case of administrative managers. Very little empirical research exists considering this point.

3. Interdependency between Interorganizational Transfers and Intraorganizational Transfers

As described above, until now research on interorganizational transfers and research on intraorganizational transfers have tended to be treated under separate traditions. Although both types of transfers have been compared in some international studies (see, for example, Lynn, Piehler and Kieler [1993]), there is no research clearly analyzing the mutual relationship between the two types of transfers. Should an interdependency exist between the two types of transfers, there is a possibility a simplistic approach aimed at encouraging innovation by improving mobility will not produce the anticipated results.

For any individual engineer, the fact that interorganizational transfers and intraorganizational transfers are mutually related is not simply because the number of transfers that can be achieved during one's entire career is limited. For example, as a result of emphasizing interaction with individuals outside the organization, an engineer who moves frequently between organizations might have a weak human network within the organization. This might lead to fewer in-house needs for that particular individual, which in turn could reduce opportunities for intraorganizational transfer (reassignment). There also is the possibility that possessing in-depth knowledge in a specific area of expertise will enhance an employee's value in the external labor market, while on the other hand making cross-functional transfers within the firm difficult. Being branded as the specialist in a specific area is also thought to create a sense of resistance to transfers within a firm.

The goal of this research is to clarify empirically the relationship between mobility and performance, while keeping in mind this mutual relationship between interorganizational and intraorganizational transfers.

III. Summary of the Analysis Data

1. Survey Summary

The data analyzed for this paper were obtained from a questionnaire survey distributed to 5,000 members of the Japan Society of Applied Physics.[3] The questionnaires were collected in January 1999, with valid responses obtained from 902 individuals. There were 749 respondents after excluding individuals with no experience at private sector firms and individuals who did not have experience in semiconductor-related businesses. Of these 749 respondents, individuals who had been at organizations other than a private corporation for 50% or more of their entire career were also excluded from the analysis. As a result, the entire sample consisted of 718 semiconductor engineers who had been employed mainly at private corporations. In addition to this entire sample, a separate sample, limited to engineers who were able to specify they had spent 50% or more of the years of their entire career in semiconductor-related design and development, was also used for the analysis. I will refer to this separate sample group as the R&D sample.

Respondents to the questionnaire survey were first asked to record their career during the period from 1965 to 1998 along a time line using eight factors, including the organization for which they worked, the region where they worked (geographic), the department to which they were assigned within the organization and the specialized area for which they were responsible. As a result, how the individuals had been transferred was understood for their entire careers by categories such as organization, geographic region, department within the organization and area of expertise. The data selected for analysis for this paper was mainly data concerning interorganizational transfers and interdepartmental transfers within an organization.

Next, respondents were asked to indicate the frequency of their communications with various individuals such as colleagues, engineers at other firms and university researchers, and to subjectively assess the importance of these individuals as a resource for problem solving.

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3 Approximately 70-80% of the registered members of the Japan Society of Applied Physics are involved in semiconductor-related businesses.

Finally, respondents were asked to enter performance on the questionnaire form. As technological performance, respondents were asked to indicate the number of patents applied for and the number of papers published outside of those in professional journals up to that point. Respondents also were requested to subjectively evaluate the degree of satisfaction with their capabilities as researchers and engineers, the speed of their promotions, and their current work. Although both individual performance and performance as a group or organization are necessary in order to measure innovation results, comparable indicators of performance at the group level were unobtainable because the respondents belonged to various firms.

Table 1 shows a summary of the sample. When transfers to affiliated firms such as subsidiaries are excluded, overall about 29% of the respondents have experienced at least one interorganizational transfer.[4] However, the percentage drops to 17% when limited to only mobility between private firms. About 15% of the respondents had earned a doctorate. Considering that nearly 70% of all respondents had an advanced degree when those with a masters degree are included, this sample is thought to include not only engineers but also many workers whose job responsibilities are close to those of a researcher. Also, the fact that many transfers between firms and universities are observed, or that more than 10% of the respondents are engaged in basic research, is believed to be a manifestation of this.

2. Variables

There were many variables included in the analysis, which were roughly classified into mobility-related variables, communications and information source-related variables, and performance-related variables. In addition, depending on the analysis, control variables were introduced.

Interorganizational transfers were measured using the number of organizations at which respondents had worked as of the survey date. However, seconding to another company or transfers to an affiliate or a subsidiary were

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[4] This could be regarded as a problem of response bias, in which respondents answered as individuals having transfer experience because of the content of the questionnaire; however, the result of this sample, in which 29% had transfer experience, is consistent with the survey results in Lynn, Piehler and Kieler (1993), in which 26% of the respondents had transfer experience. Therefore, response bias does not appear to be a major problem.

Table 1. Sample summary

	Age	Service period	Patents applied	Papers published
Mean	43.7	18.9	17.2	41.4
Standard deviation	9.7	9.5	59.3	39.3

Education completed					
High school	Technical school	Bachelor's	Master's	Doctorate	Unknown
7	3	183	379	105	41
1.0%	0.4%	25.5%	52.8%	14.6%	5.7%
Year entered company					
1960s	1970s	1980s	1990s	Unknown	
151	201	296	101	3	
21.0%	28.0%	41.2%	14.1%	0.4%	
Number of organizations (*Excluding affiliated companies*)					
1 company	2 companies	3 companies	4 companies	5 or more companies	Unknown
445	167	57	24	21	4
62.0%	23.3%	7.9%	3.3%	2.9%	0.6%
510	*132*	*42*	*17*	*13*	*0*
71.0%	*18.4%*	*5.8%*	*2.4%*	*1.8%*	*0.0%*
Main area of specialization (>50% of entire career)					
Basic research	Device development and design	Process development	Materials development	Systems development	Testing and evaluation
80	60	136	54	3	21
CAD/CAE	Equipment development	Other development	Quality control	Manufactur -ing	Planning
4	37	13	3	9	1
Marketing	Other manufactur -ing or sales	Application products	Other	Unknown	
1	1	45	88	162	

excluded from the organizations where respondents had worked.

Intraorganizational transfers were measured by the number of departments to which the respondents had been assigned until the time of the survey, with respondents selecting from among a total of nine departments. These included corporate research departments (labs), corporate development departments, corporate production technology departments, divisional research departments, divisional development departments, divisional production technology departments, factories or manufacturing departments, planning and control departments, and sales and marketing departments. The mean number of departments at which respondents had work experience was 2.11 departments; the standard deviation was 1.31. Furthermore, for individuals who had at least one interdepartmental transfer experience, the number of years they were employed until their initial interdepartmental transfer was included in the analysis. The mean was 9.03 years, with a standard deviation of 6.51 years.

The frequency of communications with 12 categories of individuals, such as colleagues in the same workplace, engineers in other departments of the company, engineers at competitor firms and university researchers, was measured using a seven-point scale for frequency of communications, ranging from 1: "Once a year or less" to 7: "Almost daily." In addition, respondents were asked to subjectively evaluate 21 categories of information sources consisting of these 12 categories of individuals, as well as sources such as academic associations and professional journals, as sources of problem-solving information using a seven-point scale ranging from 1: "Not important at all" to 7: "Extremely important" (these communication and information source items are shown in Appendix Table 1).

Technological performance was measured using the number of patent applications and number of papers published in professional journals. Respondents were asked to indicate on the questionnaire form the actual number of their patent applications and number of papers published, separated among three periods covering the past five years, from five years ago to ten years ago and more than ten years ago. In the analysis below, the values for the number of patents and number of papers, respectively, are the simple totals of the figures for the three periods of each category.

The respondents also compared their capabilities as researchers and engineers and the speed of their promotions with those of their colleagues by subjectively evaluating these items using a seven-point scale ranging from 1: "Completely inferior" to 7: "Extremely superior." The mean values for the entire sample were 5.02 (capabilities) and 4.08 (speed of promotions); the standard deviation was 1.14 and 1.33, respectively. Respondents were also asked to subjectively evaluate the level of satisfaction towards their work using a seven-point scale ranging from 1: "Completely dissatisfied" to 7: "Very satisfied." The mean value and standard deviation were 4.32 and 1.58, respectively.

Table 2. Frequency of transfers and technological performance

	Number of patents held		Number of papers published	
	Entire sample	R&D sample	Entire sample	R&D sample
Service years	0.44 ***	0.40 ***	0.33 ***	0.35 ***
Number of experienced organizations	-0.11 ***	-0.07 *	-0.09 **	-0.03
Number of experienced departments	-0.07 **	-0.04	-0.13 ***	-0.09 *
Adjusted R^2	0.14 ***	0.14 ***	0.08 ***	0.12 ***
Degrees of freedom	684	425	684	401

OLS. *p<.1, **p<.5, ***p<.01.

The correlation matrix between the transfer variables and performance variables is indicated in Appendix Table 2.

IV. Results of Analysis: Relationships between Transfers and Performance

1. Transfer Frequency and Technological Performance

Table 2 shows the results of a regression analysis concerning the relationship between transfer frequency and technological performance. As both the number of patent applications and number of papers are thought to increase with time, service years have been introduced as a control variable to show the elapsed years since being first employed until the time of the survey.

The analysis of the entire sample shows both interorganizational transfers and intraorganizational transfers have a significant negative relationship with technological performance. There is a possibility that part of this result stems from the fact individuals for whom technological performance in the form of patents and papers are not a direct goal are included in the sample, and that such individuals have experienced frequent interorganizational and intraorganizational transfers. The sample includes individuals involved in the development of application products that use semiconductors rather than in the development of semiconductors themselves. These individuals are working in areas close to commercialization, and publication of papers may not be a required output for them. Therefore, the results from a similar analysis, performed after extracting as the R&D sample only those respondents who were able to specify they had spent 50% or more of their entire career in semiconductor design and development activities, is likewise described in Talde 2.[5] As a result, the negative effect transfers have on technological performance is certainly reduced. However, such a result notwithstanding, there is still a negative relationship. The main objective of the analysis described below in Section V was to search for the logic behind this discovery, which seemingly contradicts our ordinal intuition.

2. Transfer Frequency and Speed of Promotions, Capabilities and Degree of Satisfaction

On the other hand, Table 3 shows the results of an analysis for the relationship between transfer frequency, and a subjective evaluation of speed of promotions, technical capabilities and degree of satisfaction. A statistically significant relationship was found between intraorganizational transfers and speed of promotions, and between interorganizational transfers and degree of satisfaction. This result, which suggests intraorganizational transfers have a positive influence on the speed of promotions, is consistent with the findings of the existing research. Nevertheless, because it is not possible in this research to distinguish between interdepartmental transfers accompanying a promotion and pure rotations, the possibility remains that individuals who are promoted have experience working in many departments as a result. On the other hand, the result that individuals who have transferred between organizations indicated a low degree of satisfaction with their current work might suggest that workers who transfer between firms are not always necessarily assigned to an appropriate place within their new organization. These findings will be studied again when the cause of the negative relationship found between transfers and technological performance is investigated.

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5 The main reason for the large decrease in the sample number is that the main activity area could not be identified for some individuals. This is because part of the entries for activity areas were not completed, rather than because individuals engaged mainly in semiconductor-related design and development activities were too few in the original sample. There were 162 individuals for whom their main activity area could not be specified.

Table 3. Frequency of transfers, speed of promotions, capabilities as a researcher and engineer, and degree of satisfaction with current work

	Speed of promotions		Capabilities as a researcher and engineer		Degree of satisfaction with work	
	Entire sample	R&D sample	Entire sample	R&D sample	Entire sample	R&D sample
Service years	-0.00	-0.00	0.03 ***	0.04 ***	0.03 **	0.02
Number of experienced organizations	-0.07	-0.07	0.02	-0.04	-0.07	-0.18
Number of experienced departments	0.15 ***	0.18 **	0.02	0.01	-0.01	-0.01
– 2 log likelihood	1543.3	1014.3	1296.4	877.4	1605.1	1089.0

Ordinal regression analysis (PLUM). *p<.1, **p<.5, ***p<.01.

V. Causes of the Negative Relationship Found between Intraorganizational Transfers and Technological Performance

Table 2 implies that intraorganizational transfers (interdepartmental rotations) might have a negative affect on the performance of engineers. What could cause such a result?

Intraorganizational transfers help create human networks across departments, while simultaneously increasing engineers' exposure to different knowledge. This produces the knowledge integration believed to be necessary for innovation. Such linkage has come to be regarded as the logic explaining the encouragement of innovation through intraorganizational transfers. Therefore, if we assume intraorganizational transfers have a negative impact on technological performance, there is a possibility the human networks within organizations are not functioning well or that intraorganizational transfers hinder access to important external technological information. The analysis in Table 3 was undertaken to confirm this conjecture. Table 4 shows the result of a regression analysis of the effect intraorganizational transfers have on human communications inside and outside an organization, and the factors emphasized by engineers with intraorganizational transfer experience as information sources for problem solving. Since information sources were considered to increase with each year passed, service years were controlled in the analysis. Only items for which a statistically significant result was obtained are shown in Table 4.

Table 4. Intraorganizational transfers, communications, and important information sources for problem solving

Dependent variable	Research and development sample
Frequency of communication	
Departments where previously worked for within the organization	*
University researchers	*** (-)
Information sources for problem solving	
Same area of specialization outside of the company	* (-)
University researchers	*** (-)
National research institutes etc.	** (-)
University (graduate school) friends and acquaintances outside of the company	* (-)
Professors when enrolled in university	** (-)
Business consultants	**

Ordinal regression analysis (PLUM). *p<.1, **p<.5, ***p<.01.
Independent variable: Number of experienced departments.
Control variable: Number of service years.

From Table 4, a relationship can be perceived in which individuals have less access to external information as they experience frequent intraorganizational transfers. On the other hand, despite the fact that there are extensive interactions with individuals in departments where a respondent had been assigned previously due to intraorganizational transfers becoming more frequent, no tendency to use individuals in other internal departments as an important source for problem solving was found. In other words, individuals with frequent interdepartmental transfers within an organization are cut off from external technological information, yet at the same time cannot take sufficient advantage of their in-house human network stretching across departments. Such circumstances are thought to be one reason why intraorganizational transfers are not related to the performance of engineers.[6]

[6] The possibility that individuals given frequent intraorganizational transfers are engaged in administrator activities cannot be completely denied. However, such a possibility is not considered to be high because a negative relationship is found even for the sample limited to research and development, and because the service years are controlled.

Table 5. Effect of number of years in the first assignment on technological performance

	Number of patents held		Number of papers published	
	Entire sample	R&D sample	Entire sample	R&D sample
Service years	0.16 ***	0.23 ***	0.11 *	0.19 **
Number of experienced organizations	-0.02	-0.02	-0.02	0.01
Number of experienced departments	0.04	-0.05	0.01	0.00
Number of years in initial department	0.24 ***	0.20 ***	0.18 ***	0.13 *
Adjusted R^2	0.12 ***	0.12 ***	0.06 ***	0.07 **
Degrees of freedom	451	280	451	263

OLS. *p<.1, **p<.5, ***p<.01.

The possibility that frequent interdepartmental transfers hinder the development of expertise can also be contemplated as another cause. In the case of engineers and researchers working for Japanese firms in particular, sufficient time to establish a specialty in the early stages of one's career is considered necessary. This is because in many cases the area of specialization at a university is not connected directly to an individual's area of specialization at a firm. Accordingly, transferring to another department too soon after joining a company might have a negative influence on later technological performance. To confirm this, the sample was limited to only those respondents with at least one intraorganizational transfer, and the effect the number of years until the first interdepartmental transfer had on technological performance was analyzed. Table 5 shows the results.

The result supports the prediction; a significant positive relationship was found between the number of years in a position until the first interdepartmental transfer, and the number of patents and number of papers. Moreover, the negative effect of interorganizational transfers and intraorganizational transfers on performance was extinguished by introducing the number of years individuals spent in their initial position. As intraorganizational transfers have a significant negative relationship with the number of years until the first interdepartmental transfer, the negative effect that intraorganizational transfers have on performance is thought to be explained by the short length of assignment in the first department. Such a result suggests that it is early transfers that caused problems by hindering the accumulation of expertise, rather than the issue of interorganizational transfers themselves.

Against this result, however, the hypothesis that individuals with low technological performance should be pushed out to another department at an early stage as unnecessary staff has also been sufficiently raised. As the causal direction cannot be specified here, which hypothesis is correct cannot be determined. However, in research in the United States which analyzed personnel data for specific firms, it was reported that the greater an individual's performance the higher the tendency to receive job rotations (Campion, Cheraskin and Stevens 1994). This indicated that transfers to a better position can be used as one way of rewarding employees. Which status applies in the case of Japanese firms is a topic for future research.

VI. Cause of the Negative Relationship Found between Interorganizational Transfers and Technological Performance

In recent years, the idea that engineer mobility encourages innovation has become accepted thinking. In addition, existing research tended to assume innovation promoting effects of technological knowledge spillover driven by the transfer of engineers. Nevertheless, the research reported here suggests interorganizational transfers are not necessarily linked merely to excellent technological performance, at least when viewed at the individual engineer's level, and indeed can have a negative influence on performance. What causes such a result?

One reason interorganizational transfers of engineers are thought to promote innovation is the belief that engineer mobility enables transfers of tacit knowledge. Moreover, the external human network produced within the organization following an inflow of engineers facilitates access to vital technological knowledge existing outside the organization, which in turn sets the stage for the ensuing effective integration of internal and external technological knowledge to become another factor promoting innovation.

However, to effectively integrate the knowledge introduced by engineers transferred between organizations with an organization's internal knowledge, the engineers who are transferred must be skillfully incorporated into the organization's internal human network. It is believed that interorganizational

Table 6. Interorganizational transfers, communications, and important information sources

Dependent variable	R&D sample
Frequency of communication	
Colleagues in the same workplace	** (-)
Same area of specialization outside of the company	**
Different areas of specialization outside of the company	**
Acquaintances from university years outside of the company	**
Professors when enrolled in university (graduate school)	**
Information sources	
Workplace colleagues	*** (-)
Engineers and researchers in other departments within the company	*** (-)
Workplace superiors	*** (-)
Departments where previously worked for within the firm	** (-)
Competitors	* (-)
Internal study seminars	*** (-)

Ordinal regression analysis (PLUM). *p<.1, **p<.5, ***p<.01.
Independent variable: Number of experienced organizations.
Control variable: Number of service years.

transfers will not necessarily improve technological performance if frequent transfers between organizations result in weak personal ties within the organization, or make access to technological knowledge within the organization difficult. Table 6 highlights results confirming this aspect.

Table 6 shows the results from analyzing the effect interorganizational transfers have on communications with individuals inside and outside the organization, and the effect interorganizational transfer experience has on information sources considered important for problem solving. As in Table 4, only the items for which a statistically significant result was obtained have been described.

As indicated in Table 6, there is a propensity toward more frequent communications with engineers outside the company as the number of interorganizational transfers increases. This is consistent with the general prediction. Notwithstanding this result, however, no tendency is seen in the use of these engineers outside the company as an important information source for problem solving. On the other hand, engineers who have made interorganizational transfers have fewer opportunities for communication with their colleagues at work, and do not utilize other engineers or their superiors within the organization as important sources of information for problem solving. In this respect, engineers who make interorganizational transfers have the opposite characteristics of engineers with intraorganizational transfer experience. In fact, interorganizational transfers and intraorganizational transfers have a significant negative correlation.[7] In other words, circumstances can be envisioned in which engineers who transfer between organizations maintain their external network of contacts, but tend to be shut out from the human and informational networks within the organization; consequently, the organization does not gain opportunities to sufficiently utilize the information obtained from outside. The result in which interorganizational transfers have a negative effect on technological performance is thought, in one sense, to reflect such conditions.

Moreover, there is a possibility that the inability of engineers who have transferred from another organization to achieve sufficient technological performance is also influenced by personnel assignment-related or compensation-related issues. One reason for the result shown in Table 3, in which the level of satisfaction with one's current workplace is low given more frequent interorganizational transfers, might be that such individuals are not being assigned to an appropriate workplace in the organization.

Moreover, as can be seen in the same Table 3, the fact that the speed of promotions is faster for individuals with frequent intraorganizational transfers could also be a factor lowering the motivation of individuals who transfer between organizations. To look at this aspect in slightly sharper detail, the results from studying how communication patterns or methods of using information sources within an organization exert a positive influence on the speed of promotions are shown in Table 7. According to this analysis, when it comes to communications, both frequent interaction with other internal human resources, whether colleagues, engineers in other departments in the organization, or engineers in departments where one was previously assigned within the organization, and interaction with external human resources, including engineers in the same area of specialization who work outside the

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[7] The partial correlation with service years controlled is -0.20, and it is significant at the 1% level.

Table 8. Correlation between transfers and number of experienced areas

	Interorganizational transfers	Interdepartmental transfers	Number of specialized area experiences	Number of product area experiences	Number of application area experiences
Interorganizational transfers		-0.20***	0.04	0.09*	0.06
Interdepartmental transfers			0.16***	0.10**	0.05
Number of specialized area experiences				0.38***	0.30***
Number of product area experiences					0.46***
Number of application area experiences					

R&D sample.
Numeric values in the table are a partial correlation. *p<.1, **p<.5, ***p<.01.
Control variable: Service years.
Specialized areas of experience: Basic research; device development and design; process development; materials development; systems development; testing, evaluation and simulations; CAD/CAE tools; equipment development; other semiconductor development; quality control; manufacturing and mounting; planning; marketing; applications using semiconductors.
Product areas of experience: Memories; MOS micro; logic; analog IC; discrete semiconductors; other semiconductors; applications using semiconductors.

transfers and technological performance indicates that only engineers with low performance are being transferred between organizations. Data to directly confirm this point is not available, but we have some related information. When limited to the sample reported here at least, engineers who frequently make interorganizational transfers appear to not be engineers who specialize in a specific area of expertise. Table 8 highlights this indirectly, showing the relationship between specialized areas or semiconductor product areas experienced and interorganizational or intraorganizational transfers. As predicted, frequent intraorganizational transfers have a positive relationship with the number of specialized areas or semiconductor product areas experienced. On the other hand, engineers who make interorganizational transfers are not limited to one specialized area and indeed tend to have experience in semiconductor product areas more than others. In addition, the negative correlation between the ratio of specialization in a specific area of expertise (period of longest experience in a specialized area/period of entire career) and number of organizations experienced (Kendall tau coefficient = –0.09, $p<.05$) also shows that engineers who transfer between organizations are not necessarily highly specialized human resources.

VII. Discussion

Although the idea that engineer mobility promotes innovation has become generally accepted, the research reported here showed that there is instead a negative relationship between interorganizational and intraorganizational transfers of engineers and technological performance. This finding, however, does not necessarily mean engineer mobility is unnecessary for innovation. If there are defects somewhere in the entire innovation process mediated through engineer transfers, it is possible the effects of the transfers cannot be observed.

The creation of innovations through human transfers can be understood according to three stages (Figure 1). In the first stage, engineers accumulate specialized knowledge while simultaneously forming their own human networks within the broad system of division of labor including the firm's organization. These human networks become the unique information channels necessary for obtaining information for technological development. In the second stage, engineers change the place of their technological development activities, which include the organizations to which they belong or their departments and regions. This leads to the transfer of the locations of the knowledge and information channels associated with each engineer, creating new opportunities for integrating technical knowledge. The possibilities for new combinations of knowledge will especially increase when engineers possess unique technical knowledge that is difficult to codify and document in writing. In the third stage, transferred individuals engage in direct interaction with engineers in the places to which they have transferred. The unique knowledge possessed by the transferred individuals, along with the external information that flows in through the transferred individuals' information

Table 7. Speed of promotions, communication patterns, and important information sources

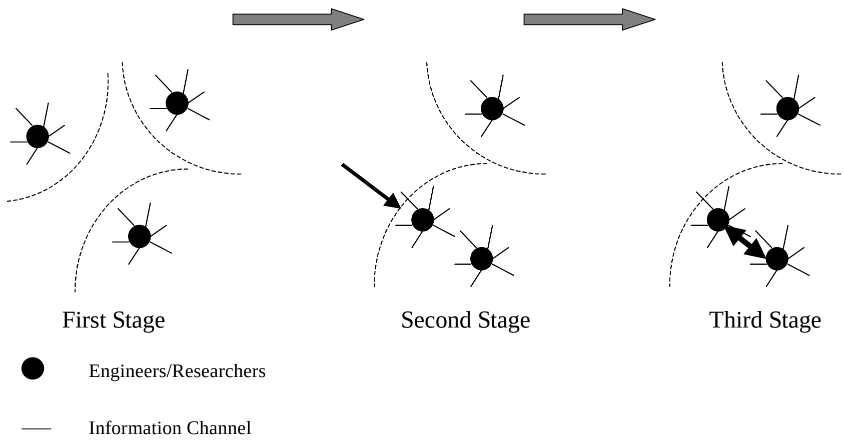
Independent variable	Research and development sample
Frequency of communication	
Colleagues in the same workplace	*
Engineers and researchers in other departments within the company	**
Departments where previously worked for within the firm	***
Same area of specialization outside of the company	**
University researchers	**
National research institutes	*
Professors when enrolled in university (graduate school)	*
Information sources	
Workplace colleagues	***
Engineers and researchers in other departments within the company	***
Managers in other departments within the company	***
Workplace superiors	***
Professors when enrolled in university (graduate school)	*
Electronics journals	**

Ordinal regression analysis. *p<.1, **p<.5, ***p<.01.
Dependent variable: Speed of promotion.
Control variable: Number of service years.

organization, university researchers, and one's professors when in college, have a positive relationship to the speed of promotions. However, as for a source of problem solving information, the extent to which individuals emphasize internal human resources, such as workplace colleagues, superiors, and engineers and administrators in other internal departments, results in faster promotions. Consequently, given the current situation in which informational ties with personnel within an organization are linked to compensation in this manner, there is a possibility that personnel who have transferred in from outside the organization are not being evaluated sufficiently and thus lose their motivation.

If the creation of human or informational networks within an organization in this manner is important from the standpoint of compensation, competent technical professionals may hesitate to move across organizations. Therefore, there is a possibility that the negative relationship between interorganizational

Figure 1. Combination of knowledge by people transfer



channels, is brought to the workplace where the new knowledge is integrated and innovations are created.

This research suggests the failure of interorganizational transfers to be linked to engineers' performance is mainly a problem at the third stage. Although transferred individuals possessed information channels outside the organization, the information obtained through these channels was not being utilized for actual problem-solving activities. For the integration of knowledge obtained through transfers to occur, transferred engineers must be incorporated into the human networks of the organization they have joined. They must also be given opportunities to actively disclose their unique knowledge and the external information obtained through their own information channels. However, there was a propensity for transferred engineers to be shut off from the human network within the organization and have insufficient interaction with other individuals in the organization, and to face limited access to internal information sources. In addition, given an environment in which promotions are faster for engineers who are well versed in internal information sources, a decrease in motivation was predicted. These circumstances were indicated by the results, which show a lower level of satisfaction among transferred engineers in their current work.

On the other hand, the fact intraorganizational transfers are not related to technological performance appears to be a problem particularly at the first of the three stages. In particular, the result indicating technical engineers who experience interdepartmental transfers early in the initial stage of their career have lower levels of performance suggests the possibility that such transfers interfere with the establishment of a special area of expertise and formation of an important human network in the area of expertise. In other words, the problem is thought not to be the organizational transfers themselves, but rather some problem in the expertise acquisition stage before the transfer. Moreover, this research suggests a problem in the third stage as well. Individuals who are transferred frequently between departments do not always use human networks they've developed in earlier assignments as an important information source. Such an outcome is conjectured to occur because personnel rotations are not being accomplished in a form that enables engineers to take maximum advantage of their past experience.

Consequently, appropriate organizational management is thought to be critical for linking both interorganizational transfers and intraorganizational transfers to technological performance. For interorganizational transfers, a process to integrate transferred engineers into the internal human network is vital; personnel assignments that enable organizations to take advantage of the knowledge and external information channels possessed by transferred individuals along with compensation systems to evaluate such knowledge and information channels are also thought to be necessary.

For intraorganizational transfers, on the other hand, it is important to think about the timing of transfers to ensure that they do not interfere with the accumulation of expertise by engineers or the formation of broad human networks in specialized fields. Giving consideration to transfer positions that can take maximum advantage of the experience and human networks accumulated by engineers prior to their transfers is also important.

In addition, the findings of this research indicating a negative relationship between interorganizational transfers and intraorganizational transfers, and the quite different characteristics of individuals transferred between organizations and individuals transferred within an organization, highlight a separate management issue concerning the balance between hiring specialized workers from the outside and the rotation of internal personnel.

There are naturally various limitations on this research. Interpretation of the causal relation in particular is a problem. First, for both intraorganizational transfers and interorganizational transfers, there is believed to be a causal relationship in the opposite direction in which engineers with low performance are transferred by necessity. However, for interorganizational transfers there also is a possibility that capable specialists are missing transfer opportunities because of management problems, whether pertaining to assignments of transferred individuals within the organization or compensation. In such instances, management needs to be reformed.

Appendix Table 1. Communication counterparts and important information sources for problem solving

Communication counterparts

Colleagues in the same workplace
Engineers and researchers in other departments within the company
Engineers and researchers in organizations where previously employed
Engineers and researchers in workplaces where previously worked for within the company
Engineers and researchers in the same area of specialization outside the company
Engineers and researchers in different areas of specialization outside the company
Engineers and researchers at competitor firms
Engineers and researchers at partner firms
University researchers
Researchers at non-profit institutions such as national research institutes
Acquaintances from years at a university (graduate school) outside the company
Professors when studying at a university (graduate school)

Information sources

Colleagues in the same workplace
Engineers and researchers in other departments within the company
Administrators of other departments within the company
Workplace superiors
Engineers and researchers in the same area of specialization outside the company
Engineers and researchers at organizations where previously employed
Engineers and researchers in workplaces where previously worked for within the company
Engineers and researchers at competitor firms
Engineers and researchers at partner firms
University researchers
Researchers at non-profit institutions such as national research institutes
Acquaintances from years at a university (graduate school) outside the company
Professors when studying at a university (graduate school)
Business consultants
Academic associations
Journals, science papers, professional literature
Electronics journals
Information delivered over the Internet
Patents
In-house training and seminars
Training and seminars outside the company

Appendix Table 2. Correlation matrix among variables

	Interorganizational transfers	Intraorganizational transfers	Years until initial transfer within organization	Number of patents held	Number of papers published	Capabilities as an engineer and researcher	Speed of promotions	Level of satisfaction with current work	Years in present position
Interorganizational transfers		-0.02 -0.05	-0.10* -0.05	0.02 0.06	0.06 0.09	0.06 0.04	-0.03 -0.02	0.02 -0.05	0.32** 0.32**
Intraorganizational transfers			-0.16** -0.12*	0.10* 0.15**	-0.02 0.05	0.08* 0.08	0.09* 0.11*	0.05 0.03	0.36** 0.39**
Years until initial transfer within organization				0.30** 0.31**	0.23** 0.21**	0.05 -0.01	0.01 -0.00	0.00 -0.08	0.42** 0.45**
Number of patents held					0.34** 0.31**	0.24** 0.22**	0.05 0.02	0.11** 0.08	0.33** 0.35**
Number of papers published						0.22** 0.24**	0.16** 0.20**	0.12** 0.13**	0.23** 0.30**
Capabilities as an engineer and researcher							0.27** 0.21**	0.15** 0.16**	0.12** 0.16**
Speed of promotions								0.33** 0.31**	0.01 0.04
Level of satisfaction with current work									0.13** 0.07
Years in present position									

Simple correlation, Pairwise deletion. Two-tailed test. *<.05, **<.01.
Upper values: Entire sample; Lower values: Research and development sample.

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Employment Systems and Social Relativity from the Perspective of Pay and Benefits for Science and Technology Researchers and Engineers

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I. Introduction

Perspectives on securing employment and job-hunting efforts are influenced by whether employment systems utilize external or internal labor markets. Professionals in Europe and the US are often sought out through the external labor market, while a considerable number of professionals in Japan are hired from the internal labor market. Accordingly, the pay and benefits offered by companies and the attitudes and behavior of professionals in Japan differ from those in Europe and the US. Japanese companies now communicate with the international community across a full range of contexts and, in the process, many professionals have experienced pay, benefits and other systems in Europe and the US unlike those in Japan. Attempts are being made in Japan by the government to increase the numbers of science and technology researchers and engineers and to transform employment systems, and some companies have not only internationalized their business operations but have also begun hiring from the external labor market. Nevertheless, many other companies have carried on with Japanese employment practices within Japan even as they adapt their businesses to the needs of the international community.

In the US, the state of California, for instance, has an employment system permitting the layoff of all employees in departments and divisions that are being eliminated (however, layoffs of individuals on the basis of racial or sex discrimination or any other factor that infringes on human rights are not permitted), an unemployment insurance premium system that imposes payments only on companies (employees are not obligated to pay premiums) and, for companies making frequent (or large-scale) use of unemployment insurance paid out to dismissed personnel, a system that imposes higher reserve fund rates for unemployment insurance in order to discourage them from frequent layoffs. While employees are naturally tense about the possibility of being laid off by their companies, they are eligible for unemployment insurance benefits without having to have paid unemployment insurance premiums whenever terminated at the initiative of their companies. In exchange, no unemployment insurance whatsoever is paid out for voluntary separation, i.e., termination resulting from causes other than layoff. The risks and costs borne by both the company and the employee in an external labor market differ from those in an internal labor market (Fujimoto 2008).

On reflection, Japanese employment practices were rejected following the collapse of the bubble economy but these practices seemed to regain favor once the economy recovered. Companies required to comply with the rules of the international community have seen conflicts at their overseas subsidiaries between local employees and employees dispatched from Japan due to differences in external and internal labor market systems; few companies resort to Japanese employment practices abroad. A small number of the researchers and engineers dispatched overseas experiencing first-hand the standards of European and American companies even find new jobs locally to secure better pay and benefits.

In terms of professional identity, physicians, attorneys and clergy as traditional professionals have secured status for themselves and have come to be regarded as independent professionals. Society’s demand for a high degree of specialist service in this day and age has promoted greater specialization, and many professionals are employed by organizations within which they work in collaboration with other professionals (Etzioni 1964; Pelz and Andrews 1966; Ishimura 1969; Takeuchi 1971; Elliott 1972; Abbott 1988; Ota 1993; Nagao 1995; Sato 1999). Professionals have been regarded as cosmopolitan in character, with little sense of belonging to the organizations with which they are affiliated (Gouldner 1957, 1958), but no general behavioral pattern of changing jobs in search of better pay and benefits can be discerned among physicians,[1] attorneys[2] and other established professionals in

[1] Mobility and pay and benefits of physicians: As about 70% of physicians are hospital physicians (Ministry of Health, Welfare and Labour 2002), hospital physicians are used to represent physicians for the purposes of this paper. Hospital physicians ordinarily belong to the “University Medical Bureau,” a group exercising organizational control, and physicians ordinarily transfer among hospitals every two to five years until they reach their 40s in accordance with the instructions of the Bureau (head professors). Urban hospitals (university-affiliated hospitals and major private hospitals) that enable physicians to boost their own levels within these physician groups are very popular, while local hospitals and hospitals with a high proportion of patients requiring geriatric care tend to be given the cold shoulder. For

Japan; these professionals exhibit low mobility in keeping with the norms common to companies in their industries.

The objective of this paper is to examine the present pay and benefits of researchers and engineers in Japan, and this necessitates a look at “institution” beyond the legal system—perspectives on securing employment and job-hunting efforts exhibited thus far and other norms and cultural makeup—and an analysis of the current situation. This paper will determine how researchers and engineers are positioned socially and analyze the differences in the roles expected of professionals and in pay and benefits between the external labor market approach of Europe and the US and the internal labor market approach of Japan.

Section II offers a comparative examination of the relative position of researchers and engineers in terms of pay and benefits vis-à-vis other professionals through the use of data from the Basic Survey on Wage Structure. The degree to which the investment effect of education is reflected in pay and benefits in the manufacturing industry, which employs large numbers of science and technology researchers and engineers, is then analyzed. Next, Section III takes a general overview of the perspectives on securing employment, the job-hunting efforts and the pay and benefits of science and technology researchers and engineers in the external labor market of Europe and the US, and notes the differences from the internal labor market of Japan.

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that reason, hospitals having a difficult time securing physicians try to entice them with large salaries (two to three times as large as those of doctors working in university-affiliated hospitals) but, even so, few physicians seek out these positions.

2 Mobility and pay and benefits of attorneys: The general pattern in recent years has been for newly-registered attorneys to be employed by small to medium-sized offices except in Tokyo, home to a growing number of large offices with staffs exceeding 100. Attorneys in Tokyo are increasingly specializing in corporate law connected with M&As and intellectual property, but the majority still have not staked out a specific area of practice. Salaries tend to be high in Tokyo, Osaka and other metropolitan areas but, even in Tokyo, more than half of the attorneys make less than 15 million yen; about 6% of attorneys make more than 50 million yen (Diamond Inc. 2005). While physicians working in community health care receive better pay and benefits than those in metropolitan areas, attorneys working in cities tend to have higher salaries than those based in outlying locations. Even in major cities, though, attorneys who move in a cosmopolitan fashion between offices are regarded as lacking in perseverance, and many of these attorneys only work at one or two offices before opening up their own offices or becoming joint managers in an office. The norms of the legal profession favor thoroughgoing problem resolution in a professional manner over mobility between organizations in search of higher salaries.

Section IV employs a number of findings to examine the perspectives on securing employment and the pay and benefits of researchers and engineers within the domestic internal labor market, and analyzes the roles expected of professionals within an internal labor market. Finally, Section V utilizes the analyses in the previous sections to assess the structure of pay and benefits for science and technology researchers and engineers in Japan that has been worked out within the internal labor market, both in terms of the inconsistency between occupational prestige and pay and benefits and of the cohesiveness of steady employment.

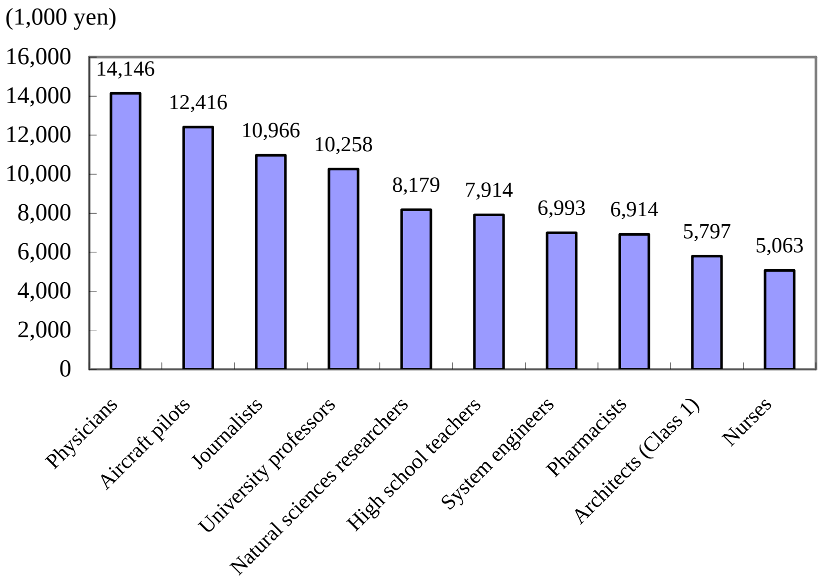
II. Pay and Benefits and Mobility of Researchers and Engineers from a Relative Perspective

Section II compares the pay and benefits of science and technology researchers and engineers with the pay levels of other professionals and with other industries to determine their relative position.

1. Comparison of Economic Compensation with Other Professionals

Approximately 60% of researchers are employed in industry (Statistics Bureau, Ministry of Internal Affairs and Communications 2004), and more researchers work at companies than at universities and public research institutions. About 90% of industry’s approximately 460,000 researchers and engineers work in manufacturing (Statistics Bureau, Ministry of Internal Affairs and Communications 2004) and, given that large companies are most able to employ researchers, their pay and benefits are quite often on par with white-collar standards at other large companies. Figure 1 shows a comparison of the estimated annual salaries of professionals utilizing data from the FY2006 Basic Survey on Wage Structure. The average age differs by occupation and, with only data for male employees available, the age factor was controlled by comparing men aged 40 to 44. The estimated annual salary of researchers in the natural sciences is about 8.18 million yen, lower than those of physicians and aircraft pilots but higher than those of high school teachers and pharmacists. The salary figure for researchers and engineers within the manufacturing industry ranks higher than those for other jobs in manufacturing, but there is little disparity with other white-collar jobs requiring a high level of education (Fujimoto 2005). Pay levels for researchers and

Figure 1. Average annual income of professionals (men, ages 40-44)



Source: FY2006 Basic Survey on Wage Structure.
Note: Only male nurses have been used here for comparison purposes; female nurses make about 50,000 yen more.

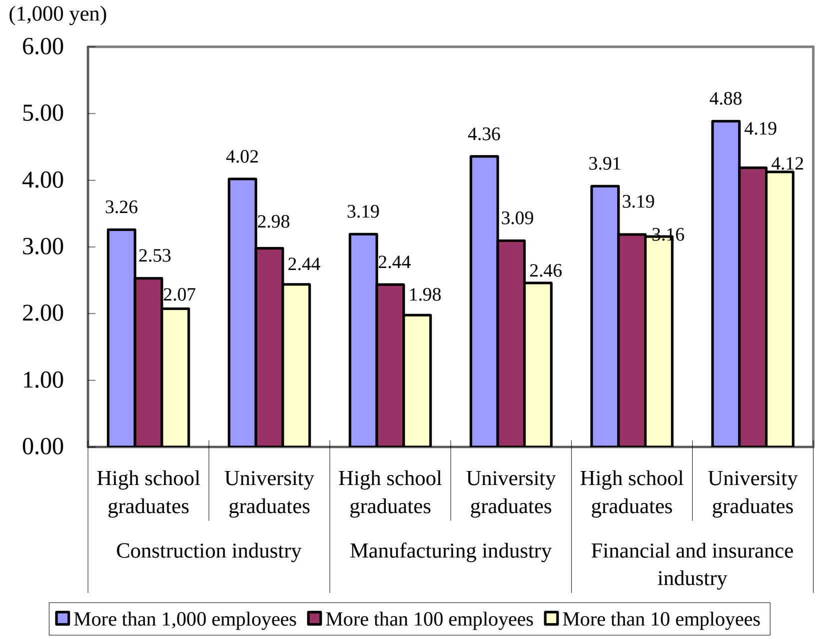
engineers at companies are determined not in comparison with other professionals but relative to other jobs within their companies.

2. Inter-industry Disparities in Pay and Benefits and Correlation with Academic Qualifications

As shown in Figure 1, highly-educated persons do not necessary earn high incomes across the board. From the data in the FY2004 Basic Survey on Wage Structure, "hourly wages" have been calculated below by dividing yearly income by total working hours[3] for one year for the purpose of determining inter-industry differences in pay and benefits. Furthermore, because the average figures for industries employing many irregular workers, women, and young adults are skewed vis-à-vis industries with large numbers of regularly

3 "Uncompensated overtime" not reflected in total working hours is thought to be prevalent in Japan but, as this is believed to exist in all industries and not just specific industries, no particular adjustment was made to working hours.

Figure 2. Annual income by industry and education/annual working hours (regular male employees aged 40-44)



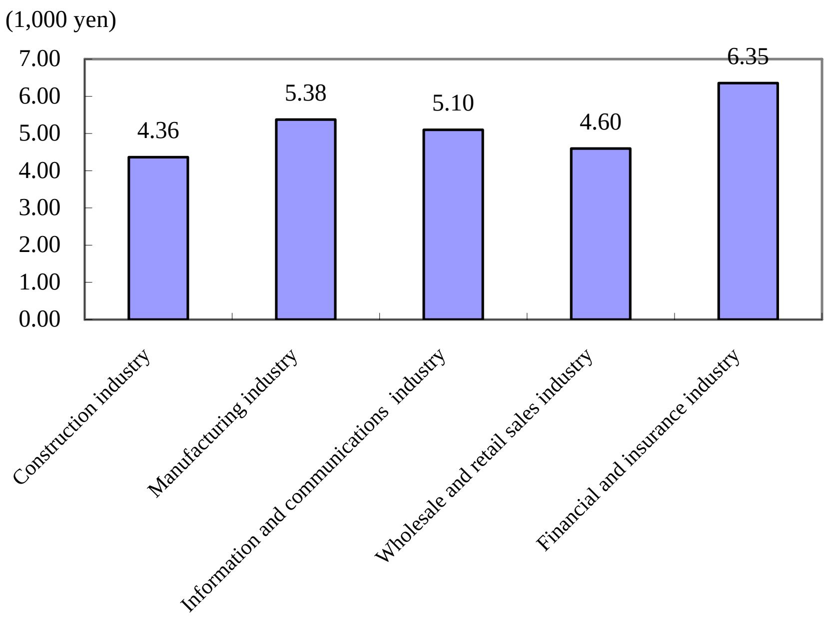
Source: FY2004 Basic Survey on Wage Structure.

employed men as well as industries with little age bias, the inter-industry salary comparison is limited to regularly employed men aged 40 to 44.

Figure 2 reveals that the hourly wages of university graduates in the financial and insurance industry exceed those of high school graduates whether at companies with "1,000 or more employees," "100 or more employees," or "10 or more employees," but the hourly wages of high school graduates at manufacturing companies with 1,000 or more employees are higher than those of university graduates at companies with 100 or more employees. In other words, company size has a greater impact on pay and benefits than do academic qualifications in the manufacturing industry. A similar tendency can be seen in the construction industry.

The manufacturing industry employs about 30% of new graduate-school graduates, the highest figure for any industry (the financial and insurance industry hires less than 5%). Nevertheless, this phenomenon can be attributed

Figure 3. Hourly wages (annual income/annual working hours) for division chief level employees (aged 40-44) at companies with 1,000 or more employees



Source: FY2006 Basic Survey on Wage Structure.

to "the pull of the majority" (Fujimoto 2007); more than 80% of new-graduate hires in the financial and insurance industry are university graduates, with high school graduates accounting for an extraordinarily low percentage. On the other hand, about 70% of the new-graduate hires in Japan's manufacturing industry are high school graduates—even as plants are being shifted overseas—with university or graduate-school graduates making up the remaining 30% or so (data on regularly-employed new male graduates from the 2003 School Basic Survey). Salary structures are thus formed in relative comparison to the salaries of the majority of employees in each industry, giving rise to this inversion phenomenon.

Although the hourly wage of university graduates in the manufacturing industry is lower than that of university graduates in the financial and insurance industry, it is by no means low in comparison with other industries. Figure 3 shows a comparison by industry of annual incomes for positions equivalent to division chief (aged 40–44) at large companies of 1000 or more employees divided by annual working hours. It is apparent that the hourly wage for the manufacturing industry is lower than that for the financial and insurance industry but higher than those for the information and communications industry, the construction industry and the wholesale and retail industry. Consequently, the pay and benefits of white-collar workers in the manufacturing industry cannot in any way be said to be low in the context of an inter-industry comparison.

III. International Comparison of Valuation and Pay and Benefits of Researchers and Engineers

Section III presents an overview of the valuation and the pay and benefits of European and American researchers and engineers employed via external labor markets and Japanese researchers and engineers employed via internal labor markets.

1. Careers and Pay and Benefits for Engineers in Japan, the US, and the UK in the Latter Half of the 1980s

Joint international (Japan, the US, the UK, Germany) research was conducted in 1988 by the Senior Productivity Engineer Research Committee on the career and pay and benefits of engineers (Senior Productivity Engineer Research Committee 1990a, 1990b, 1990c). Utilizing this report, this section shows the status of Japan at that time vis-à-vis the UK, which emphasizes fundamental scientific research, and the US, which has been highly influential on Japan's science and technology. This research focused on engineers at fundamental research laboratories and development laboratories working for major electrical equipment, electronics and communications companies in Japan (three companies), the UK (three companies), and the US (four companies) and at major chemical companies (three companies each in Japan, the US and the UK).

The first differences can be found in the social environment. The UK is strongly inclined toward fundamental science and has fewer engineers than scientists; the UK has only half the number of engineers as Japan relative to population. Engineers are given low social valuation in the UK, and only a small percentage of students pursue higher education in engineering. Many of the students admitted to engineering departments seek employment in non-manufacturing industries, and not a few graduates employed as engineers have subsequently changed to non-engineering jobs. Because salaries are prescribed by position and because pay raises are not directly tied to age, many young adults are interested in moving into management positions. Given the low social valuation and pay and benefits for UK engineers in the manufacturing industry, social factors make management positions more appealing to them than research and development posts.

The ratio of engineers per 10,000 population in the US is about the same as Japan. Unlike the UK, engineers in the US make higher salaries than scientists, and those working in the fields of electrical and electronics engineering or computers are particularly high. Salaries in the US, like those in Japan, tend to rise with age but, while the salaries of younger engineers are 170% those of their counterparts in Japan, those of US engineers 41 years of age or older are 85% those of Japanese colleagues, producing an age disparity less than that in Japan.

The salary levels of industrial researchers in Japan do not differ widely between research and development and, though there does exist a sense of academic hierarchy between scientists and engineers (Fujimoto 2005), the public tendency to lump them together under “science and technology” creates little difference between them in occupational prestige. The manufacturing industry with its large companies enjoys high social valuation, and its seniority-based wage system results in a salary structure with large age disparities. While engineers in the UK strive for higher salaries, engineers in Japan, where salaries are determined by age, tend to seek promotion within the organization and a greater degree of freedom in research.

2. Orientation of Researchers and Engineers in 1999 and 2000 in Japan, the US, and the UK

Comparative international (Japan, the US, the UK, Germany, France) research on the orientation of researchers and engineers was conducted about ten years after the research discussed above (Institute for Social Engineering, Inc. 2000, The Institute for Future Technology 2001, Hideo Ishida (ed.) 2002). This research focused on institutional representatives and researchers and engineers at national research institutions and private research laboratories. A Japan-US-UK comparison has been excerpted from this report for examination here. The majority of researchers and engineers in the US and the UK are highly educated; more than 80% of them hold PhDs. By contrast, Japan has fewer PhD holders at its national research institutions (70%) and at private laboratories (40%). Many researchers at Japanese companies are hired while still having only master's degrees and then go on to earn their PhDs while working.

Feedback on the results of individual evaluations is provided far more often in the US and the UK than in Japan, and national research institutions in Japan lag furthest behind in this regard. Compared to their colleagues in the US and the UK, Japanese researchers were discovered to be far more interested in receiving appropriate evaluations of the contributions of individual researchers to collective results. Many researchers have called for a more sophisticated system of performance assessment that would incorporate long-term evaluations and not overly emphasize short-term evaluations. The better the performance of the researcher and engineer, the greater the tendency to demand rewards for research results; where a civil service structure prevents such rewards from being reflected in salaries, researchers ask for increased research funding and expanded freedom in their research. In a comparison of compensation in Japan, the US, and the UK, age has a greater impact in Japan than in the US and the UK, while performance is given more weight in the US than in Japan and the UK.

The career path of researchers and engineers is generally one of transitioning from research and engineering jobs to management positions, but many companies have a system for professionals or other "dual ladder" system that serves engineers as an occupational ladder unlike that for administrative jobs. While the emphasis in Europe and the US is on research skills regardless of age, deeply-rooted age limitation norms in Japan (where natural sciences researchers and engineers are thought to reach their peak at 35 years of age) have reportedly hindered the effective functioning of such systems for professionals (research conducted in 1995 and 2001 by this author revealed a similar tendency).

IV. Domestic Comparison of Evaluation and Pay and Benefits of Researchers and Engineers

This paper has thus far chiefly examined the views of researchers, but

Section IV will look at their pay and benefits from the perspective of research institution personnel managers at research institutions whose positions require them to evaluate researchers and engineers. Below is shown an excerpt from the findings of research conducted by this author in 2001 on fundamental research laboratories at five major companies (a communications company, a foreign computer-related company, two domestic computer-related companies, and a heavy electric machinery company). The evaluation and pay and benefit structures of these five companies have been classified into two principal categories.

1. Evaluation and Pay and Benefits of Researchers and Engineers at Companies Emphasizing Research Results

Evaluation of researchers and engineers at the communications company and the foreign computer-related company places a very heavy emphasis on research performance (number of papers, number of patents, academic awards and other external recognition). Evaluations at the communications company cover more than 10 items, including number of papers (consideration also given to IF and number of citations),[4] number of patents (not stressed as much as papers), and target assessment (degree of difficulty × degree of achievement). About 70% of the evaluation is quantitative, with qualitative evaluations (subordinates' potential skills, project implementation capabilities, etc.) by superiors (primary – tertiary raters) accounting for the remaining 30%. Pay levels at this company are about twice those of the natural sciences researchers in Figure 1 (this company, privatized in 1985 and working since to reach parity with the private-sector manufacturing industry, has a top-class research institute in Japan with access to plentiful research facilities and funding) because researchers and engineers are not the only employees receiving generous salaries; administrative personnel hired as candidates for higher positions are also paid high salaries, and the salary structure for research posts resembles that for administrative posts (researchers and engineers with graduate degrees start out on the salary structure at a higher point than university graduates in accordance with their academic

4 IF (Impact Factor)—publication in magazines with high numbers of citations—is incorporated in evaluation scoring. The numbers of citations of researchers' own papers are also considered in their evaluations.

qualifications). The numbers of papers published in prominent and oft-cited academic journals and of papers that are themselves cited many times are converted into points and added to evaluations. Patent applications are encouraged but not compulsory, so researchers do not presently regard these as directly tied to their evaluations. Opportunities for study abroad are also afforded to nearly half of the fundamental research laboratory's younger researchers (up to about age 35), and researchers expressed a high degree of satisfaction with educational opportunities, research freedom, research budgets, salaries, etc. Although there are no requirements that employees who quit soon after returning home from study abroad reimburse the company for overseas study costs, only a very tiny number of people leave the company. Many researchers and engineers have not changed jobs because "given the tremendously robust research environment available here, moving to another research institution would mean less favorable working conditions" (Fujimoto 2004).

2. Evaluation and Pay and Benefits of Researchers and Engineers at Companies Giving Priority to Commercialization

At one domestic computer-related company, a dominant member of the industry with a "results-based" approach, researchers often feel that conducting joint research with business divisions provides positive feedback for their own research, and a number of researchers engaged in research at a level that would allow them to remain at the central research laboratory have expressed interest in being assigned to a business division. Researchers and engineers are fully aware that they work at a commercial enterprise, and recognize that the highest regard is given to research oriented toward developing products.

The heavy electrical machinery company was using no well-defined criteria for evaluation as of 2002, and individual researchers were evaluated through self-assessments and relative evaluations by their superiors; IF and citations of papers were not used in direct evaluations. Numerous researchers and engineers who have been assigned office positions due to in-house personnel transfers have left the company for universities. Others have gone on to fundamental scientific research institutes that are highly regarded in academic circles, even accepting salary cuts in doing so, indicating that some researchers are oriented less toward economic compensation and more toward an environment allowing them to conduct fundamental research.

At the other computer-related company, researchers are assigned positions in a comparatively flat manner. Researchers do not aspire to become research managers, and the company follows a policy of selecting candidates for management positions from a comparatively young age rather than turning researchers into "playing managers" who perform managerial functions while continuing their research. Efforts toward commercialization are considered important in the evaluation of researchers and, since the number of conference reports and papers are not given emphasis in evaluations, researchers whose areas of expertise are not suited to the company's business policies have a tendency to move on to universities, other companies, national experimental research institutes, etc. As one personnel manager put it, "Ultimately we do not care if our researchers do not even publish a single paper; we want them to engage in research tied to business" (Fujimoto 2004).

3. Evaluation and Pay and Benefits of Researchers at High-tech Measurement and Analytical Equipment Company

This measurement and analytical equipment company, which has a solid reputation in the field of high-tech, accords no special treatment to researchers carrying out fundamental research. It also has no pre-determined hiring quota for research jobs and, while its salary structure does incorporate differences based on the level of an employee's position, there are no occupation-specific structures for technical, sales, managerial and other personnel; the company's policy is to regard employees as a collective whole and not designate certain occupations for special treatment. Promotions in terms of the level of duty rather than position serve as both social and economic compensation. Employees feel that difficult assignments are recognition of their skills, and the company's system pegs salaries to the difficulty of duties. Individual evaluation is handled through bonuses and similar means, although the company has not adopted a strict job rate wage system making possible pay cuts or imposed a negative system for assessing pay raises. In-depth evaluations would only result in small additional salary allowances for skilled personnel, but this disparity would lead to dissatisfaction and lower morale. The executive responsible for personnel affairs accordingly noted the problems of segmentalized pay raise assessments and insisted on the need for a balanced, company-wide approach to evaluations and pay and benefits.

Nevertheless, persons engaged in fundamental research are granted discretion in their working hours. The company also officially authorizes researchers to engage in "underground research" (individual research not directly connected to commercialization) at the conclusion of projects, and rewards researchers with greater freedom and funding for research. Great importance is attached to an evaluation system that allows individuals to feel rewarded but that does not undermine organization-wide balance; this is seen as a manifestation of the wisdom born of experience gained in the more than 100 years of organizational continuity the company has enjoyed.

4. Tendency of Japanese Science and Technology Companies to Hire Mainly Master's Degree Holders

Japanese companies find it easier to hire and educate master's degree holders able to flexibly adapt to the requirements of various projects than doctorate holders specializing in a narrow field of expertise. A survey conducted by this author (2001-2005) discovered that only about 20% of doctorate holders were immediately employed after receiving their PhDs and that post-doctoral[5] experience did little to improve their prospects.[6] Companies requiring research personnel capable of adapting flexibly to a range of projects have little need for researchers who do not wish to do research outside their areas of specialty. Given that employees of eliminated divisions and departments cannot be laid off in Japan as they can overseas, taking on large numbers of personnel with narrowly focused specialties who have difficulty in flexibly adapting to other fields of endeavor poses a major risk for companies.

V. Pay and Benefits and Social Relativity of Researchers and Engineers in Japan

1. Trends in Japan as Seen in Comparative Surveys

The pay and benefits of science and technology researchers and engineers have been comparatively examined above from several angles. The comparison with other professionals in Japan in Section II showed that their pay and benefits were lower than for such professionals as physicians and aircraft pilots

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[5] Non-permanent research posts of limited term for younger researchers who have recently earned their degrees.

[6] Efforts are underway to improve job placement for persons with post-doctorate experience.

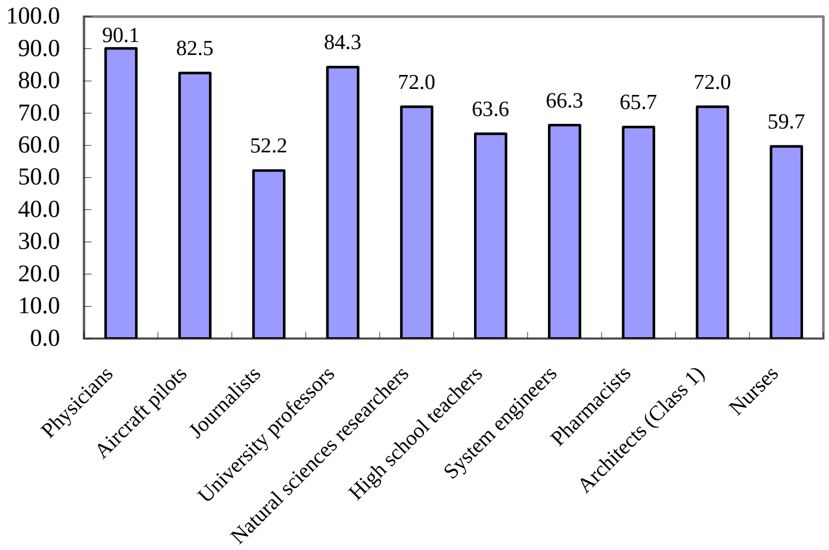
but higher than such professionals as high school teachers and pharmacists. Pay and benefits were lower in the manufacturing industry than in the financial and insurance industry, and the effect of academic qualifications is skewed in that high school graduates at large companies receive greater economic compensation than university graduates at small and medium-sized enterprises. The international comparison in Section III noted that salary structures in Japan tend strongly to be regulated by age, prompting many researchers and engineers to demand improvements in salaries. While evaluations in the US center on research performance, greater attention is given in Japan to qualitative factors such as potential skills and effort. Researchers and engineers in the US and the UK hope even as young adults to move into management positions, while age-dominated salary structures in Japan lead many researchers and engineers to avoid management posts that would put them in leadership positions in favor of continuing in their specialized work. Salaries dictated by age provide little motivation to advance to higher positions (the duty allowance for such positions is also relatively low), and the tendency instead is for researchers to seek out greater funding and freedom for their research activities, i.e., a degree of autonomy from organizational control. Section IV's comparison of corporate research laboratories in Japan made clear that research performance is emphasized in evaluations at the communications company and the foreign company (both focused on fundamental scientific research) while the stress was on contributions to commercialization at the other companies. Many companies are seen as offering excellent research environments in terms of discretionary research time, opportunities for study abroad, participation in overseas conferences, etc.

2. Role Expectations in External and Internal Labor Markets, and Correlations with Pay and Benefits

(1) Inconsistency between Occupational Prestige and Income

The pay and benefits of researchers and engineers in the manufacturing industry are lower than those for researchers and engineers employed by the financial and insurance industry, but still higher than those in other industries. The continued strength of the internal labor market approach in Japan is no doubt one major factor keeping researchers and engineers in the manufacturing industry. Another might be the availability of certain advantages deemed more valuable than economic compensation, e.g., the sense of contributing to society

Figure 4. Occupational prestige scores for professionals



and the public respect accorded researchers and engineers in science and technology fields. In particular, engineers in Japan are not held in the same low social valuation as engineers in the UK, and children who early on demonstrate aptitude in science-related courses are considered outstanding students.

Figure 4 shows a comparison of occupational prestige scores[7] of professionals based on social stratum and social mobility research data (Tsuzuki 1995). According to this data, the occupational prestige of researchers in the natural sciences, who ranked fifth in terms of annual salary, placed fourth (above journalists), while system engineers, who ranked seventh in terms of annual salary, placed sixth (above journalists and high school teachers). Their counterparts employed in the financial and insurance industry far and away surpassed those in the manufacturing industry in the income comparisons in Figure 2 and Figure 3, but the occupational prestige of "bank employees" was 56.4, beneath both natural sciences researchers and system

[7] These scores were calculated using the answers on the prestige of occupations given by respondents to the survey on social stratum and social mobility (participants selected by random sampling of nationwide voter rolls) for use in evaluating occupational prestige.

engineers. Consequently, the occupational prestige of science and technology researchers and engineers is quite high relative to their income, and their economic status does not appear consistent with their occupational status. This social prestige (social compensation from the general public) is perhaps even more important than economic compensation in attracting high school students to science-related studies and persuading university students to seek employment involving science and technology.

(2) Social Relativity as Seen from the Pay and Benefits of Researchers and Engineers

Despite its scarcity of resources Japan became an economic power through added-profit trade, making it important that the country continue to steadily create added value through science and technology. The UK, too, has built its economy on added-profit trade, but there seems poor understanding among its public of the role of engineering in this regard, and the pay and benefits for personnel responsible for collaboration between science and industry can by no means be said to be adequate. One factor in Japan's success in spite of its lack of resources is that, though there does exist a disparity in the valuation of science and engineering, Japan has managed to boost social approval of engineering higher than in the UK. The assimilation of staff members as "company employees" can be seen as connected to acceptance by researchers and engineers that they will not receive special pay and benefits as professionals but will instead enjoy a high regard among their fellow "company employees."

In the seniority-based wage system, once academic qualifications and age at hiring have been reflected in the starting point on the salary ladder, the costs entailed in evaluating the skills of individuals and the contributions of various occupations are consolidated in a laborsaving manner into the evaluation criteria of "age"; outliers (young but outstanding personnel and poorly-skilled middle-aged and elderly personnel, as well as employees in occupations extremely useful or relatively useless in commercialization) tend to be submerged therein. This can be said to reflect not only an averaging assessment of individual skills in the form of a linear increase in capabilities, but also an averaging assessment of the contributions of differing occupations. This system has proven effective in maintaining balance among personnel involved in joint operations within the company. The emergence of relative disparities in the salaries of staff members at Japanese organizations, which have procured their personnel in an internal labor market, could be termed a double-edged sword, enhancing the morale of those who benefit from high evaluations but lowering the morale of many of those on the "negative" side of even slight disparities. In societies relying on an external labor market approach, employees who are dissatisfied with their evaluations often change jobs, a fact that puts many personnel dispatched from Japanese companies at a loss when evaluating employees overseas (Fujimoto 2008).

Even as interest has grown in recent years in generous pay and benefits for young researchers and engineers in the US and in the fluid employment of researchers and engineers in Europe and the US, support for "steady employment" remains deeply rooted. Because an environment suited to long-term research and development is even more appealing to researchers and engineers than high salaries, there are those who desire steady employment above all else. Japanese companies essentially guarantee employment even in periods when researchers and engineers are unable to contribute directly to commercialization or when they cannot exercise effective leadership during the transition from research to management. In fact, although attracted by a results-based approach when engaged in research that could be expected to generate notably higher pay and benefits, many younger researchers and engineers return from study abroad to the company that originally dispatched them when faced with the harsh reality overseas that compensation or research funding is difficult to obtain when research is not proceeding smoothly.

New systems are now being introduced for ex gratia payments and patent rewards, and methods developed to reward outstanding researchers and engineers. Recent years have also seen researchers and engineers who have produced outstanding research results fighting for greater pay and benefits in court, giving rise to new issues. On the other hand, the impact that more generous pay and benefits for researchers and engineers would have on other staff members is a problem that cannot be ignored by Japan's manufacturing industry, which has grounded its salary structures on balance and equitability via the "*Densan* wage system."[8] The measurement equipment manufacturer

[8] The "*Densan* wage structure" is a wage structure that "classifies wages into standard and non-standard labor wages, with the 'standard wages' accounting for the principal part of standard labor wages simply comprising three components: livelihood security pay, merit pay, and seniority pay….This structure is arranged so

mentioned earlier offers extra compensation to employees who have produced outstanding results regardless of occupation. To this point there has been little correlation between economic compensation for researchers and engineers and their degree of contribution; relatively low compensation during periods of high contribution has been somewhat offset by the absence of substantial reductions in responsibility or salary during periods of low contribution, and researchers and engineers have enjoyed a "guaranteed" income. Persons employed via the external labor market are given generous pay and benefits because they assume this risk. It behooves us to realize that the time has come to consider the relationship between contributions to companies' bottom lines and pay and benefits, and to acknowledge responsibility when the anticipated contributions are not forthcoming. Given Japan's emphasis on its manufacturing industry, the pay and benefit packages for researchers and engineers and other systems used in Europe and the US must not be imported wholesale but must be discussed in light of Japan's own social and cultural background.

Interview data used in this paper

1. High-tech measurement equipment manufacturer: executive in charge of personnel affairs (male, 50s); conducted in 2005.
2. Five company research institutes: personnel managers; conducted in 2001 (Fujimoto 2004).
3. Major communications company research laboratory: university professor and former researcher (male, 40s); conducted in 2005.
4. Selected physician: physician at university hospital (male, 40s); conducted in 2005.
5. Selected attorney: attorney employed at law office (male, 30s); conducted in 2005.

that, of these constituent elements of…'standard wages,' about 80% of total wages [standard labor wages (inserted by this author)] can be received through the 'livelihood security' component" (Kawanishi 1999) .

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Scientists and Engineers' Occupational Community and Organizations: Their Partial Inclusion and Role Conflict in Organization

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> Turning to Robert Lund, the supervising engineer, [Jerald] Mason [then senior vice president of Morton Thiokol, Inc.] directed him to "take off your engineering hat and put on your management hat." The earlier no-launch recommendation was reversed.
>
> Roger Boisjoly was deeply upset by this reversal of the engineers' recommendation…….—*he was an engineer*. It was his *professional* engineering judgment that the O-rings were not trustworthy. He also had a *professional* obligation to protect the health and safety of the public, and he evidently believed that this obligation extended to the astronauts. Now his *professional* judgment was being overridden [emphasis in original]. (C. E. Harris, Jr., M. S. Pritchard and M. J. Rabins, *Engineering Ethics: Concepts and Cases*, 5)

> Group leader Yoshida then feared that this unfolding situation could lead to a crisis that would threaten the survival of the company [Mitsubishi Motors], and resolved that "in order to protect the company from the Ministry of Transport's audits, I would persist with the fabrication *in my position as a manager* in the Quality Assurance Department" [emphasis added]. (T. Okuyama, *The Power of Internal Whistle-blowing: What Does the Whistleblower Protection Act Protect?*, 24)

> The next day, just 73 seconds into the launch, the *Challenger* exploded, taking the lives of the six astronauts and schoolteacher Christa McAuliffe [emphasis in original]. (*Engineering Ethics: Concepts and Cases*, 6)

I. Introduction

Japanese society has witnessed many scandals in recent years, including the Tokaimura nuclear accident at a JCO plant, concealment of cracks at nuclear power plants operated by TEPCO, fabrication of earthquake resistance data by Aneha Architect Design Office and others in the construction industry, Misuzu Audit Corp.'s involvement in window-dressing of financial reports, faking of data by academics at Tokyo University, and concealment of product recalls at Mitsubishi Motors. Shocking though the frequency of these scandals and the involvement of workers on the spot rather than mainly top management as in the case of past scandals may have been (Tanaka 2002), even more shocking has been the involvement of members of the professions, such as university researchers and scientists, engineers, physicians, accountants, and architects, who with their recognized advanced skills and expertise had been regarded as setting an example for society. Ironically, one effect of this wave of scandals has thus been to stoke interest in the role and position of the professions.

The involvement of the professions in several scandals has prompted some reflection in organizational behavior studies, which seeks to explain the attitudes and behaviors of people who work in organizations: firstly, that the study of the professions, which completely disappeared from the field's research agenda at the beginning of the 1970s, should be resurrected as a serious subject of research;[1] and secondly, that such research must examine the professions through both the lens of the occupational community and the lens of the organization (Van Maanen and Barley 1984, 288), the latter being of particular importance.[2]

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[1] The professions were a subject of vigorous research in the field of organizational behavior from the later 1950s to the 1960s, when the primary focus was on scientists and engineers. From the beginning of the 1970s, however, interest almost entirely vanished. Interestingly, this largely coincided with when the U.S.'s superiority in its fierce rivalry with the U.S.S.R. surrounding science and technology became apparent with the Apollo 11 lunar landing. It is not hard to imagine that the end of the Cold War spurred this trend further. Since then, interest in organizational behavior has concentrated mainly on blue collar and white collar workers. Research on scientists and engineers, who as special groups do not even make 10% of an organization's members, may already have lost much of its appeal to researchers of organizational behavior.

[2] The term "occupational community" used in this paper signifies horizontal groups of people employed in the same work or occupation, such as the various groups of craftsmen frequently observed on construction sites (Van Maanen and Barley 1984). A profession, on the other hand, is an occupational community with a particular knowledge base, such as physicians and lawyers. Professionalization is defined as the process by which an occupational community becomes a profession (Wilensky 1964). Prominent examples of occupational groups that have professionalized are nurses and engineers.

Viewed through the lens of the organization, which emphasizes the superiority of the objectives and values of the organization over the individual, obedience to directions and orders based on the legitimate authority and power of management, coordination between departments, roles as employees, and loyalty to the organization, the behavior of Mitsubishi Motors group leader Yoshida is entirely understandable. Boisjoly's attitude and behavior, however, cannot be explained or predicted using any single organizational lens. This is because regardless of what judgment he may have come to as an engineer, as an employee he had to comply with the decision of management. Viewed through the lens of the organization, his attitude that his "hat as an engineer was a source of pride" even appears as a form of deviant behavior. Boisjoly's behavior cannot be explained or predicted without understanding the occupational community of engineers to which he belonged.

Interestingly, unlike researchers of organizational behavior, who have mainly used only the lens of the organization, the general public instead uses mainly the lens of the occupational community when judging the attitudes and behavior of professionals, as amply demonstrated by the public outrage that has greeted the involvement of professionals in the recent wave of scandals. The public interprets and judges their behavior according to the popular image and perception of the profession, rather than the organization to which the individual belongs. This is a clearly different attitude from that of seeing the structure of the organization to which the individual belongs as the problem, rather than blaming the individual, when people in management positions create scandals. And herein lies the reason why researchers of organizational behavior, who have hitherto employed mainly the lens of the organization, must reassess their approach to the professions.

Based on this reassessment, this paper considers the professions working within organizations, and in particular the attitudes and behavior within organizations of scientists and engineers. I argue that in order to understand and predict the attitudes and behavior within organizations of scientists and engineers, it is above all necessary to employ the lens of the occupational community. Focusing on two thorny problems associated with the management of scientists and engineers—i.e., their limited inclusion and role conflict in the organization—I explore how they should be managed in corporate organizations that are growing increasingly dependent on scientists and engineers, and what should be the relationship between them and the organization.

II. Organizations as Role Systems and the Inclusion of the Individual in the Organization

Among the diverse ways of looking at organizations (e.g., Morgan [1986]), one persuasive approach is to see them as role systems (Katz and Kahn 1966). Role, which from an early stage has drawn the attention of researchers as a bridge linking between the individual and the organization, is defined as the aggregate of expectations of a "focal person"—i.e., a person holding a specific position in a group, organization, and various social institutions—held by those around him/her (Jacobson, Charters and Liberman 1951; Kahn et al. 1964; Katz and Kahn 1966). An organization is thus seen as a single system in which the roles expected, formally and informally, of various positions essential to the attainment of organizational objectives are intricately linked, both vertically and horizontally.

If the organization is a single role system, then the individuals that work in it are actors who fulfill the roles expected of them by the organization. In practice, people are exceedingly sensitive to the roles demanded of them, and role is an extremely effective concept for explaining and predicting the attitudes and behavior of individuals in an organization. Just how sensitive people are to roles is clear from the significant changes that occur in the speech, attitudes, and behavior of focal persons in the event of changes in their positions as a result of vertical or horizontal movements. In addition, roles can in certain situations exert a major impact even on the values of the individual. In the case of the Challenger disaster, for example, it may be speculated that the reason why "things appeared extremely different when Lund was wearing his manager's hat" (Fujimoto 2002, 5) was that he abandoned his role as an engineer and accepted his new role as a manager. Roles thus have the powerful potential to change even people's outlooks and values.

If the organization is regarded as a single role system, then the relationship of the individual to the organization by which he or she is employed is necessarily limited. Katz and Kahn (1966) explain this using the concept of "partial inclusion." Partial inclusion here refers not to a relationship of the individual to the organization that subsumes his/her entire character (personality, values, psychology, feelings, and mentality in their entirety), but simply a relationship limited to the work and roles demanded by the organization. In reality, an individual cannot bring his/her entire character into the organization no matter how great his/her loyalty to the organization is, for while he/she may be fulfilling the role expected of him/her by many others, he/she will at the same time be working while thinking of his/her family and private life.

While it is true that the individual is only partially included in the organization, the degree of inclusion will differ considerably according to the individual. When considering the extent of inclusion of the individual of the employing organization, the concept of role furnishes us with an important insight. This is because even outside the employing organization, the individual belongs to various organizations, communities, and social systems, and has a variety of roles. In reality, the individual performs a variety of roles, including not only his/her role as an employee, but also the roles of husband and parent, expert and teacher, and citizen and local community resident.

If the individual is thus regarded as being incorporated into various organizations, communities, and social systems, the extent of inclusion in the employing organization will differ substantially according to the following three factors. These are: the number of roles held by the individual, the level of priority of the role as employee in the employing organization among the various roles held, and the level of commitment to the role as employee (Katz and Kahn 1966). Other things being equal, the fewer the roles held by an individual, the greater the level of priority of the role as employee, and the greater the commitment to his/her role as employee, the greater may be expected to be the individual's inclusion in the organization.

Assuming this to be so, occupational communities—i.e., groups of people performing the same work—could be an additional important factor affecting the level of inclusion of the individual in the employing organization. Below, I examine in detail the characteristics of occupational communities and professions.

III. Occupational Communities and Professions

Occupational communities, which may substantially impact on the extent of the individual's inclusion in the organization, are typically defined as horizontal groups of people employed in the same work and occupation who have a powerful "consciousness of kind" (Van Maanen and Barley 1984).[3] For

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3 Van Maanen and Barley (1984) provide a detailed analysis of occupational communities,

those who belong to an occupational community, their work and occupations are not simply a means of earning a living or deriving satisfaction, but also a definitively important means of distinguishing the self from others. They consequently have a strong tendency to identify themselves with their work and occupations, and their occupational lives penetrate deeply into their private lives, human relations, and leisure pursuits. There is also known to be a strong tendency for such people to adopt their coworkers as a reference group vis-à-vis the self, as a consequence of which the occupational community develops norms and assessment criteria regarding work, occupational ethics, and occupationally specific clothing, terminology, and culture (Van Maanen and Barley 1984).

This does not, of course, mean that all occupations and types of work form occupational communities. There are some, however, that form occupational communities in a relatively visible and identifiable form, good examples of which are the various groups of craftsmen observable on construction sites, firefighters, police officers, train drivers, pilots, physicians, dentists, nurses, scientists, and engineers. Of these various occupational communities, it is the professions, such as physicians, lawyers, and scientists, that most clearly bear the hallmarks of a community and also exercise considerable influence in society. While the precise definition and characteristics of a profession may be open to some debate, it is still possible to identify the following features as characterizing the "ideal-type profession" (Greenwood 1966; Hall 1968; Hodson and Sullivan 2002; Kerr, Von Glinow, and Schriesheim 1977; Nagao 1995).[4]

Firstly, a profession, more than various other occupational communities, is

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observing that it is extremely important to adopt a participant rather than an observer perspective when identifying occupational communities. For example, members of an economics faculty may appear to be observed to form a single occupational community, but for the participants, "modern economics" and "Marxist economics" are completely separate occupational communities. Far from sharing a feeling of solidarity, the two are more often at loggerheads.

4 For a definition and description of the characteristics of professions, see Windt (1989). It should be noted, however, that these characteristics are derived from the characteristics of physicians, lawyers, and holy orders, which have traditionally been treated as serving as the ideal type for professions in Western societies. Accordingly, the various professions presently in existence do not necessarily have all of these characteristics, and may also differ in the extent to which they exhibit them (Greenwood 1966; Vollmer and Mills 1966).

possessed of a knowledge base that provides a monopoly of certain knowledge and skills of definitive importance to people's life or death and happiness, or organizations' competitive advantage. The knowledge acquired by professions is of three kinds: theoretical knowledge (such as knowledge of anatomy and the theory of physiology) acquired through intensive education at specialist institutes of learning such as universities; applied knowledge required in order to provide services to actual clients (such as various knowledge concerning the symptoms and diagnosis of cancers); and technical knowledge (such as the various medical skills necessary to actually treat cancer patients) (Hodson and Sullivan 2002).

Secondly, a profession demands autonomy and self-control as a group. By autonomy is meant the selection of themes and goals to pursue, the methods of their performance, work priorities, methods of problem resolution, and so on based on its members' independent judgment free from external pressure, such as pressure from clients or employing organizations (Hall 1968; Nagao 1995). Because professions have a strong belief that appropriate checks and assessments of their work and performance are performed only by associates involved in the same specialist field, they additionally exhibit a strong tendency for the community itself to exert self-control without outside intervention in the various issues that arise within the profession. The trend toward the regulation of bioethics through the creation of standards and guidelines by the medical community itself, which has recently become a hot issue in medical circles in Japan, provides an excellent example of self-control by a profession.

Thirdly, a profession is a group that has powerful authority over the client and demands the client's strong compliance with its members' judgment. Greenwood (1966, 12) observes that one striking characteristic that distinguishes professions from other occupational communities is that whereas non-professions have customers, the professions have clients. Generally speaking, whereas the customer can personally choose the goods and services that he/she requires, the client cannot, the reason for this being that, as is apparent from the relationship between physician and patient, lawyer and client, and scientist and organization, the client lacks the skills and expertise to resolve his/her problems. This is at the root of the profession's strong authority over the client.

Fourthly, professions espouse stronger occupational ethics, especially altruism, than other occupational communities. Altruism here consists of two aspects: the moral rule that one must sacrifice one's own interests if necessary to serve the interests and happiness of the client, and the obligation to use one's skills and expertise for the general public (Hodson and Sullivan 2002). Specific examples of altruism are the Hippocratic Oath and the ethical charters often observed in the rules and regulations of academic associations of scientists and engineers. While it may certainly be negatively argued that such altruism is only advocated to preserve a profession's power, authority, and interests, it does go beyond simple lip service in one respect. This is that because professions monopolize knowledge and skills of definitive importance to people's life or death and happiness, the misapplication of this knowledge and skills can potentially have a serious impact on not only the client, but also the public, as is evident from the diversion of expertise into the development of nuclear weapons. If specialist skills and expertise become frequently abused, the high status, prestige, and power built up hitherto by a profession can be undermined. In order for a profession to maintain its own social position, therefore, its members must inevitably be strongly committed to occupational ethics. That is why commitment to altruism is not simply a matter of lip service.

These characteristics of a profession raise tricky questions when its members are employed by an organization. Before proceeding to the issues arising in the case of employment by an organization of scientists and engineers, which are the main subject of analysis of this paper, I consider firstly the dependence of the organization on scientists and engineers, and their contribution to the organization.

IV. Dependence of the Organization on Scientists and Engineers

The processes by which scientists and engineers form professional communities differ considerably.[5] It was not until early in the 19th century

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[5] Regarding the process of formation of occupational communities of scientists and engineers, numerous insights are provided by Murakami (2000, chap. 1) and Kornhouser (1962, chap. 4). Particular attention should be drawn here to the professionalization of engineers. While engineers certainly embarked on the road to professionalization early in the 19th century, the prevailing view is that they are still in the process of achieving full professionalization (Kerr, Von Glinow, and Schriesheim 1977; Raelin 1991). Regarding the differences between science and technology, see Allen (1997), and regarding the differences between scientist and engineer groups,

that science, originally the pursuit of groups of amateurs with a shared intellectual curiosity, formed a professional community (Kornhauser 1962; Murakami 2000). In contrast, engineers, who were already forming an occupational community with clients, commenced on the path to professionalization when the technical potential of science came to be recognized and technology was linked to science as systematic knowledge. In short, the two followed completely opposite trajectories, with scientists professionalizing from the top (knowledge) to the bottom (occupation), and engineers professionalized from the bottom to the top (Kornhauser 1962, 86-87).

Though the processes differed, professionalization was in both cases spurred by strong demand for scientists and engineers in industry. Following the end of World War II in particular, industry emerged fully as a client of scientists and engineers, and industry's demand for their services has surged further since the end of the Cold War under the mantra of transferring military technologies to the private sector and collaboration between industry and academia. As a result, the communities of scientists and engineers exemplified by specialist academic societies now have many members working in industry, as well as at universities and government research institutes.

It goes without saying that behind the strong demand for scientists and engineers in industry lurks science and technology's increased importance to companies as a source of competitive advantage. As information technology, genetics, nanotechnology, medical drugs, environmental technologies, and so on all show, the knowledge and skills acquired by scientists and engineers are directly linked to a company's competitive advantage. The importance of science and technology as a source of competitive advantage is also evident from the superior financial performance of companies that pursue a more research and development (R&D) oriented business strategy (Capon, Farley, and Hoenig 1990). Industry's dependence on scientists and engineers has heightened further in recent years due to the addition of speed as another source of competitive advantage (Chae 1999; Pfeffer 1994; Stalk and Hout 1990).

Being constantly exposed to fierce competitive pressures, corporate

see Goldner and Ritti (1967). The reader should note that this paper has in mind scientists, who are nearer to the ideal type.

organizations' primary interest is naturally in whether R&D performance is higher if scientists and engineers are more committed to the professional community. Though scientists and engineers may appear to form a single monolith group when viewed in terms of the ideal type, there can exist considerable variation in their degree of commitment to the professions at the individual level. Gouldner (1958) already found the existence of six groups among university academics that differed according to their orientations in the late 1950's. Such differences between individuals observable in professions have been researched to date employing mainly the concept of professional commitment. Professional commitment is defined as the extent of psychological attachment to a specialist field, such as the extent of identification of the self with the occupation and specialist field to which one belongs, and the extent of the desire to strive for the development of the specialist field (Aranya and Ferris 1984; Chae 1999; Hall 1968; Morrow and Wirth 1989). The stronger the attachment to the specialist field and the desire to strive for its development, the greater the professional commitment is considered to be.

The problem is the relationship between professional commitment and R&D performance. Most empirical research into the relationship of the two in the case of scientists and engineers has reported a significant positive statistical correlation between the two. Gouldner (1958) and Tuma and Grimes (1981), for example, both investigated the relationship between the two focusing on scientists working at universities, and found that researchers with greater professional commitment produced higher research performance. This finding was confirmed in a study by Chae (1999) of the relationship between the two focusing on scientists working at science and technology faculties at universities in Japan and South Korea, and scientists and engineers working at leading enterprises' institutes of pure research in South Korea. Chae reports that when several attribute variables that could affect the research performance of scientists and engineers, such as acquisition of doctorate qualifications, are controlled for, the number of presentations at academic conferences, number of papers published in journals, and number of patents applied for increase with researchers' professional commitment.

Considering that scientists and engineers are motivated above all by intrinsic factors such as commitment to their specialist fields and knowledge internalized through long specialist education and training, the approval of their peers, and interest in their work (Badawy 1970; Kerr, Von Glinow, and Schriesheim 1977), these findings are perhaps unsurprising. At any rate, they illustrate corporate organizations' growing dependence on scientists and engineers, especially those with a strong professional commitment in sustaining or improving competitive advantage of organization.[6]

V. Communities of Scientists and Engineers and Organizations

While corporate organizations grow increasingly dependent on scientists and engineers as competition surrounding science and technology grows fiercer, their belonging simultaneously to a corporate organization and a professional community brings with it two tricky problems for their management. One is the professional community's functioning in a manner that hinders scientists and engineers' inclusion in the corporate organization, and the other arises from the collision of scientists and engineers' roles as professionals and as employees (Scott 1966; Kornhauser 1962).

As already observed, the inclusion of the individual in the employing organization is influenced by the number of roles held by the individual, their order of priority, and the individual's level of commitment to his/her role as an employee. This being so, scientists and engineers' inclusion in an organization is inevitably lower than that of managers and regular employees. This is because scientists and engineers, as members of professional communities, have more roles, and, moreover, their roles as professionals are likely to take top priority due to the particular social prestige and strong influence wielded by their professions in comparison with other occupational communities. The low level of inclusion of scientists and engineers in organizations is clear if one compares the careers and nature of the commitment of scientists and engineers with those of managers, whose inclusion in the organization is considered to be relatively high.

For managers and regular employees that have not formed occupational communities, a career means a career of advancement in accordance primarily

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[6] It goes without saying that due to the huge facilities and research expenditures on R&D necessitated by the drastic increase in scale of science and technology projects, scientists and engineers, too, have grown increasingly dependent on corporate organizations. In other words, corporate organizations and scientists and engineers are growing increasingly interdependent.

with the hierarchy inside the organization. In contrast, the career of a profession, such as a scientist or engineer, is a career of "centrality" (Van Mannen and Barley 1984). Centrality here means not that the individual is no more than a single member of a profession, but rather that as a result of successively achieving skills and expertise held in high regard by the profession, a central position in the network of the community is attained and the individual's prestige and respect in the community steadily increases accordingly. In reality, scientists write papers frequently cited in the community and make discoveries, as a result of which they move from the margins to the center in scientist community they belong to. Interestingly, the career of centrality can potentially impact on the career of advancement in the organization, as not promoting a person who occupies a central position in a professional community is by no means a sensible choice for a corporate organization. The practice often observed in R&D organizations of making a person who has produced scientifically outstanding research performance the head of an organization (Kornhauser 1962; Marcson 1960), illustrates how the external power of an occupational community also affects careers within an organization.

The low level of inclusion of scientists and engineers is apparent also in their commitment to the organization. Managers and regular employees, who are insulated from the outside and lack anything with which to identify themselves apart from the organization, acquire company-specific knowledge and skills through, for example, on-the-job training, internal training programs, and internal transfers, resulting in a steadily increasing "continuance" commitment. Thus, they are likely to develop continuance commitment, which is a type of commitment that arises from individual perception of the cost associated with separation from the organization, such as the economic loss that one would suffer if one were to quit the company (Allen and Meyer 1990; Suzuki 2002). In contrast, scientists and engineers acquire specialist knowledge and skills of value on the external labor market, and so are not committed to the organization for reasons of continuance. They are committed to the organization due to factors such as a perception of its suitability as a place for developing a career as a professional, the presence of role models for specialists, and access to experimental facilities and research funds. Scientists and engineers thus develop quite equal relations with the organization compared with regular employees and managers, and their commitment to the organization is also quite instrumental and conditional in nature (Scott 1966).

The extent of inclusion has a substantial impact on the extent of influence and control of the organization over the individual. Typically, the influence of the organization is proportional to the extent of the individual's inclusion in the organization (House, Rousseau, and Thomas-Hunt 1995). The flip side of this is that the influence of the organization on scientists and engineers is quite low. In practice, the organization's influence on what most concerns corporate organizations, such as scientists and engineers' motivation, level of effort, research performance, and so on, is quite limited. This is because factors such as the strength of scientists and engineers' commitment to the professional community and the extent of internalization of the occupational ethics embraced by the professional community have a stronger influence than the organization's methods of control and human resource management. This means that human resource management that functions well in the case of managers and regular employees, whose level of inclusion in the organization is high, may not necessarily function well when applied to scientists and engineers. In practice, there exists in Japan, too, a deep-rooted doubt that the human resource management strategies traditionally pursued by Japanese companies have not always been entirely effective in R&D departments where many scientists and engineers work (Fukui 1989; Ota 1994; Sakakibara 1995).

As scientists and engineers belong to professional communities, there arises another thorny problem. This is that scientists and engineers acquire a role as a professional through long formal and informal education and socialization before entering an organization, and this increases the likelihood of a collision with the newly required role of employee after joining an organization. The role conflict experienced by scientists and engineers was recognized some while ago by Gouldner (1957, 1958), who classified people who work at organizations into two types: cosmopolitans and locals. Cosmopolitans are those who have low commitment to the organization but high commitment to their own specialist knowledge and skills, and have their reference group outside the organization. Locals, on the other hand, are completely the opposite. Gouldner (1958) observes that scientists and engineers employed by an organization are placed in a position in which, due to their strong cosmopolitan orientation, they are susceptible to experiencing conflict in the organization. The following four types of role conflict that can tend to be experienced by scientists and engineers as a result of having cosmopolitan values and norms have been identified (Chae 1999; Hall 1968; Kerr, Von Glinow, and Schriesheim 1977; Kornhauser 1962; Marcson 1960; Raelin 1986, 1991, 1994; Scott 1966).

Firstly, there can arise conflict concerning the goals pursued by each party. Scientists and engineers are socialized to adopt contributing to progress in science and their own specialist fields as personal goals, and emphasize above all else creativity and new ideas in research. The goal of a corporate organization, on the other hand, is to raise corporate performance through the development of new products and exploitation of new markets. The differences between the goals pursued by the two might be an important cause of the role conflict experienced by scientists and engineers. Secondly, there can occur conflict between autonomy and coordination. It has already been observed that scientists and engineers set exceedingly great value on autonomy. Insofar as the organization is a role system consisting of a complex horizontal and vertical intertwining of roles and expectations, management in order to coordinate roles is essential. The control necessary for coordination may well as a result constrain the autonomy valued by scientists and engineers. Thirdly, there is conflict concerning the source of authority respected by each party. The authority respected by the organization is ultimately associated only with the position held, and in most instances is the authority of management. Scientists and engineers, on the other hand, who set an exceedingly high value on the authority of the professional community, are reluctant to recognize the authority of management. The differences in the sources of authority respected can thus be an important cause of conflict between the two parties. Fourthly, there is the conflict surrounding evaluation criteria. Scientists and engineers have a strong tendency to believe that evaluation of the individual, too, should be based on his/her scientific achievements. On the other hand, the evaluation criteria valued by the organization include the individual's contribution to the commercialization and development of new products, and his/her loyalty to the organization. Such differences in evaluation criteria could be another important cause of the role conflict experienced by scientists and engineers.

Naturally, not all scientists and engineers experience role conflict in an organization, and the role conflict experienced will vary according to a number of factors. Researchers have noted that role conflict is more likely to be experienced by scientists, who more closely resemble the ideal type of professionals than engineers, by scientists and engineers who work in corporate organizations rather than professional organizations such as universities, hospitals, and government research institutes, by scientists and engineers involved in applied and development research rather than pure research, by scientists and engineers who come into contact with management, such as team leaders and institute directors rather than people in low positions, by scientists and engineers who work at research institutes other than those that are among the top in their industry, and by scientists and engineers who have a strong professional commitment (Chae 1999; Goldner and Ritti 1967; Fujimoto 2005; Kerr, Von Glinow, and Schriesheim 1977; Kornhauser 1962; Marscon 1960; Raelin 1991).

The results of role conflict are never desirable. According to the literature (Kahn et al. 1964; Kahn and Byosiere 1992; Rizzo, House, and Lirtzman 1970), role conflict not only lowers the job satisfaction and commitment to the organization of role performers, but can also lead to more frequent work absences and employee turnover, and lower productivity. Overpowering role conflict can also lead to deviant behavior among scientists and researchers, dealing a fatal blow to the research performance of the individual and the ability of the organization to innovate (Raelin 1986, 1994). Specific examples include loss of interest in the organization's affairs, ceasing to be absorbed in research or work, a weakening of sense of responsibility, disregard for the organization when tackling something that contributes to one's career, performing only pre-assigned work, and constantly looking for new places of employment. In short, role conflict can in some cases even cause deviant behavior that is fatal to scientists and researchers' research performance.

VI. Conclusion: Adaptation of the Organization to Scientists and Engineers

Assuming that companies' competitive advantage will in the future depend heavily on scientists and engineers' motivation and research performance, the objective of corporate organizations should clearly be placed on how to improve their creativity to the utmost. This is by no means an easy problem to resolve, however, as scientists and engineers are embedded in professional communities, and not just organizations. The core argument of this paper is that in order to resolve the problems involved in managing scientists and engineers, it is necessary to employ the lens of the professional community as well as the lens of the organization. Thus, without intensive researches on how professional communities form in Japan, to what extent the values and occupational ethics of professional communities are internalized by scientists and engineers, and how the values and occupational ethics internalized by scientists and engineers are changed by corporate organizations in Japan, there can be no real solution of the problems associated with the management of scientists and engineers.

It is well known that Japanese companies have traditionally sought to maximize employees' sense of belonging and loyalty to the organization, and scientists and engineers have been no exception. Japanese companies have applied the same strategy to scientists and engineers as well, such as through intensive education and training on the factory floor when they are hired, frequent re-allocation to other departments outside R&D, and fostering of a strong commitment to manufacturing in accordance with inclusive uniform management. Combined with long-term employment, age-based pay and promotion, retirement payment systems, corporate pension plans, and other elements of Japanese employment practice that hindered the interorganizational movement of scientists and engineers, such a strategy resulted in the mass production of scientists and engineers who were as a result confined to the organization. As a matter of fact, the interorganizational movement of scientists and engineers is known to be extremely low in Japan (Fujimoto 2005).

This strongly suggests that scientists and engineers in Japan face greater pressure to be included in corporate organizations than their counterparts in the West, and also that the logic of the organization is more prevalent among scientists and engineers in Japan. Far from leading to role conflict in organizations, the strong inclusive pressure is thought to produce large numbers of "professionals who have dreams of the organization" (Fujimoto 2005) among scientists and engineers at top-level R&D organizations in industry, making a major contribution to the high R&D productivity of Japanese companies to date. In practice, the human resource management strategies of Japanese companies, which have required homogeneous scientists and engineers, have been observed to create extremely efficient R&D organizations and to have contributed to the high international competitiveness of Japanese manufacturing (Clark and Fujimoto 1991; Sakakibara 1995).

If inclusive pressure on scientists and engineers is strong and the logic of the organization is pervasive, however, the effects can also be harmful. A particular risk is that the human resource management strategies that seek homogeneity may reduce the diversity and heterogeneity of researchers essential for the breakthrough product innovations sought by Japanese companies in the future (Sakakibara 1995). In some cases, a too pervasive logic of the organization may even have tragic consequences, as highlighted by Murakami's (2000) insightful interpretation of the causes of the Tokaimura nuclear accident at a JCO plant.

Murakami (2000) traces this incident above all to the quality control (QC) circle activities that have traditionally been admired in Japan and abroad, and his argument is as follows. Despite being an incident that should essentially have been avoidable had workers had a basic knowledge of nuclear power, the company left many decisions to regular employees on the spot who lacked this knowledge, and QC activities that should have been undertaken to enable the people on the spot to further raise efficiency for the company resulted in the incident. The problem here was that improvements to systems that had been computed and designed in minute detail to prevent a criticality incident were left to a QC circle that gave priority to efficiency without having the requisite knowledge of nuclear power. Underlying this may be glimpsed the logic of the organization of Japanese companies of leaving to these domestically and internationally admired QC circles even work that by its nature should be performed under the guidance and judgment of scientists and engineers.

At the same time, there is an undeniable possibility that Japanese companies' excessive emphasis on the inclusion in the organization of scientists and engineers may also have acted to heighten their role conflict. This is because, notwithstanding the effect of the powerful logic of the organization, scientists and engineers in Japan have not abandoned their cosmopolitan orientation (Chae 1999; Fujimoto 2005) and have retained considerable latent potential for movement to other organizations (Fujimoto 2005; Ota 1993). In view of these two facts, it may well be that scientists and engineers in Japan who either have a particularly high professional commitment or work in R&D organizations located lower in the industrial hierarchy experience even greater conflict due to the powerful logic of the organization.

What is required above all else in order to reduce the role conflict experienced by scientists and engineers in organizations is their accommodation by corporate organizations (Kornhauser 1962; Marcson 1960; Raelin 1986, 1994). What this means in concrete terms is granting significant recognition to the values and needs of scientists and engineers by, for example, respecting and at times positively encouraging contributions to the development of science and specialist fields, autonomy in research and development, the authority as professionals, and their outside activities as experts. Even regarding research performance, which are corporate organizations' principal concern, the adaptation of the organization to scientists and engineers is of extreme importance given that research shows that their performance increases as the organization takes measures to accommodate the values and needs of scientists and engineers (Chae 1999, 2002).

Furthermore, the present trend in business ethics is toward encouraging greater adaptation of the organization to scientists and engineers. This is because the world described by Friedman (1962), in which the values and ethics pursued by professional communities and corporate organizations are fundamentally different, and corporate organizations are not under any special moral obligations *qua* economic entities, is steadily drawing to a close, to be replaced by a growing emphasis on companies' social responsibility, business ethics, and compliance. This trend means nothing more or less than that corporate organizations must actively accept the values and occupational ethics of scientists and engineers. As long as communities of scientists and engineers and corporate organizations are growing increasingly interdependent as important social players, each must adapt to the other. Needless to say, it is very likely that better relations between the two will emerge if, in the process, simultaneous use is of the occupational community lens as well as the lens of the organizations.

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Trends in Structural and Frictional Unemployment

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I. Introduction

In order to be able to accurately judge employment situation and the state of the mismatch between labor supply and demand, properly monitoring rates of structural and frictional unemployment is crucial. In this paper, I review trends in structural/frictional unemployment, together with demand-deficient unemployment, based on Fujii (2008).[1]

The main methods of estimating structural unemployment rates are UV analysis and the NAIRU.[2] Fujii (2008) uses a similar method to the UV

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1 Unemployment is classified into several kinds according to its causes, the main ones being: demand-deficient unemployment, structural unemployment, and frictional unemployment. (i) Demand-deficient unemployment is unemployment arising from reduced demand during economic downturns; (ii) structural unemployment is unemployment resulting from (qualitative) differences between the employee attributes sought by employers and those actually offered by job seekers (e.g., in terms of vocational skills and age), despite overall supply and demand on the labor market being in balance; and (iii) frictional unemployment is unemployment that arises from the incompleteness of the information available to employers and workers when workers change or start new jobs, and the time required for workers to move between regions. It is naturally tricky to categorize actual instances of unemployment into one or another of these categories, and the distinction between structural and frictional unemployment is particularly blurred. Normally, therefore, these two are referred to together as "structural/frictional unemployment."

2 UV analysis consists of breaking unemployment down into demand-deficient unemployment and structural/frictional unemployment by plotting the unemployment rate (U) on the vertical axis and the vacancy rate (V) on the horizontal axis in order to explore trends in each. The intersection between the UV curve and a 45^o line indicates where supply and demand coincide; the unemployment rate at this point is the rate at which there is no demand deficiency; i.e., when the labor market is in equilibrium ("equilibrium unemployment rate"). The unemployment rate at this time is called the structural/frictional unemployment rate. The demand-deficient unemployment rate is the difference between the actual unemployment rate and the structural/frictional unemployment rate.

The NAIRU (Non-Accelerating Inflation Rate of Unemployment) is the rate of unemployment that does not cause inflation rate to change (given that prices are at an acceptable level) under conditions of long-term equilibrium when, other things being equal, the expected inflation rate coincides with the actual inflation rate. If the unemployment rate exceeds the NAIRU, the inflation rate does not accelerate. If it is analysis used in the 2005 White Paper on the Labour Economy to reestimate the UV curve and calculate the structural/frictional unemployment rate and the demand-deficient unemployment rate. According to Fujii's calculations (2008), the total unemployment rate of 3.76% in the second quarter of 2007 broke down into a structural/frictional unemployment rate of 3.49% and a demand-deficient unemployment rate of 0.27%. I also find that the rise in the unemployment rate in the late 1990s was affected by both demand-deficient and structural/frictional unemployment, and suggests that the decline in the unemployment rate during the present recovery phase since 2002 has been due in large part to demand-deficient unemployment (Figure 1). Below, I consider the fluctuations in structural/frictional unemployment, in conjunction with demand-deficient unemployment, by examining mismatch-related indices according to attribute.

II. Situation of Mismatch between Occupation

Calculating mismatch indices by occupation shows that, at the major group level, indices rose in the 1980s, before declining in the 1990s and leveling off from 2000. These indices exhibit similar trends at both the major and medium group levels of occupational classification. At the detailed group level, however, the indices are high. Although not shown in the figure, the rise in mismatch indices in the 1980s was due to the contribution of clerical and related workers etc., the decline in the 1990s was due to the contribution of manufacturing process workers, and the leveling off since 2000 has been due to the rise in the index for professional and technical workers amid the decline in the index for sales workers etc. While the index excluding part-time workers is greater, it can be seen that the mismatch is greater for full-time workers than part-timers. Broken down by job category, differences can be observed between professional and technical workers, and manufacturing process workers and laborers (Figure 2).

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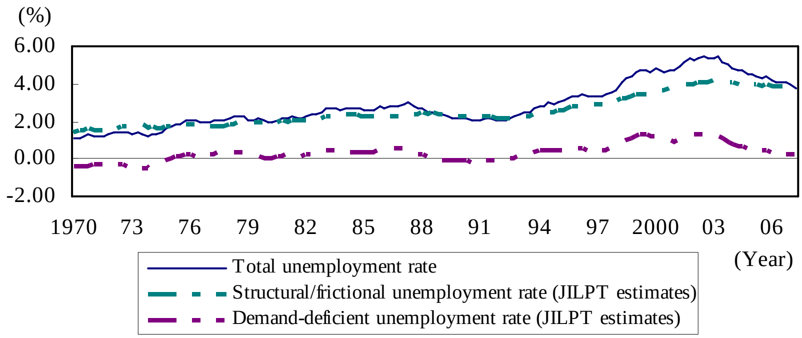
less than the NAIRU, however, the inflation rate will accelerate more rapidly than the long-term expected inflation rate. The NAIRU is a form of analysis based on the (expectations-augmented) Phillips curve.
In Japan, projections tend to be made based on UV analyses (as in the White Paper on the Labour Economy) due to the availability of statistics on vacancies according to Report on Employment Service, and NAIRU estimates are uncommon.

Figure 1. Trends in total unemployment rate, structural/frictional unemployment rate, and demand-deficient unemployment rate



Sources: Estimated based on data from Ministry of Internal Affairs and Communications (MIC), Statistics Bureau, *Labor Force Survey* and Ministry of Health, Labour and Welfare (MHLW), *Report on Employment Service*.

Notes: 1. Estimation of UV curve.

$\ln(EU) = \alpha + \beta \ln(V)$

EU: Employment/unemployment rate. V: Vacancy rate.

Estimated by the generalized least squares method.

$$\text{employment/unemployment rate} = \frac{\text{number of unemployed}}{(\text{number of unemployed} + \text{number of employees})}$$

$$\text{vacancy rate} = \frac{\text{numer of active job openings} - \text{number of placements}}{(\text{number of active job openings} - \text{number of placements}) + \text{number of employees}}$$

Estimation period	α	t-value	β	t-value	Adjusted AR^2	S.E.	D.W.
(1) 1967 I～75IV	1.355	10.839	-0.556	-5.427	0.910	0.058	2.016
(2) 1883 I～89 IV	1.710	22.511	-0.515	-6.384	0.958	0.029	1.902
(3) 1990 I～93 IV	1.461	14.579	-0.401	-4.214	0.920	0.025	1.300
(4) 2001 I～06 IV	2.334	24.060	-0.569	-6.549	0.952	0.024	1.967

2. The structural/frictional unemployment rate is calculated by the following formula based on the results for the UV curve estimated as above.

   $1n(eu^*) = (1n(EU) - \beta \times 1n(V)) / (1 - \beta)$

   Where eu* is the unemployment rate at which EU (employment/unemployment rate) and V (vacancy rate) are equal (equilibrium employment/unemployment rate).

   β is the coefficient of the vacancy rate in formulae (1)-(4) for the above UV curve (in practice it is 1n (V)).

   In periods for which no UV curve is estimated, β is calculated as follows:

   1) 1Q 1976 to 4Q 1982: Weighted average of β in estimation formulae (1) and (2) weighted according to period.
   2) 1Q 1994 to 4Q 2000: Weighted average of β in estimation formulae (3) and (4) weighted according to period.
   3) 1Q 2007 onward: β in estimation formula (4).

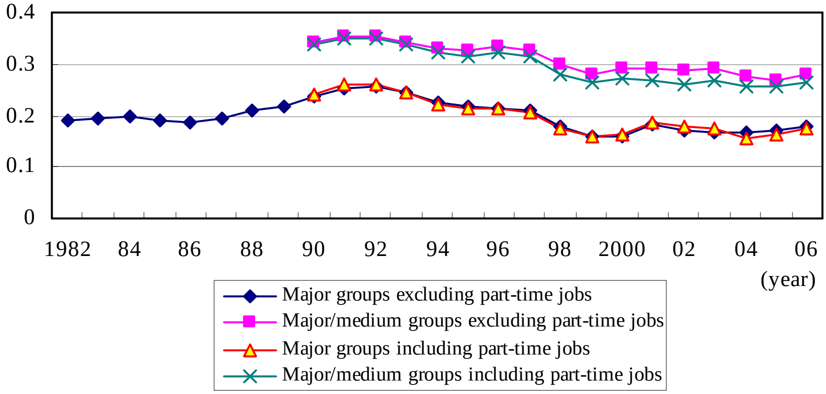
   If the equilibrium number of unemployed is U*, the structural/frictional unemployment rate (equilibrium unemployment rate) for employed persons (u**) (calculated from the number of employees (EE) and the number of employed persons (E)) is:

   $U^* = EE / (100 - eu^*) \times eu^*$

   $u^{**} = U^* / (E + U^*) \times 100$ (%)

3. Demand-deficient unemployment rate = overall unemployment rate – structural/ frictional unemployment rate.

Figure 2. Occupational mismatch indices (new and regular jobs each August)



Source: MHLW, *Report on Employment Service.*

Notes: 1. Mismatch index = 1/2 × Σ | Vi/V - Ui/U|

V: Total number of job openings.

Vi: Number of job openings in category i.

U: Total number of job applicants

Ui: Number of job applicants in category i.

The number of job applicants (from 1990) is calculated excluding unclassifiable data.

2. Based on new and regular job each August.
3. The most detailed categories of jobs presented in Report on Employment Service are here called “major/medium groups.” (In the statistics published in Report on Employment Service, occupations in the “manager and official worker,” “agricultural, forestry and fishery worker,” and “protective service worker” categories are broken down only into major groups, while other occupations are, with certain exceptions, broken down into medium groups.)
4. The occupational categories have been partially reclassified since 2000 (though not at the major group level), and this should be borne in mind when interpreting statistics at the major/medium group level.
5. The different number of occupational categories in the “major group” and “major/medium group” levels means that comparisons of levels and changes cannot be made between the two.

Regarding the mismatch by occupation, structural/frictional, and demand-deficient unemployment were estimated based on job seekers using data on job openings, job applications, and placements, by region and occupation, from public employment security offices in Otani (2007). Ohashi (2006) also breaks down the data on job openings and job applications regarding age and occupation, though by using a different method of calculation.

III. Mismatch between Ages

Looking at the UV curve by age, it is evident that both the unemployment and vacancy rates are rising in younger (15-34-year-old) age groups, with the rise particularly marked among 15-24-year-olds. This suggests that structural/frictional unemployment is rising. While the unemployment rate has fallen during the present recovery, the still high level is indicative of continuing harsh conditions (Figure 3).

In the 60-64-yeard-old age group, employment demand is low, but the unemployment rate fluctuates. During the present recovery, there has been a marked decline in the unemployment rate among 60-64-year-olds. In addition to economic factors, this may be ascribed to the effects of growing moves of continuous employment of workers in this age group in order to limit the retirement of baby-boomers when they reach the age of 60, along with institutional changes in the form of the revision of the Law Concerning Stabilization of Employment of Older Persons to phase in mandatory continued employment of workers up to the age of 65.

In the 35-44-year-old age group, the level of the employment/unemployment rate is lower than that for all ages, indicating a widening mismatch. Among 44-59-year-olds and those aged 65 and over, the employment/unemployment rate and vacancy rate are both low, and there is little variation in the UV curve.[3]

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[3] The traditional way of calculating the ratio of active job openings to active job applications by age is to allocate the number of job openings equally to each age group in the age range concerned for each age range type for which a job opening arises (classified into 66 types according to which of 11 five-year age groups they span), aggregating the number of active job openings by age, and dividing the product by the number of active job applicants by age. (This is called the “equal allocation of job openings” method.) This method does not always properly reflect situation where, due to the increase in job openings available to all ages, it has become common for employment opportunities to be shared among job applicants belonging to different age groups. This causes the ratio of active job openings to active job applications in the 65-and-over age group, which has relatively few job applicants, to rise markedly, thus diverging more from reality. (The annual average rate rose sharply from 0.24 in 2002 to 1.09 in 2004.)
Instead of the conventional method, therefore, the Ministry of Health, Labour and Welfare calculates the number of employment opportunities per applicant for the job opening concerned by dividing the number of job openings by the total number of active job applicants in the age group concerned, and then aggregating these employment opportunities for the total number of job applicants in order to calculate the ratio of active job openings to applicants by age (referred to below as the

Regarding age mismatch unemployment, the situation may be examined in terms of (1) the mismatch index (the sum of the mismatch between job openings and job applicants) and (2) the difference between the ordinary equilibrium employment/unemployment rate and the equilibrium employment/unemployment rate assuming there to be no age mismatch (Figure 4). Both indices indicate that the mismatch declined during the bubble period, and rose after the collapse of the bubble. Underlying this appears to have been a combination of expanding and shrinking demand for older age groups with the tightening and easing of labor supply and demand, together with the spread of mandatory retirement at age 60 (improvement of employment conditions such as a decline in the unemployment rate for 55-59-year-olds in the latter half of 1980s), and it may be speculated that movements in the age mismatch affect fluctuations in overall structural/frictional unemployment. However, the contribution to the variation in structural/frictional unemployment is not particularly great, measuring around 0.1% points on an employment/unemployment rate basis. The small scale of the contribution of age mismatch agrees with the analysis by Sasaki (2004).

Since 2001, the mismatch index has declined dramatically, no doubt due in part to the impact of the introduction of regulations requiring that employers endeavor to ease age restrictions on recruitment and hiring. The proportion of job openings available to all ages is increasing considerably. In September 2001, job openings for all ages made up 1.6% of the total, with the great majority (95.3%) being age restricted. However, the proportion of job openings for all ages exceeded the 10% mark in 2002-2003, rose dramatically during 2004 to reach 40% in December 2004, rose further in the second half of

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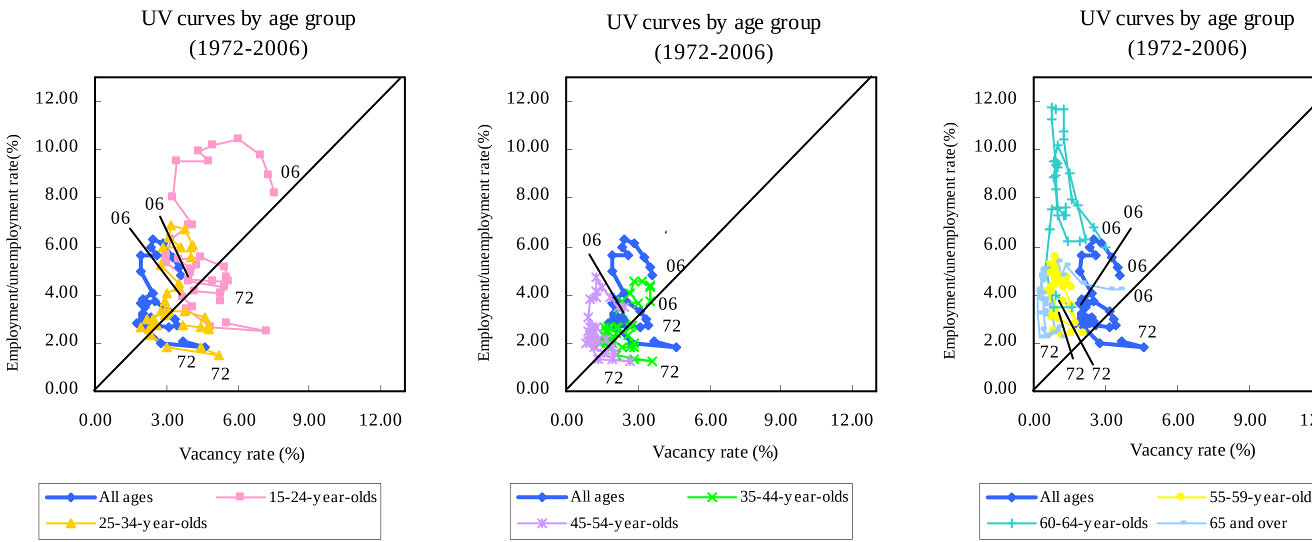
"employment opportunity summation" method), figures for which have been published since July 2006. (This method has also been applied retrospectively back to January 2005. The ratio of active job openings to active job applicants calculated by the conventional method also continues to be calculated and published for the time being.) The distribution of active job openings differs substantially between the two methods. With the employment opportunity summation method, job openings are allocated according to the distribution of job applicants, resulting in particularly sharp declines in the number of openings in the 15-19 and 65-and-over age groups, a decline also in the 40-54-year-old age group, and large increases in the 25-34-year-old age group compared with the conventional "equal allocation of job openings" method. There is also an increase among 55-59-year-olds. Regarding the UV curves by age, therefore, V (vacancies) changes, especially in the younger and 65-and-over age groups, and the combination of U and V changes (Figure 3).

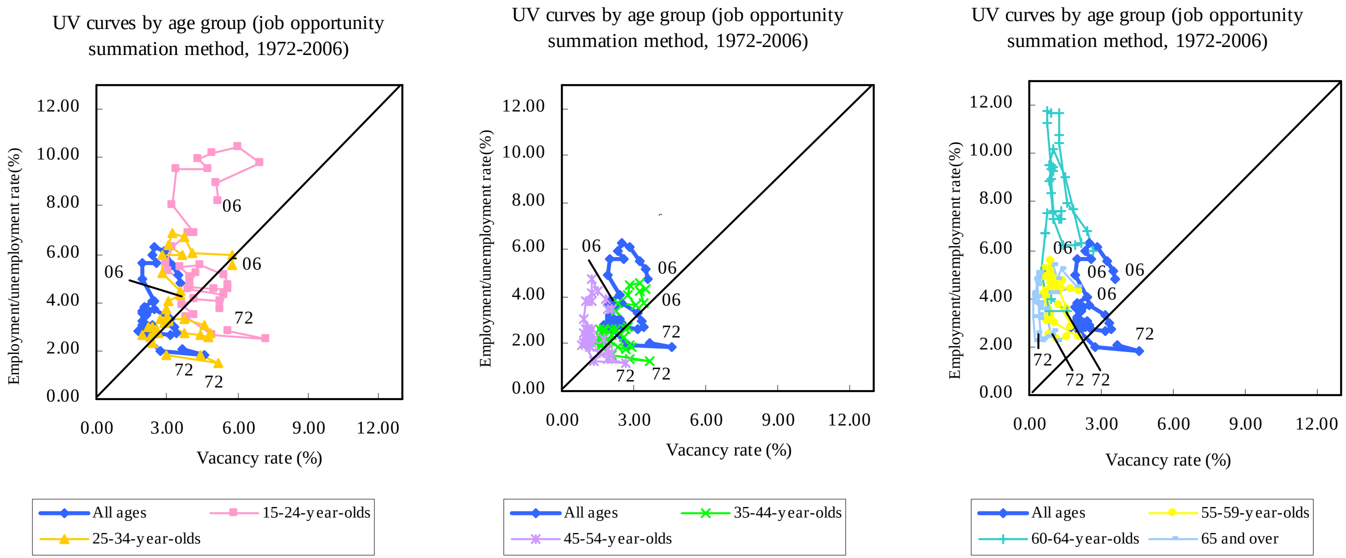
Figure 3. (1) UV curves by age group



Sources: MIC, Statistics Bureau, *Labor Force Survey* and MHLW, *Report on Employment Service*.

Note: The vacancy rate and employment/unemployment rate are defined as in Figure 1. Note that the number of vacancy (= number of active job openings – number of placements) is for regular jobs including part-time jobs each October. The number of active job openings is calculated by the conventional "equal allocation of job openings" method. Annual averages were used for the number of employees and unemployed persons.

Figure 3. (2) UV curves by age group

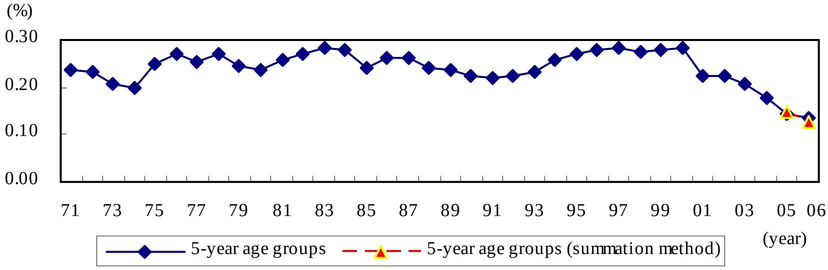


Sources: MIC, Statistics Bureau, *Labor Force Survey* and MHLW, *Report on Employment Service*.

Note: The vacancy rate and employment/unemployment rate are defined as in Figure 1. Note that the number of vacancy (= number of active job openings – number of placements) is for regular jobs including part-time jobs each October. The number of active job openings is calculated by the job opportunity summation method in 2005 and 2006, and by the conventional "equal allocation of job openings" method up to 2004. Annual averages were used for the number of employees and unemployed persons.

Figure 4. Situation of age mismatch unemployment situation

(1) Age mismatch index (active regular job openings including part-time jobs each October)

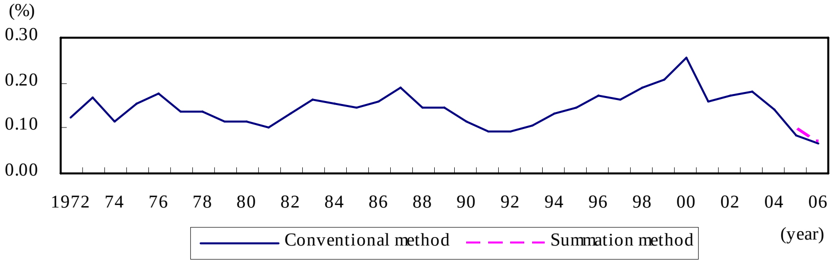


Source: MHLW, *Report on Employment Service*.

Notes: 1. The mismatch index is defined as in Figure 2 and is calculated for five-year age groups (treating ages 65 and over as one category) based on regular job openings including part-time jobs each October.

2. The number of active job openings for each age group was calculated by both the conventional "equal allocation of job openings" method and the job opportunity summation method in 2005 and 2006.

(2) Age mismatch unemployment situation



Sources: MHLW, *Report on Employment Service* and MIC, Statistics Bureau, *Labor Force Survey*.

Notes: 1. Employment/unemployment rates were broken down by age by extrapolating from the analysis in Ministry of Labour, *1999 Annual Report on Labour*.

2. As a substitute age mismatch index, we here use the difference between the equilibrium employment/unemployment rate for all ages (Us) and the equilibrium employment/unemployment rate (Ut) calculated from the weighted average of the equilibrium employment/unemployment rates for each five-year age group weighted by the number of employees in each age group. It should be borne in mind that the equilibrium employment/unemployment rate is calculated based on the strong assumption that the value of β for the UV curve estimated by $\ln U = \alpha + \beta \ln V$ (U: employment/unemployment rate, V: vacancy rate) is a uniform 0.55 for all ages and all age groups, based on the estimated UV curves by age group for core age groups (30-50-year-olds) (1999 White Paper on the Labour Economy).

3. The number of vacancies is for regular jobs each October, and the numbers of employees and unemployed persons are annual averages.

4. The figures for 2001 onward are affected by the entry into effect from October 2001 of the requirement that employers endeavor to relax age restrictions in recruitment and hiring.

5. Due to the change in the method of calculating the number of active job openings by age group to the job opportunity summation method, the number of job openings was calculated by both this and the conventional "equal allocation of job openings" method in 2005 and 2006.

2006, and by February 2007 stood at 50.0%. The proportion of age-restricted job openings, on the other hand, has continued to decline, falling to 37.7% as of February 2007.

To summarize, the age mismatch appears to be affected by both economic and institutional factors.

IV. Situation of Regional Mismatch

Regarding the regional mismatch unemployment situation, the regional UV curves (on an annual basis) exhibit considerable differences in shape and position according to region. Nevertheless, despite a clockwise loop, there may be discerned a rightward and upward shift over the long term, with the shift being particularly marked following the collapse of the economic bubble in the 1990s. This suggests that structural/frictional and demand-deficient unemployment are both increasing in all regions. During the present recovery phase, the employment/unemployment rate has also fallen while the vacancy rate has risen. Regional differences in the fluctuation and pace of improvement in the UV curve may be observed. Structural/frictional unemployment has increased particularly in the Kinki region. In Hokkaido, less of a shift is evident compared with other regions, and the pace of improvement is weaker and the level of the unemployment rate is higher. In the Tokai, Hokuriku, and Chugoku regions, meanwhile, the supply and demand situation on the UV curve improved to a point downward and to the right of the 45^{o} line in 2006 (Figure 5).

Drawing on the method employed by Sasaki (2004), business cycle dummy variables (based on the strong assumption that the incline of the UV curve would be constant for 30 years) were included among the explanatory variables to estimate the shift in the UV curve, suggesting that, in all regions, the UV curve shifts downward in the bubble period, and considerably upward in the 1990s after the collapse of the bubble. With this method, however, there is a large shift in the UV curve concentrated in the late 1990s (indicating a sharp rise in structural/frictional unemployment rate), and the interpretation of these results remains open to some doubt (Table 1).

Using as a mismatch index the difference between the ordinary equilibrium unemployment rate and the equilibrium unemployment rate assuming that the national UV curve and the regional UV curves estimated here have the same inclination (in the case that there is no mismatch between regions), we find

Figure 5. (1) UV curves by regional block

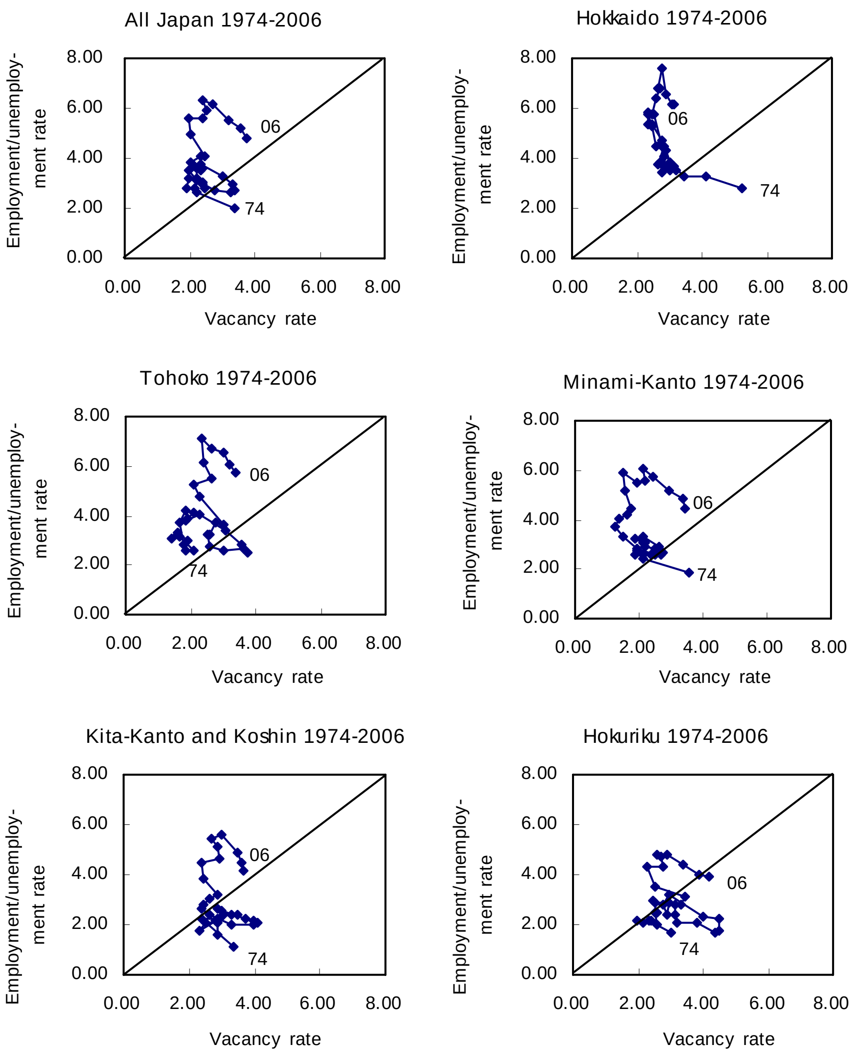
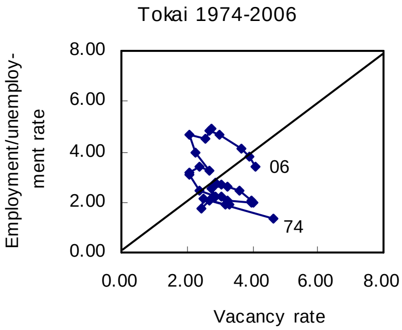
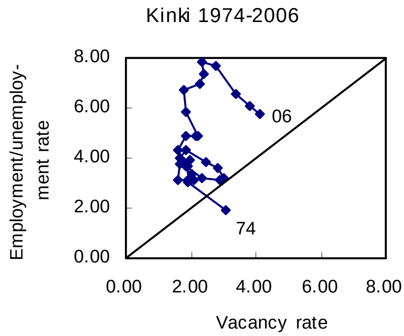
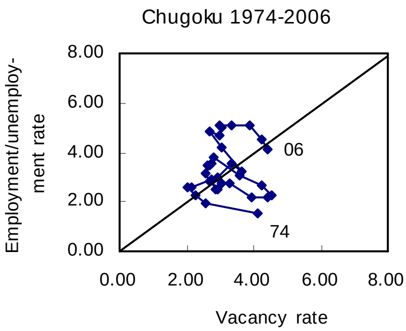
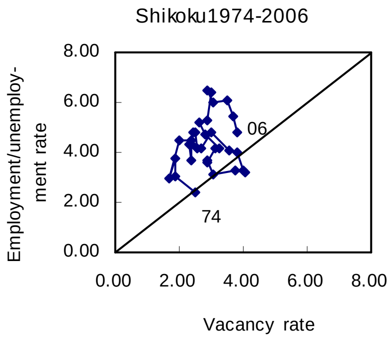


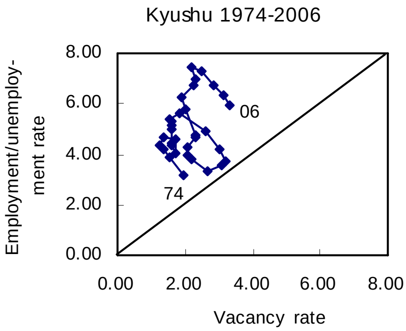
Figure 5. (2) UV curves by regional block











Sources: MIC, Statistics Bureau, *Labor Force Survey* and MHLW, *Report on Employment Service*.

Notes: 1. The employment/unemployment rate and vacancy rate (%) are defined as in Figure 1.

2. Regional blocks are as follows:
Hokkaido block: Hokkaido
Tohoko block: Aomori, Iwate, Miyagi, Akita, Yamagata, Fukushima
Minami-Kanto block: Saitama, Chiba, Tokyo, Kanagawa
Kita-Kanto and Koshin blocks: Ibaraki, Tochigi, Gunma, Yamanashi, Nagano
Hokuriku block: Niigata, Toyama, Ishikawa, Fukui
Tokai block: Gifu, Shizuoka, Aichi, Mie
Kinki block: Shiga, Kyoto, Osaka, Hyogo, Nara, Wakayama
Chugoku block: Tottori, Shimane, Okayama, Hiroshima, Yamaguchi
Shikoku block: Tokushima, Kagawa, Ehime, Kochi
Kyushu block: Fukuoka, Saga, Nagasaki, kumamoto, Oita, Miyazaki, Kagoshima, Okinawa

Table 1. Example estimates of UV curves by regional block (For reference)

Estimation formula: InEU = a + b1D1+…b13D13+clnV (annual data for 1974-2006)

	Hokkaido		Tohoku		Minami-Kanto		Kita-Kanto & Koshin		Hokuriku		Tokai		Kinki		Chugoku		Shikoku		Kyushu	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Constant term	2.456	4.826	1.432	10.615	1.205	9.841	0.692	3.392	1.186	6.874	1.200	6.961	1.035	7.397	1.341	5.483	1.383	6.874	1.476	15.415
D1	-0.130	-0.861	0.051	0.451	0.065	0.779	0.568	5.123	0.129	1.151	0.143	1.424	0.310	3.156	-0.046	-0.318	0.188	1.568	0.094	1.070
D2	-0.158	-0.755	-0.082	-0.606	0.030	0.306	0.291	2.193	-0.004	-0.033	-0.126	-1.069	0.263	2.190	0.064	0.362	0.017	0.117	0.093	0.875
D3	-0.171	-0.797	0.059	0.533	0.131	1.589	0.500	4.540	0.065	0.577	0.120	1.216	0.445	4.437	0.240	1.672	0.552	5.106	0.268	3.095
D4	-0.132	-0.586	0.015	0.146	0.242	3.266	0.482	4.740	0.347	3.318	0.201	2.230	0.397	4.324	0.283	2.274	0.503	5.056	0.221	2.765
D5	0.006	0.022	0.425	3.917	0.293	3.540	0.749	7.140	0.496	4.579	0.384	3.963	0.533	5.378	0.481	3.536	0.699	6.679	0.404	4.743
D6	-0.007	-0.027	0.315	2.889	0.266	3.110	0.751	7.109	0.402	3.721	0.408	4.292	0.520	5.085	0.532	3.935	0.588	5.585	0.390	4.544
D7	-0.105	-0.493	0.427	3.778	0.278	3.940	0.723	7.464	0.498	4.804	0.388	4.781	0.603	7.666	0.569	5.302	0.722	6.002	0.509	6.311
D8	-0.268	-1.348	0.263	2.283	0.162	1.918	0.614	6.206	0.290	2.753	0.234	2.634	0.461	5.503	0.381	3.459	0.506	4.077	0.270	3.238
D9	-0.213	-0.949	0.399	3.738	0.345	3.358	0.768	7.066	0.517	5.089	0.431	3.882	0.727	7.617	0.511	4.317	0.575	5.485	0.356	4.540
D10	-0.001	-0.003	0.612	5.424	0.588	6.070	1.012	9.139	0.678	6.303	0.608	5.699	0.887	9.388	0.725	5.980	0.730	6.540	0.550	6.622
D11	0.136	0.547	0.798	7.274	0.785	8.357	1.284	11.573	0.840	7.603	0.819	7.399	1.133	11.921	0.889	6.837	0.850	7.975	0.748	9.032
D12	0.301	1.250	0.936	7.414	0.888	9.773	1.438	11.681	0.968	7.722	0.992	8.958	1.269	12.800	0.978	6.876	1.104	8.694	0.864	8.945
D13	0.341	1.647	1.105	10.311	0.930	14.048	1.449	15.442	1.033	10.650	0.936	11.479	1.342	15.754	1.063	10.115	1.048	9.423	0.926	11.349
InV	-0.855	-2.831	-0.638	-4.591	-0.468	-5.506	-0.468	-3.046	-0.617	-4.620	-0.588	-5.724	-0.352	-3.235	-0.636	-3.986	-0.566	-2.830	-0.488	-4.839
Adjusted R^2		0.878		0.923		0.967		0.951		0.924		0.960		0.959		0.906		0.870		0.915
Standard error		0.092		0.088		0.058		0.086		0.088		0.068		0.067		0.095		0.085		0.067
DW value		2.813		2.563		2.390		2.540		2.182		2.460		2.855		2.757		2.466		2.818
(Coefficient difference)																				
D0→D1	-0.130		0.051		0.065		0.568		0.129		0.143		0.310		-0.046		0.188		0.094	
D1→D2	-0.029		-0.133		-0.035		-0.277		-0.134		-0.269		-0.047		0.110		-0.171		-0.001	
D2→D3	-0.012		0.141		0.101		0.209		0.070		0.245		0.182		0.176		0.535		0.175	
D3→D4	0.038		-0.044		0.111		-0.017		0.281		0.081		-0.047		0.044		-0.049		-0.047	
D4→D5	0.138		0.410		0.051		0.267		0.150		0.183		0.135		0.198		0.196		0.183	
D5→D6	-0.013		-0.110		-0.027		0.002		-0.094		0.024		-0.013		0.050		-0.111		-0.014	
D6→D7	-0.098		0.112		0.012		-0.028		0.097		-0.020		0.083		0.037		0.134		0.119	
D7→D8	-0.163		-0.164		-0.116		-0.109		-0.208		-0.154		-0.143		-0.187		-0.216		-0.239	
D8→D9	0.055		0.136		0.183		0.154		0.227		0.197		0.266		0.130		0.069		0.086	
D9→D10	0.212		0.212		0.243		0.243		0.161		0.177		0.160		0.214		0.154		0.194	
D10→D11	0.137		0.186		0.197		0.272		0.161		0.211		0.246		0.163		0.120		0.197	
D11→D12	0.165		0.139		0.103		0.154		0.128		0.172		0.136		0.089		0.254		0.116	
D12→D13	0.040		0.168		0.042		0.011		0.065		-0.055		0.073		0.085		-0.057		0.062	

D0: 1974 (Recession) D1: 1975-76 (Boom) D2: 1977 (Recession) D3: 1978-79 (Boom) D4: 1980-82 (Recession)
D5: 1983-84 (Boom) D6: 1985-86 (Recession) D7: 1987-90 (Boom) D8: 1991-93 (Recession) D9: 1994-96 (Boom)
D10: 1997-98 (Recession) D11: 1999-2000 (Boom) D12: 2001 (Recession) D13: 2002-06 (Boom)

Sources: MIC, Statistics Bureau, *Labor Force Survey* and MHLW, *Report on Employment Service*.

Notes: 1.Estimated using the same method of Sasaki (2004).

2. Note that this approach is tentatively offered as just one possible method of calculation, and the numerical results should be interpreted with caution.
3. The employment/unemployment rate (EU) and vacancy rate (V) are defined as in Figure 1. D0-D13 are economic dummy variables.

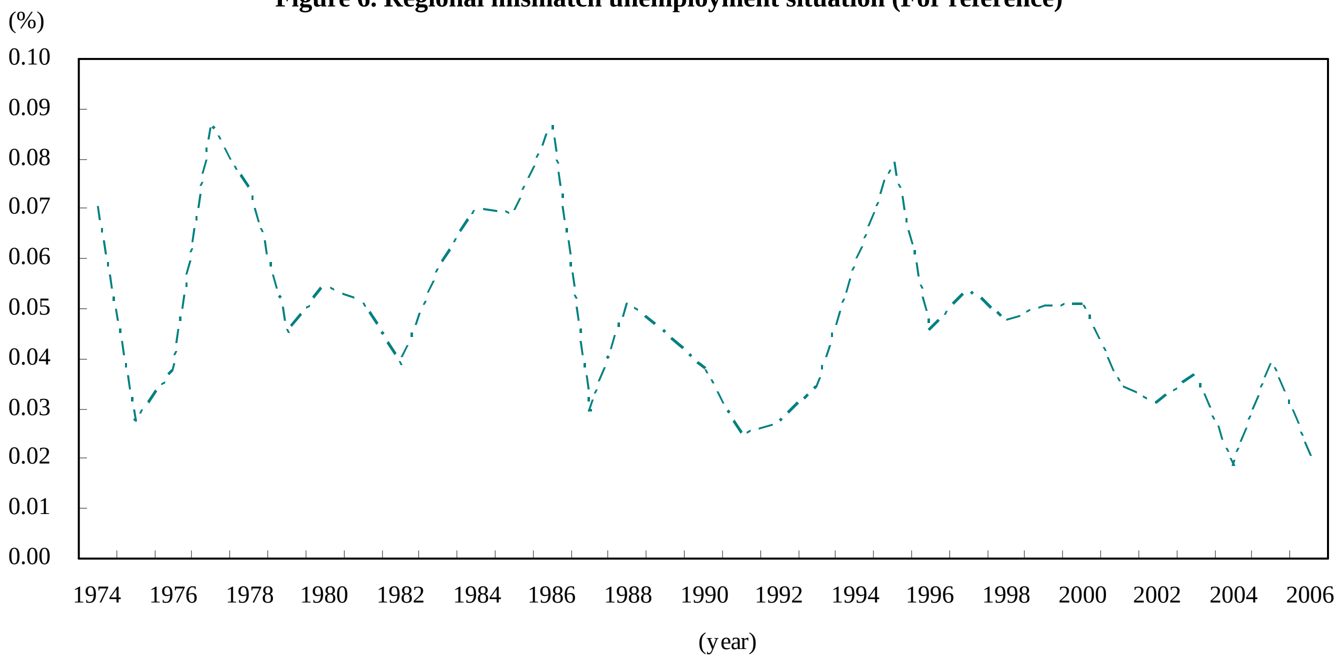
that the contribution of regional mismatch unemployment to fluctuations in structural/frictional unemployment at the national level is considerably smaller, and smaller more recently (Figure 6). Possible reasons for this include not only the inaccuracy of assuming UV curves are the same as at the national level, but also the absence of much long-term variation in unemployment patterns between regions, and the decline in variation itself over the long term.

Estimating the mismatch index for job openings and applications or the coefficient of variation of the unemployment rate and ratio of job openings to applicants for each region, we find that although variation was declining, it has increased during the present period of economic recovery (Figure 7). Although regional variation tended to widen during recovery phases in the past (particularly during periods of export-led recovery), the present recovery has been distinguished by a continuing widening of variation (according to data up to 2006).

V. Mismatch Situation According to Employment Status

One recent employment issue has been the widening gap between regular staff and non-regular staff workers. The ratio of active job openings to active job applicants for regular staff employees is considerably less than 1. On this point, then, let us examine the state of vacancies and unemployment according to employment status (type of work sought). (As the number of vacancies for regular staff/non-regular staff employees can only be determined for the most recent period, however, long-term estimates can serve as a reference only.) Combining U and V shows that the unemployment rate rose considerably in the late 1990s, though it needs to be borne in mind that, due in part to the fact that the Report on Employment Service defines “regular” as employment for a term of at least four months, unlike the Labor Force Survey, which defines it as “one year or more,” job openings for regular staff employees account for around 70% of regular job openings, which differs considerably from the level of the vacancy rate. Furthermore, there appears to have occurred an upward shift in the UV curve for both regular staff and non-regular staff workers, providing evidence of an increase in mismatch unemployment, with the mismatch regarding non-regular staff workers being particularly noticeable (Figure 8).

Figure 6. Regional mismatch unemployment situation (For reference)



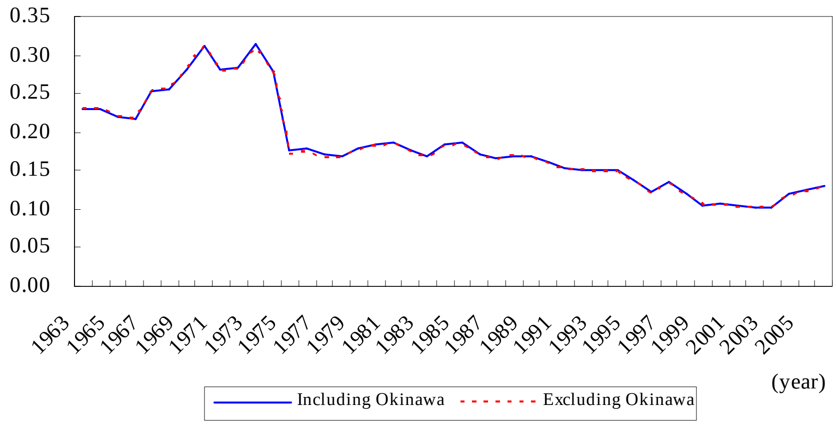
Sources: MIC, Statistics Bureau, *Labor Force Survey* and MHLW, *Report on Employment Service*.

Notes: 1. As a substitute regional mismatch index, I here use the difference between the equilibrium employment/unemployment rate for all Japan (Us) and the equilibrium employment/unemployment rate (Ut) calculated from the weighted average of the equilibrium employment/unemployment rates for each regional block weighted by the number of employees (employees + unemployed) in each block.

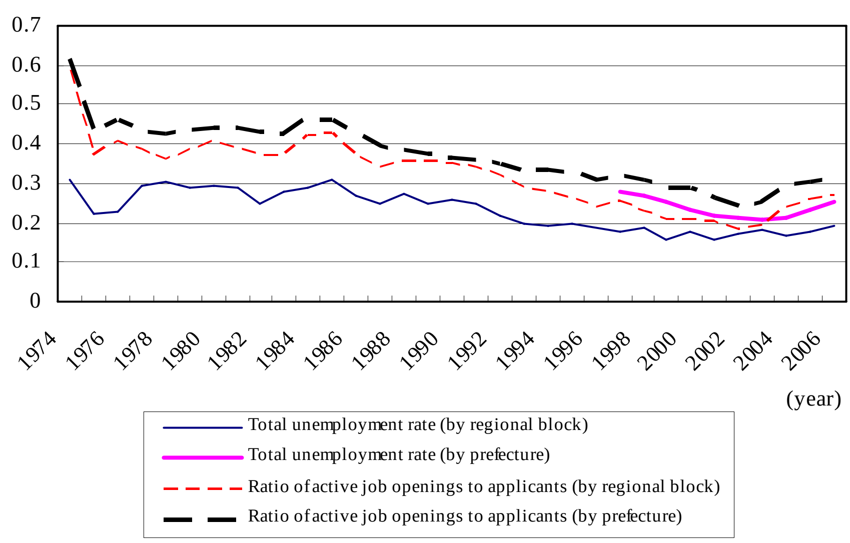
2. It should be borne in mind that the equilibrium employment/unemployment rate is calculated based on the strong assumption that the value of β for the UV curve estimated by $\ln U = \alpha + \beta \ln V$ (U: employment/unemployment rate, V: vacancy rate) is the same for all regions and Japan as a whole. (The employment/unemployment rate and vacancy rate are defined as in Figure 1.)

Figure 7. Regional mismatch-related indices (state of variation)

(1) Mismatch indices by prefecture (active job each year)



(2) Coefficient of variation of total unemployment rate and ratio of active job openings to applicants by region (unweighted)

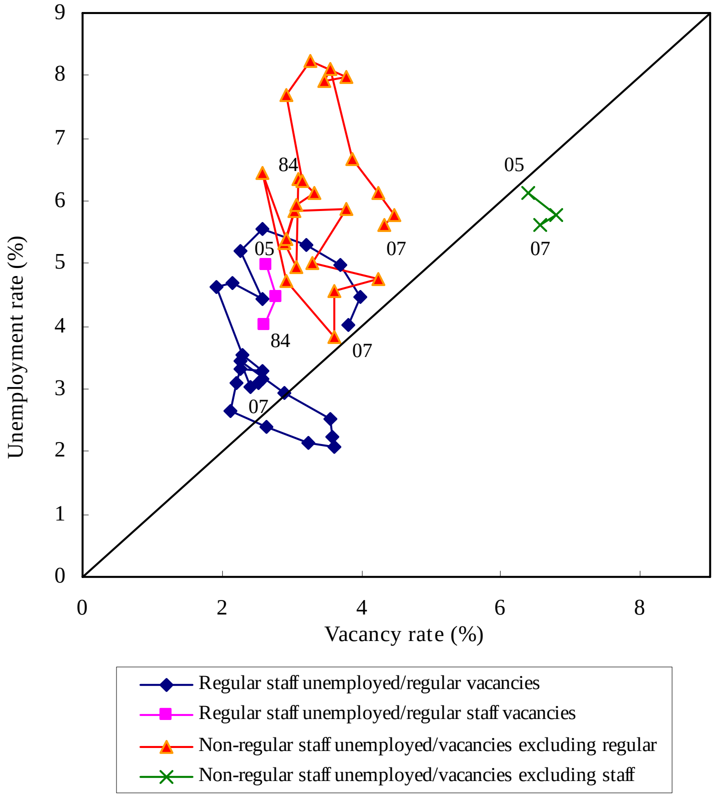


Sources: MIC, Statistics Bureau, *Labor Force Survey* and MHLW, *Report on Employment Service*.

Notes: 1. The mismatch index is calculated as described in Figure 2, based on annual average active job.

2. Regional blocks are classified as described in Figure 5.

Figure 8. Unemployment and vacancy rates by form of employment sought (Feb. 1984 to Jan.-Mar. 2007)



Sources: MIC Statistics Bureau, *Special Survey of the Labor Force Survey* (Feb. 1984 to Feb. 2001), *Labor Force Survey Detailed Tabulation* (January-March 2002 to January-March 2007); MHLW, *Report on Employment Service*.

Notes: 1. Regular staff (non-regular staff) unemployment rate = number of unemployed persons seeking regular staff (non-regular staff) employment / (number of unemployed persons seeking regular staff (non-regular staff) employment + number of regular staff (non-regular staff) employees)

2. Regular staff (non-regular staff) vacancy rate = regular staff (non-regular staff) employee vacancies / (regular staff (non-regular staff) employee vacancies + regular staff (non-regular staff) employees).

Vacancies = number of active job openings – number of placements

It is necessary note that Report on Employment Service presents no statistics on regular staff employees up to January-March 2005. For the purpose of long-term comparison, therefore, vacancies of regular excluding part-time are treated as regular staff employee vacancies, and other vacancies are used as a substitute measure of vacancies other than regular staff employee vacancies.

Regarding the statistics cited from Report on Employment Service, original figures for February are used for 1984-2001, and for January-March for 2002-2007.

VI. Trends among Unemployed in Terms of Reasons for Being Unable to take up Jabs

As Genda and Kondo (2003) observe, the state of demand deficiency and mismatch unemployment may also be inferred from a breakdown of unemployment according to reason for being unable to take up job. Following Genda and Kondo (2003), I divide unemployment into the following broad categories: unemployment due to “unfavorable job” (“unfavorable working conditions,” “limited age,” or “need more skill or knowledge”), i.e., forms of unemployment corresponding to mismatch unemployment; unemployment due to “wish to have any kind of work but it is not available,” i.e., unemployment corresponding to demand deficiency; and unemployment due to “preferable kind of job is not available,” i.e., unemployment corresponding to a combination of demand deficiency and mismatch (these two are treated together as “job is not available”). While data are only available from 1999, it is apparent that “unfavorable job” unemployment increased slightly up until around 2002 (age, working hours), as did the demand deficiency-related “no work” unemployment. During the present recovery, “no work” unemployment and “unsuitable work” unemployment have both fallen considerably. To summarize, the evidence indicates that both demand-deficient unemployment and mismatch unemployment are declining (Table 2).

Within the “unfavorable job” category, the decline in “limited age” unemployment suggests that policies to ease age requirements and the revision of the Law Concerning Stabilization of Employment of Older Persons are having an impact. Also noteworthy, however, is the fact that there has been hardly any decline in mismatch unemployment in relation to working hours, which is indicative of the difficulty of choosing suitably flexible working hours.

Looking at trends in the number of unemployed by reason for seeking a job, the large decline in the number of unemployed persons who quitted a job involuntarily, which soared from the end of the 1990s, suggests that demand-deficient unemployment is declining.

Table 2. Number of unemployed by reason for being unable to take up jobs

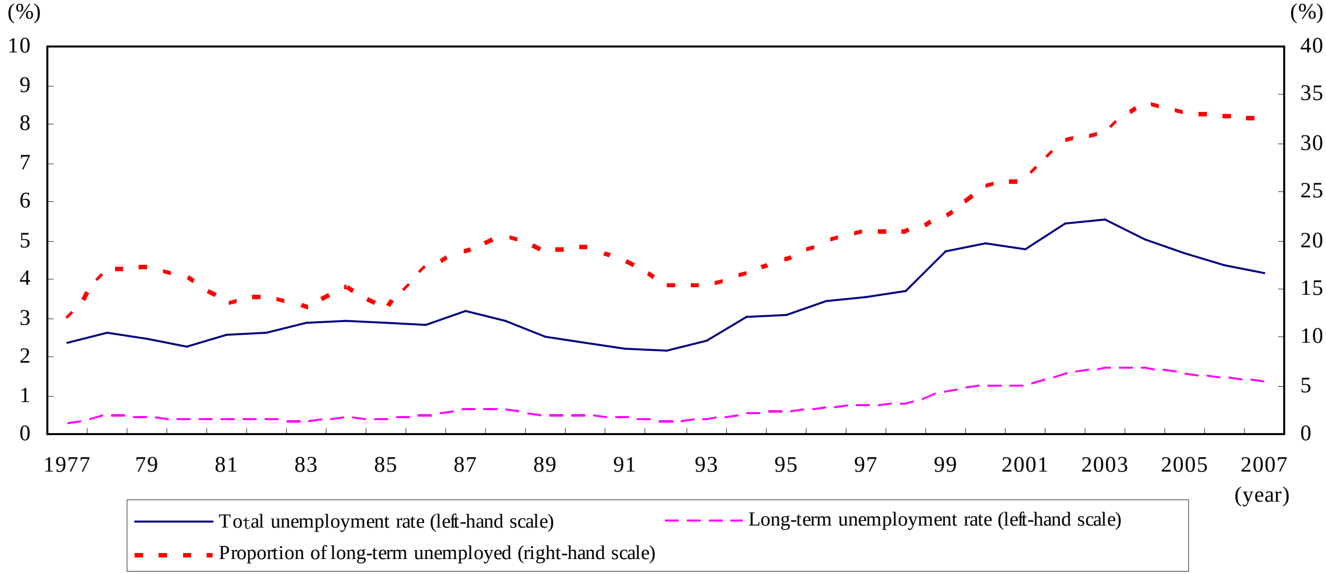
(10,000 persons, %)

		Total	Unfavorable job	Unfavorable working conditions	Not satisfied with the salary or available job	Unfavorable working hours and days	Limited age	Need more skill or knowledge	Available job is not necessary to use acquired skill or knowledge	Need more skill or knowledge	Job is not available	Preferable kind of job is not available	Preferable kind of job is not available	Status in employment of available job is different from the wished one	Wish to have any kind of job but it is no to available	Other	Work place is not nearby	Other
Actual number	Feb. 1999	313	146	48	26	22	71	27	19	8	123	90	59	31	33	43	11	32
	Feb. 2000	327	141	48	26	22	67	26	18	8	132	94	67	27	38	52	14	38
	Feb. 2001	318	140	47	25	22	69	24	17	7	125	93	66	27	32	50	12	38
	Jan.-Mar. 2002	360	153	60	31	29	74	19			141	102			39	45		
	Jan.-Mar. 2003	363	162	53	25	28	83	26			150	109			41	49		
	Jan.-Mar. 2004	329	140	46	23	23	74	20			148	109			39	40		
	Jan.-Mar. 2005	305	131	47	21	26	60	24			120	94			26	53		
	Jan.-Mar. 2006	286	121	50	24	26	54	17			113	92			21	50		
	Jan.-Mar. 2007	272	117	51	24	27	51	15			103	82			21	47		
Percentage of total	Feb. 1999	100.0	46.6	15.3	8.3	7.0	22.7	8.6	6.1	2.6	39.3	28.8	18.8	9.9	10.5	13.7	3.5	10.2
	Feb. 2000	100.0	43.1	14.7	8.0	6.7	20.5	8.0	5.5	2.4	40.4	28.7	20.5	8.3	11.6	15.9	4.3	11.6
	Feb. 2001	100.0	44.0	14.8	7.9	6.9	21.7	7.5	5.3	2.2	39.3	29.2	20.8	8.5	10.1	15.7	3.8	11.9
	Jan.-Mar. 2002	100.0	42.5	16.7	8.6	8.1	20.6	5.3			39.2	28.3			10.8	12.5		
	Jan.-Mar. 2003	100.0	44.6	14.6	6.9	7.7	22.9	7.2			41.3	30.0			11.3	13.5		
	Jan.-Mar. 2004	100.0	42.6	14.0	7.0	7.0	22.5	6.1			45.0	33.1			11.9	12.2		
	Jan.-Mar. 2005	100.0	43.0	15.4	6.9	8.5	19.7	7.9			39.3	30.8			8.5	17.4		
	Jan.-Mar. 2006	100.0	42.3	17.5	8.4	9.1	18.9	5.9			39.5	32.2			7.3	17.5		
	Jan.-Mar. 2007	100.0	43.0	18.8	8.8	9.9	18.8	5.5			37.9	30.1			7.7	17.3		

Sources: MIC, Statistics Bureau, *Special Survey of the Labor Force Survey* (Feb. 1999 to Feb. 2001) and *Labor Force Survey Detailed Tabulation* (January-March 2002 to January-March 2007).

Note: The choices of reasons for being unable to take up jobs offered to survey respondents were different up to February 2001.

Figure 9. Total unemployment rate, long-term unemployment rate, and proportion of long-term unemployed



Sources: MIC, Statistics Bureau, *Labor Force Survey, Special Survey of the Labor Force Survey* (1977-2001) and *Labor Force Survey Detailed Tabulation* (2002-2007).

Notes: 1. Long-term unemployment rate = persons unemployed for 1 year or more / labor force.

2. Proportion of long-term unemployed = proportion of persons unemployed for 1 year or more among unemployed (excluding persons unemployed for indeterminate period).

3. Figures are actual numbers for each March up to 1982, each February from 1983 to 2001, and each January-March from 2002 to 2007.

4. The long-term unemployment rate and proportion of long-term unemployed in 1983 are for mainly job seekers.

VII. Trends among Long-term Unemployed

Among the unemployed, the long-term unemployed (defined as persons who have been unemployed for one or more years) constituted a strongly growing presence, both in absolute number and as a percentage of the total, from the end of the 1990s to the beginning of the present decade, and the level of long-term unemployment has subsequently remained high. This suggests that mismatch and other forms of structural unemployment stubbornly refuse to disappear (or it may suggest that the absorption capacity of employment is still weak) (Figure 9).

Looking at movements in the above indices suggests that demand-deficient unemployment rose in the latter half of the 1990s, and is declining during the present recovery phase. Structural/frictional unemployment appears to have risen in the latter half of the 1990s, despite some differences between individual indices, but no clear trend is discernible during the present decade.

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