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.

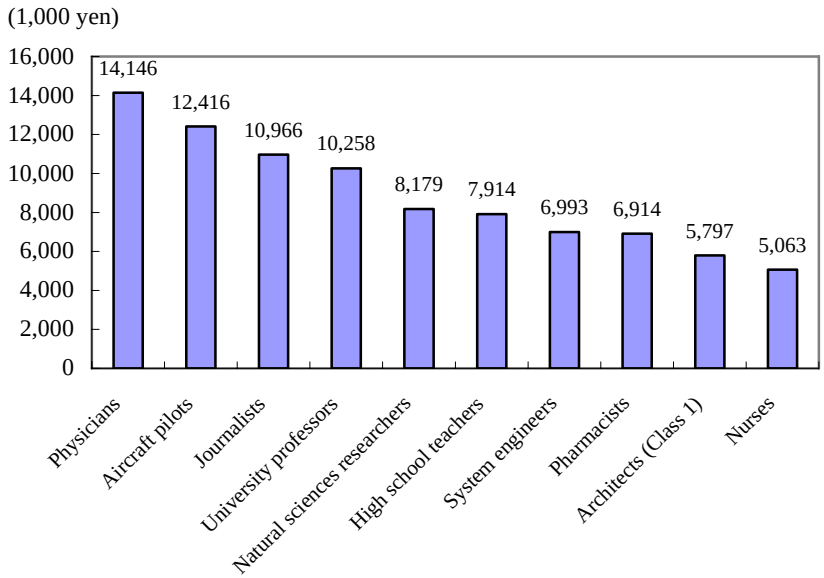
II. Pay and Benefits and Mobility of Researchers and Engineers from a Relative Perspective

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.

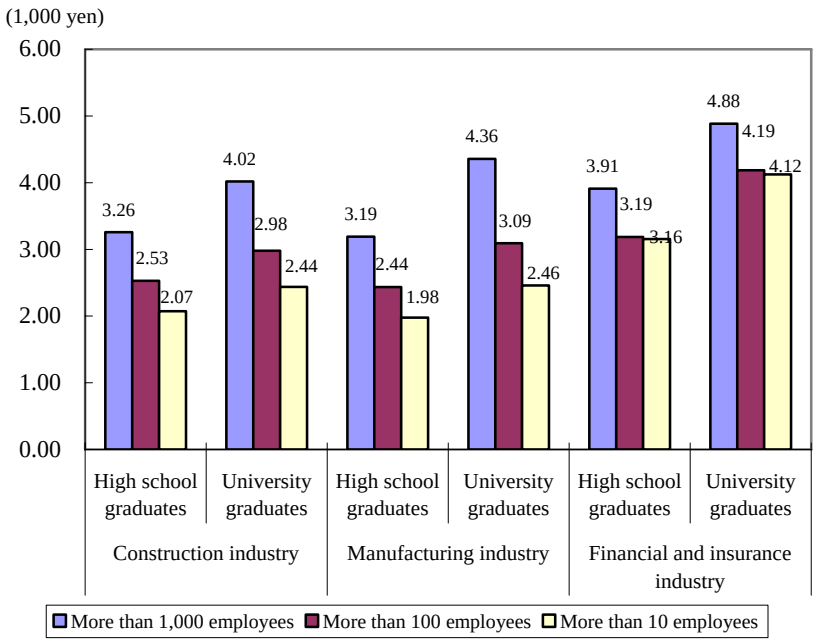
engineers at companies are determined not in comparison with other professionals but relative to other jobs within their companies.

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)



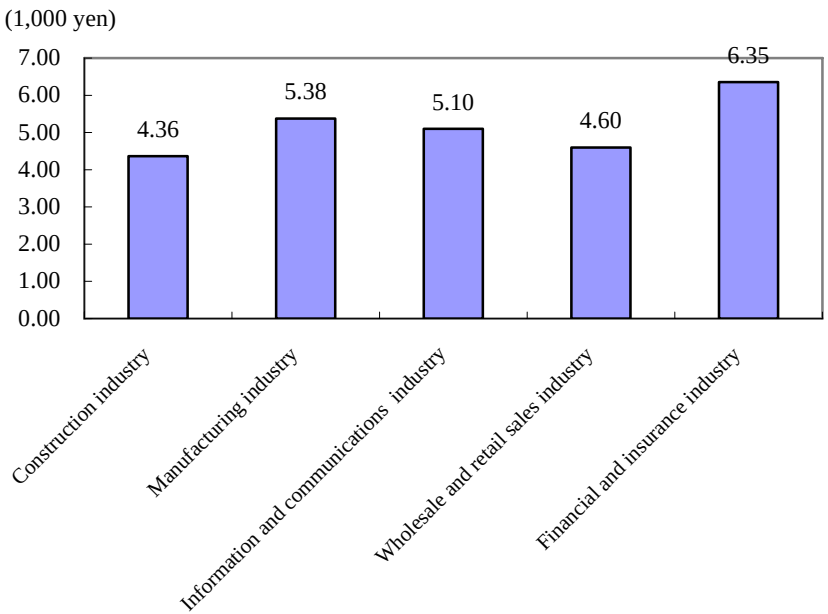
Source: FY2004 Basic Survey on Wage Structure.

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.

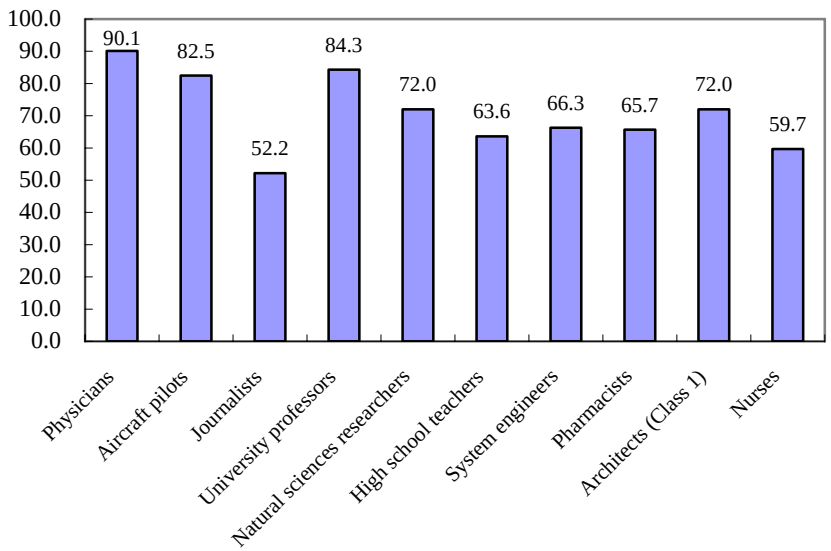
but higher than such professionals as high school teachers and pharmacists. Pay and benefits were lower in the manufacturing industry than in the financial and insurance industry, and the effect of academic qualifications is skewed in that high school graduates at large companies receive greater economic 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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