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

Masanobu Fukutani
Ritsumeikan Asia Pacific University

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

[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

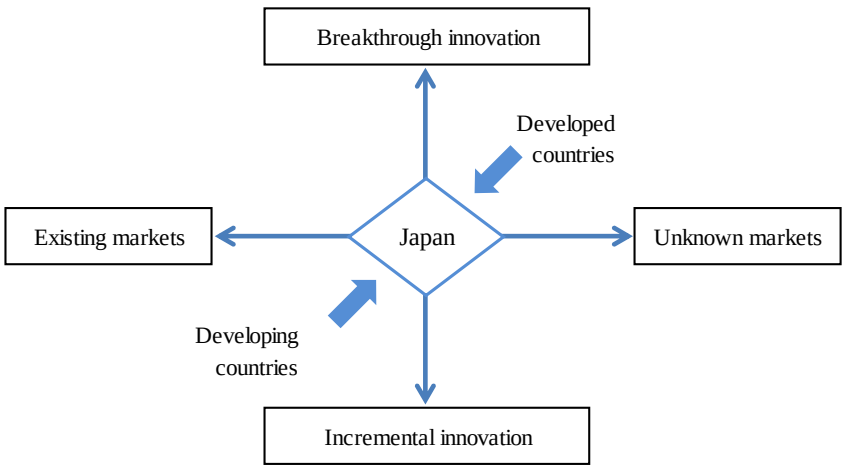
R&D in Japan consisted of introducing basic technologies from advanced Western countries and focusing on applied research and product development. Technology development aimed at "catching up and overtaking" consequently made Japanese enterprises competitive at raising the quality and lowering the cost 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

[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.

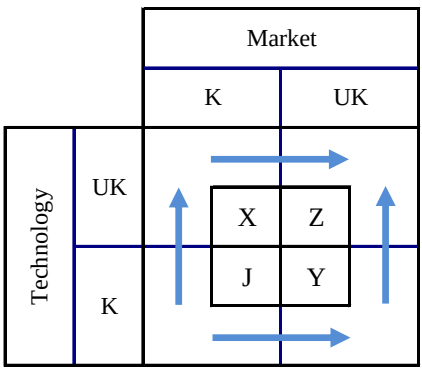
International competition to develop technologies is growing fiercer, and there are limits to the extent to which enterprises can dominate world markets by cheaply adopting technologies from developed countries in the West and specializing in product development. Developed countries are now entering 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

[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

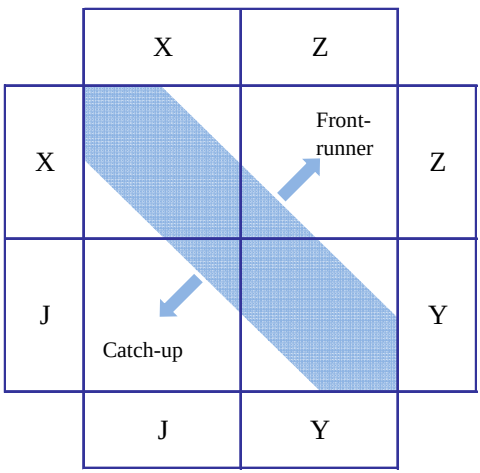
economic growth, such as the supply of labor and capital, are not going to grow as in the past, then it is essential that they secure an advantage in developing technologies in order to attain a certain degree of growth and development (Figure 2).

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

[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

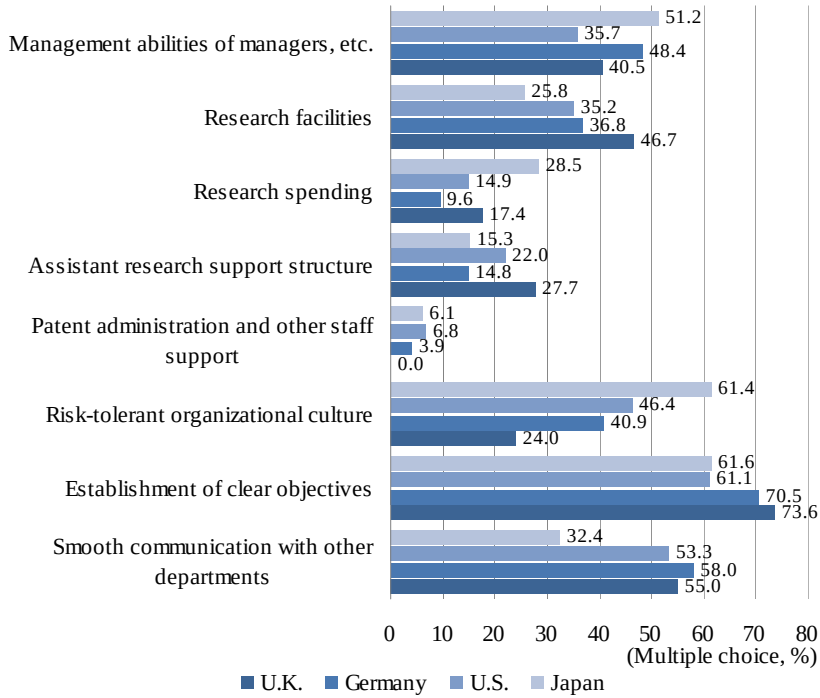
Note: Figures indicate the percentage of valid respondents who circled the response concerned.

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.

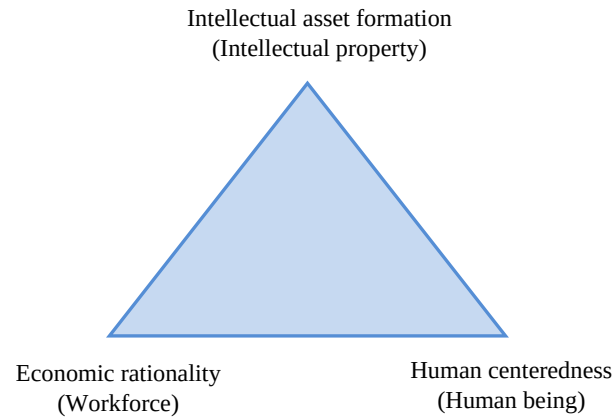
V. Conclusions

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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