

HUMAN RESOURCE MANAGEMENT FOR PRODUCT DEVELOPMENT ENGINEERS IN JAPANESE, SOUTH KOREAN, AND CHINESE COMPANIES*

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I. Introduction

The manufacturing industry—the source of much of Japan's growth—is at a crossroads, i.e., in tight competition with South Korean and Chinese corporations. Recent studies have revealed that, while Japanese engineering technology is advanced, motivation toward work and organizational contribution has been decreasing since the 1990s and is clearly low compared to what is found in other job sectors and in other countries, even in terms of treatment (Nakata, 2009). Thus, today, the highly competitive capability of South Korean corporations and the vigorous innovative activities of Chinese corporations are a threat to Japan.

This paper sheds light on the situation according to corporate survey results, focusing on what type of management Japanese, South Korean, and Chinese corporations employ to govern product development engineers, who are an important source of competitiveness in corporations.

Different types of personnel systems have become more widespread owing to the dependence on the history of each country. Using the Marsden employment system theory, this paper analyzes what type of human resource (HR) management is being implemented and what types of complements to product architecture are taking place for the same products in the three countries. Since each product we examined had to be something developed in all the three countries, we selected mobile phone devices, LCD TVs, and information systems.

II. Human Resource Management: Literature Review

1. Grading System

In comparing international research in HR management, it is important to first check the grading system (a ranking system for employees) that serves as the core for the personnel

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TABLE 1. DIFFERENCES BETWEEN ABILITY-BASED, ROLE, AND JOB GRADE SYSTEMS

	Ability-based grade system	Role grade system	Job grade system
Grading criteria	Person (ability)	Role	Duties
Consideration of wages	Competency built-up from the past	Size of current role	Value of current duties (job size)
Assessment capability	Potential + Apparent ability	Apparent ability	Apparent ability
Treatment and job assignment	Separation	Linking	Linking
Promotion and promotion patterns	Two ladders: role promotion and professional qualification improvement	Focus on promotion: revaluation of role	Focus on promotion: revaluation of actual duties. Skipping grades is allowed
Promotion/demotion	No fundamental rules	Yes	Yes
Personnel cost management method	Management of number of promotions	Management of number of posts	Management of number of posts
Authority to make decisions for rating	Personnel Management Department	Department head	Line-manager position
Adjustment of wage level	Balance in the organization	Balance in the organization	Market rates
Job analysis/job evaluation	Not conducted	Not conducted	Conducted

Source: Created by author based on Ahn (2011, p.198)

qualification and performance system. A grading system clarifies rank order within the organization and is the systematic, foundational analysis tool of HR management. Such a structure not only affects compensation but also job assignment, training, and other HR management issues (Ishida and Higuchi, 2009).

The basic principles of a grading system are determined on the basis of the definitive criteria, and they include (1) an ability-based grading system based on people (capabilities), (2) a job grading system based on duties, and (3) a role grading system based on function. These differences are highlighted in Table 1.

The ability-based grading system is a scheme that has spread throughout Japan using competency (i.e., occupational ability), which serves as an assessment standard for potential ability and is not directly affected by task difficulty. In general, there are no demotions or salary decreases, and there are periodic raises. On the one hand, advantages of an ability-based grading system include ease of cooperation, job rotation, and promotion of long-term capability development, such that the system provides high affinity when long-term employment is the priority. On the other hand, disadvantages suggest that operations tend to resemble a seniority-based wage system, and capabilities tend to become obsolete owing to the speed of technological innovation (Tsuru, Abe and Kubo, 2005).

In contrast, the job grading system is common in the U.S. and has become increasingly common in corporations in Japan. Job analysis or evaluation is conducted, and wages are set according to the various duties required. Corporations pay the wages required for the jobs demanded, and it is not a seniority-based wage system. From the perspective of the employees, there is no promotion unless their duties change, so this incentive provides an advantage that ends up improving each person's expertise. However, job rotation is difficult, as is the promotion of firm-specific skill development, and it is hard to promote cooperation exceeding one's job scope. Furthermore, in some cases there are costs accompanying job analysis or evaluation.

TABLE 2. CHARACTERISTICS, ADVANTAGES, AND DISADVANTAGES OF VARIOUS PERSONNEL SYSTEMS

	Ability-based grade system	Role grade system	Job grade system
Advantages in human resource management	① Collaboration is promoted. ② Job rotation is easy. ③ Long-term skill development and form-specific skill development are promoted.	① Pay the wages required for management. ② Annual seniority-based raises are reduced, compared to ability-based wages. ③ Job analysis and job evaluation costs are low.	① Pay the wages required for the duties necessary for the corporation. ② There are no seniority-based raises. ③ Incentives for each person are needed to improve expertise to raise wages.
Disadvantages in human resource management	① Operations are seniority-based. It is difficult to reflect individual performance in wages. ② Risk of functional deterioration of skills with the speed of technological innovation.	① Omission of job analysis and job evaluation leads to vagueness in the basis of role-setting. ② Incentives for long-term skills development are low; therefore, it is difficult to promote cooperation exceeding the role.	① Job rotation is difficult. ② Promotion of form-specific skill development is difficult, and thus, promoting cooperation beyond the scope of work is difficult.
Conditions of compatibility	① When industry-specific human capital is important and requires skill training ② When wage funds increase ③ Suitable for employees who avoid risk	① When facing intense changes in the market ② When objective indices for individual performance can be obtained ③ Unsuitable for employees who avoid risk. Company must allocate risk.	① Corporations in which the organizational structure is stable and major changes are not made frequently ② Corporations in which skills accumulated through job rotation are unimportant ③ Suitable for employees who avoid risk

Source: Tsuru *et al.* (2005, p.53)

In recent years, a new scheme, known as the role grading system, has started to gain traction in Japan. This system addresses the seniority issue of the ability-based grading system and is an eclectic system that incorporates the concepts of both ability-based and job grading systems. Unlike the job grading system, this scheme does not include task analysis or evaluation, and salary is set according to “role,” so wages increase or decrease with role changes. There is a big advantage in terms of cost; however, there are disadvantages that include low incentives for long-term skill development and little cooperation beyond one’s own role.

Thus, each of the ability-based grading, job grading, and role grading systems has its own advantages and disadvantages. Furthermore, compatibility also depends on the corporation’s actual growth stage, types of employees, and age ranges of the employees. Table 2 lays out the advantages and disadvantages in addition to the requirements for compatibility for the three systems. According to these advantages and disadvantages, we can also see many cases wherein the ability-based grading system is used for younger demographic and non-managerial roles, and pay-for-performance types of roles or job grading systems are used for management positions (Tsuru, Abe and Kubo, 2005).

In South Korea, seniority-based grading schemes are most common and such elements take the lion’s share in terms of both salary and promotion management. However, owing to the intensification of international competition in the early 1990s because of problems in increased personnel expenses and stagnant personnel, in many cases ability-based grading systems from

Japan were introduced as systems including elements of merit systems while retaining seniority-based elements. Furthermore, ever since the 1997 IMF financial crisis, annual salary arrangements and other pay-for-performance wage structures have been introduced, so there have been many modifications to ability-based grading systems (Ahn, 2011).

In China, job grading systems are common. HR management in Chinese state-owned enterprises (after the Chinese economic reform) employ a job grading system modeled after the former soviet management method, and the nationwide unified duties that classify wages are determined by the level of importance and responsibility attributed to duties (Chin, 2005).¹ However, in jobs entailing the same kind of work, wages are determined on the basis of the number of years on the job instead of proficiency, so there is a problem with one's lack of will to work. In Chinese corporations, after the economic reform, America's job grading system and merit-based HR management methods were introduced one after another.

2. Human Resource Management International Comparison Theory

Further, we cover research that specifically includes examples of Japan to discuss the theoretical framework in HR management via making international comparisons. In his historically famous work, Dore (1973) compares English and Japanese factories producing similar products and contrasts the market-oriented attitudes of English corporate employees with the organization-oriented attitudes of Japanese corporate employees.

Jacoby (2005) observed the scale and concentration of authority in Japanese and American HR departments, noting that, in the U.S., the authority of the HR departments is minimal and decentralized, while in Japan they are centralized and wield far more authority in the overall personnel system. He also showed that the level of corporate governance marketing differed in both the countries.

Hall and Soskice (2001) state that, in addition to the liberal market economy models used in England and the U.S., the coordinated market economy models of Japan and Germany had advantages as well as a better reason to endure, presenting the varieties of capitalism theory and criticizing the convergence theory, which converges to the liberal market economy.

Next, we explain the Marsden theory, which is referred to in the analysis in this paper. Marsden (1999) classifies the differences in systems by country, U.S., Japan, England, and Germany, founded on the differences in hiring transactions based on the reasonable selection of corporations and individual employees. While this theory is a similar concept to Hall and Soskice's Varieties of Capitalism, it serves as an important study regarding the discovery of the four keystone types of corporate personnel systems.

This classification is divided on the basis of how to set up employee tasks, and it is shown that issues in the various transaction rules naturally differ, e.g., wage-payment standards and measurement of results. First, the "work-post rule" is typically seen in the U.S. and is equivalent to job grading system rules, and because duties are strictly defined at an individual level, this work serves as a wage-payment standard. When granting additional incentives, it is suitable to assess the same according to the level of effort or performance.

The "competence-rank rule" is typically seen in Japan and is equivalent to an ability-

¹ In the former Soviet Union, scientific management was thoroughly implemented and the national uniform pay rate meant that wages were determined based on the skill qualification catalog (Horie, 2009).

TABLE 3. FOUR TYPES OF EMPLOYMENT RELATION

	Production approach	Training approach
Task-centered rule	“Work post” rule (USA, France)	“Job territory” / “tools of trade” rule (UK)
Function-centered rule	“Competence rank” rule (Japan)	“Qualification” rule (Germany)

Source: Created by author based on Marsden (1999)

based grading system. At the root of these rules, job boundaries are vague, and detailed performance methods are entrusted to the team or organization. Therefore, competency seniority becomes the standard for salary schedules and efforts required for duty performance become the standard in the case of additional incentives.²

For the “work-post rule,” position and authority are outlined in addition to work details when defining jobs, which become the foundation for setting wages. Hence, there is a significant difference in wages by profession and job classification. The competence-rank rule allows for flexibility in duties, so there are no large differences in wages, and job assignment conversion is easy.

The following analysis addresses where South Korea and China stand in this type of classification. In contrast to the expectation that Japan and China would be complete opposites, while South Korea would at least originally have had a more rigid seniority-based system, it appears that an ability-based grading system is being introduced in Japan, and now, it even includes pay-for-performance-type changes owing to American influence. Hence, it is worth noting what kind of changes South Korea is making.

According to Marsden, if one of the transaction rules comes to obtain the mainstream position in that company, there is a mutual enforcement between the company and systems outside it, which creates more stability. He writes that, in this case, the difficulty is perceived in the risk that transitioning to different rules may come at a certain cost. This concept supports varieties of the capitalism theory, which negates the convergence theory wherein the personnel system converges to one of the types. Even so, it is difficult to imagine these four types continuing infinitely because they are each likely to be revised in various ways owing to external pressures such as intensification of competition in the product market, variations in product architecture, etc.

3. Product Architecture

Before beginning the analysis, we would like to elaborate on the concept of product architecture as it is used in this paper. This concept explains what kind of structure achieves a functional product (Fujimoto, 2001). The axis is labeled as the adjustment level between parts; it is integral at one extreme (e.g., vehicles, machine tools, etc.), for which the level of adjustment is high, and it is modular at the other extreme (e.g., computers, TVs, electric cars, etc.), for which the adjustment level is low. When researching product architecture, it becomes

² Furthermore, for the “occupational field/category rule” (England) and “qualification rule” (Germany), qualifications are systemized by external training facilities, etc., which serve as important standards in detailed duties. The foundation of wage payment is these fields and qualifications, so there are no performance evaluations for additional incentive.

clear that integral-type products are highly compatible with long-term employment and internal training, while modular-type products are better for short-term employment and external hiring (Fujimoto, 2001). However, this is only a suggestion, and in terms of HR management, it has not been sufficiently verified. In this research, we also examine the relationship between HR management and product architecture.

III. *Data and Methods*

The data used in this article were obtained from research conducted by research groups in Japan, China, and South Korea, including the author of this paper. The research comprises questionnaires and oral surveys (interviews) pertaining to corporations. In the following sections on the analysis, we use these two materials.

1. **Corporate Interviews**

We performed interviews for nine companies, including one company from each country for each product (i.e., mobile phones, LCD TVs, information systems). The procedure for selecting target corporations included first presenting products that could be compared between the three countries and then selecting companies that represented each product in their respective countries. The nine companies share the fact that they are large-scale leading corporations in their respective countries.

Furthermore, the three target products (i.e., mobile phones, LCD TVs, information systems) have advanced modularity on a global level in their product architecture. Modularity is the highest in information systems, LCD TVs, and mobile phones in the given sequence.

The contents of the corporate oral survey included speaking with the HR department manager, product development manager, and product development supervisor at each company. The interviews were conducted from May 2009 to January 2010, with 60–150 minutes allowed for each person. The survey form for the interview sessions was first created in Japanese; then, a Chinese version was made by the Chinese researchers in the research group; and finally, a Korean version made by the group's South Korean researchers.

2. **Corporate Survey**

Our research groups conducted surveys in Japan, South Korea, and China using the same survey form.

In Japan, the companies had to belong to the private sector with at least 185 employees in the manufacturing and software industries. Surveys (nationwide) were distributed to HR departments and product development department heads. The research was conducted during March 1–12, 2010, with a recovery rate of 3%.

In South Korea, the companies belonged to the nationwide private sector and the manufacturing industry (at least 300 people) or information communication industry (at least 150 people). These surveys were conducted through on-site interviews by corporate survey specialists. The research was conducted between July 8, 2010 and October 4, 2010, with a recovery rate of 19%.

TABLE 4. CORPORATE AND PRODUCT ARCHITECTURE FOR SURVEYING

Products	Japan	Korea	China
Mobile phone	JA, Co. Integral	KA, Co. Separate use	CA, Co. Modular
LCD TV	JB, Co. Integral	KB, Co. Separate use	CB, Co. Modular
Information system	JC, Co. Integral	KC, Co. Modular	CC Co. Modular

Source: Analysis and modeling by author

In China, the four target regions included Shanghai, Beijing, Guangzhou (Canton), and Shenzhen, and corporate survey specialists visited the sites to perform interviews. The research was conducted between August 14, 2010 and October 15, 2010, with a recovery rate of 7.2% for Shanghai manufacturing.

After creating the final version of the Japanese questionnaire, it was translated by Chinese and South Korean research members into the respective languages. These surveys were conducted in two stages wherein, after the HR department answered questions regarding the personnel system, the survey sheets were given to the product development department head, who answered questions regarding the product development process for a certain product. It is possible that at this stage, distinct formatting led to difficulties in answering questions, which, in turn, led to a low recovery rate.

IV. *Comparison between Japan, China, and South Korea*

The interviews and questionnaires from the three countries were used for analysis, and the following indicators were selected: (1) the personnel system, (2) its relation with the external labor market, (3) the development of capabilities, and (4) the granting of incentives. Comparison analyses were performed for each of these elements.

Furthermore, products and product architectures for the nine companies that participated in the hearing survey are presented in Table 4. Assuming a personnel system, when we checked the average age at the nine companies, the figures were 35–40 years old in Japan's JA, JB, and JC; 30–35 years old in South Korea's KA, KB, and KC; and 27–28 years old at China's CA, CB, and CC companies.

1. Personnel System

First, let us take a look at the personnel system. The points here are how the personnel system is designed, whether it is possible to provide favorable treatment for engineers, and the presence and positioning of a specialist system.

In considering the survey results, Japan's JA, JB, and JC companies all adopted ability-based grading systems. Company JA used a "grading system based on the ability to perform duties (competency)," but its basic format was similar to an ability-based grading system. The personnel system is uniform throughout the company, and when one is promoted to a management position, there is plurality in the management and technology systems, but the

management system is the mainstream. Company JB had introduced a company-wide occupational ability-based system and applied a pay-for-performance-like system for the managerial levels, which is similar to a role grading system. Company JC also features an ability-based grading system.

All three companies used company-wide personnel systems, and in spite of variations by job group or favorable treatment for engineers, there existed the possibility to transfer from one job assignment to another. A common aspect is that when promoted to a management position, employees are separated into specialist courses and management courses, but the management course is the mainstream, and very few people are admitted to the specialist course.

In South Korea, companies KA, KB, and KC used systems similar to ability-based grading systems, but there were established job groups, and the systems allowed for significant favorable treatment for engineers.

While company KA had a system similar to ability-based grading systems, there were also job levels divided into six job groups (i.e., E: research and development, D: design, T: products or manufacturing technology, P: production, M: sales and marketing, and G: staff). There is a policy of favorable treatment for engineers as well; as within groups E and D, which are the categories for development personnel, base salary, or merit pay is set high.

Company KB has very detailed categories for roles, so at first, it looks like a job-based system, but the salary does not seem to be connected to these categories, and the actual system more closely resembles an ability-based grading system. There are qualification levels for office work (4 levels) and for engineers (4 levels) working on research and development. The two available career paths for engineers are management positions and technical positions.

At company KC, like company KA, the system is similar to an ability-based grading system, but there are job groups (i.e., consulting, IT architecture, IT management, IT operations, IT infrastructure, sales, and marketing, management support), and the jobs are subcategorized. Jobs and capabilities are defined in detail further.

In China, companies CA, CB, and CC used a job grading system. Company CA used the one based on the hay system, evidence of their adherence to the U.S. consulting company's advice ten years prior. There are 20 ranks between general employees and the CEO. After three years with the company, employees are divided into management position courses and specialist courses. Since the pace of promotion is high in the management position course, there are many employees who prefer it, but 80% of employees actually take the specialist course. Furthermore, the specialist course includes not only engineers but also people from the sales, legal, and financial departments.

Company CB also uses a job grading system. Employees are broadly categorized into either managerial or specialist courses and the latter includes non-management employees such as technical, marketing, finance, and HR departments. The job details, authority in organization, and required basic skills are defined in the job description.

Company CC also utilizes a job grading system. Technical positions are broadly divided into four levels. Similarly, duties and ability requirements are defined in detail.

Checking the results of these questionnaires, the basic personnel system for Japan was a combination of ability-based and role grading systems in over 50% of companies. In South Korea, 50% were ability-based grading systems, and in China, nearly one-half were job grading systems, which matched with the results of the interviews.

In terms of a method for establishing a personnel system, 86.4% of cases in Japan have

company-wide systems compared to 75.0% in South Korea and 60.0% in China. In South Korea, and more so in China, there are higher percentages of companies establishing these systems by job or department, thereby generating possible favorable treatment for engineers.

Specialist systems were implemented in 20% of cases in Japan, 42.1% in South Korea, and 48.0% in China.

Thus, as found in the interviews, in Japan, ability-based grading systems are implemented company-wide, wherein favorable treatment for engineers and specialist systems are not widespread. However, in South Korea, while there are many cases of systems similar to ability-based grading systems, there are different schemes depending on job type and department, and the possibility for favorable treatment for engineers and specialist systems is common. In China, there are many job grading systems as well as possibilities for favorable treatment of engineers. Specialist systems are commonplace, and there are actually more people categorized as specialists.

In South Korea, it is worth noting that while the system is an ability-based grading system, there are job groups. This can be interpreted as stemming from the influence of separate job grades for office workers and manufacturing employees in the seniority-based grading system before spread of the ability-based grading system. However, more research on this system transition is required.

2. External Labor Market

Next, let us take a look at the relationship with the external labor market. The points to emphasize fall on the internal training for new hires, ratio of mid-career hires, the turnover rate, and the presence of systems for underachievers; for example, systems of eliminating the lowest-ranking performance assessment cohort.

Japan's Company JA focuses on hiring new graduates and mid-career hires are supplementary. The department engineer turnover rate is 1.7% and the draw-out rate is low. Company JB's core hiring is also new graduates with a small number of mid-career hires. The turnover rate is extremely low at 0.5%. Company JC also focuses on hiring new graduates and only 15%–17% of new hires are mid-career while the turnover rate is low at 1.35% overall.

In the three Japanese companies, there was very little liquidity and the focus was on the hiring of new recruits. Mid-career hiring was also low, as was the turnover rate, and there was no system for underachievers, meaning that measures were probably taken in terms of job assignment.

Next, Company KA in South Korea had a foundation of hiring new graduates, and in order to handle new technology trends, mid-career hires were only allowed on a scale equivalent up to 10% of new graduate hires. The engineer turnover rate was low at 3.5%. There were many employees who were let go in systems that eliminated the lowest-ranking performance assessment cohort (second life plan) if they continued to underachieve.

The hiring policy of company KB is two-dimensional with both strategic importance and organizational ability, and both internal training and external hiring were implemented. Mid-career hiring was used in a positive manner to expand business with over 40% of new hires coming in mid-career. The turnover rate was 5–8%. Previously there were systems used to eliminate the lowest-ranking performance assessment cohort, but this practice changed to a milder version, wherein employee evaluations are disclosed, and a certain percentage of the top

employees in the organization are notified, and meet with their superiors. The subject either must change their duties or quit.

Company KC also has a strong disposition to hiring new graduates and there is a system of hiring students in advance, in order to grab exceptional new talent.³ There were a high number of mid-career recruits at 25–30%. The average engineer turnover rate over the past five years was 4–5%. There was also a system of eliminating the lowest-ranking performance assessment cohort.

The three South Korean companies focused on internal training by hiring new graduates, but they were also positive about external, mid-career hiring, which makes up a high percentage of about 30% of new hires. One of the characteristics is that there is a system of eliminating the lowest-ranking performance assessment cohort, wherein, if underachievement continues, it is recommended that the employee is asked to leave. Therefore, they have well-incorporated policies from the external labor market pressures.

Moreover, company CA from China hired one-half of its personnel from new graduates and one-half from mid-career hires, increasing the focus on mid-career hires compared to what it was before. Most new graduate hires were from the master's degree programs at well-known universities in China, with high wages and benefits, and they were able to attract exceptional talent. The turnover rate was 5%, and there was also voluntary retirement, so core employee retention was a goal. There was also a system of eliminating the lowest-ranking performance assessment cohort, and each year 5% of the employees were let go. There were also job transfers, but such people were put in the easiest positions after transferring.

Company CB focused on hiring new graduates, but they were also active in hiring mid-career hires, making up 25% of all new hires. They were especially making efforts to acquire human resources with the three “highs” (i.e., high position, high remuneration, and high level of education). The company-wide turnover rate was 5–10%, but in the research and development department it was lower, at 3.8%. Company CC had a strong tendency to hire new graduates, but mid-career hires were around 30%. The overall employee turnover rate was about 15% but was low for engineers at 5%. There was also a system of eliminating the lowest-ranking performance assessment cohort.

The three Chinese companies were in growth stages and had younger employees, and thus were trying to internalize efforts to retain core employees. However, there was some demand for required personnel and they were thus active in mid-career hires, too. The correlation with the external labor market was also high, such as in its system of eliminating the lowest-ranking performance assessment cohort.

Checking the questionnaire results regarding these points, in Japan 50.5% of companies “focus on internal training of new graduates,” while 41.6% “place equal focus on hiring new graduates and experienced mid-career hires,” and 7.9% “focus on mid-career hiring.” The weight of experienced mid-career hires was slightly higher in South Korea than in Japan with 45.0% of companies focusing on new graduates, 34.3% placing equal focus on both things, and 20.7% concentrating on mid-career hires. The China questionnaire results matched the interview results with only 8.0% of companies focusing on new graduates, 46.0% placing equal focus on

³ This system grants 3rd-year university students the right to join the company after passing an interview prior to graduation. Students who have earned spots in the company use their summer vacation for free technical training. Approximately 300 people are hired per year.

TABLE 5. FAVORABLE TREATMENT AND WITHDRAWAL FOR ENGINEER

	Japan	Korea	China
	JA, Co.	KA, Co.	CA, Co.
Mobile phone			
Definition of job	No	Yes (Use in Training)	Yes
Favorable treatment	No	Yes	Yes
Specialist track (Share of Specialists)	Yes (20%, not in mainstream)	Yes	Yes (80%)
Lowest ranked selection	No	Yes	Yes
Career change	Yes	Few	Yes
LCD TV	JB, Co.	KB, Co.	CB, Co.
Definition of job	No	Yes (Use in Training)	Yes
Favorable treatment	No	Yes	Yes
Specialist track (Share of Specialists)	Yes (20%, not in mainstream)	Yes (half Specialist and managerial courses are equal.)	Yes (Majority is in specialist course.)
Lowest ranked selection	No	Abolished	None
Career change	Yes	Few	Very few
Information system	JC, Co.	KC, Co.	CC, Co.
Definition of job	No	Yes (Use in Training)	Yes
Favorable treatment	No	Yes	Yes
Specialist track (Share of Specialists)	Yes (20%, not in mainstream)	Yes (half Specialist and managerial courses are equal.)	Yes (Majority is in specialist course.)
Lowest ranked selection	No	Yes	Yes
Career change	Yes	Few	Few

Source: Analysis and modeling by author

both objectives, and 46.0% focusing on mid-career hires.

Table 5 provides a summary of the relationship between favorable treatment of engineers and retirement. In Japan, job assignment transition is considered important, so in many cases there is one company-wide personnel system. Job assignment transfer has two purposes, one of which is personnel training and the other is to continue hiring underachievers. One advantage of job assignment transfer is that there are no significant changes or decreases in salary after realizing the transfer. In cases of favorable treatment for engineers, when people doing jobs other than engineering are transferred for continuous employment, it would not be convenient to decrease their wages, making it hard to give special treatment to engineers.

However, while South Korea and China have favorable treatment of engineers, we see that underachievers are mainly resolved with the system of eliminating the lowest-ranking performance assessment cohort. In South Korea, there are cases in which jobs other than engineers are transferred to other duties due to underachievement, but this also comes with poor treatment such that many employees choose to quit. In China a job grading system is used so that employees start over from zero when transferred to a new job and are given a low-grade position.

The survey results also reinforced this outcome. In Japan, there are cases of transferring engineers to manufacturing or sales departments, but these types of transfers are not common in either South Korea or China.

3. Development of Abilities

Next, let us examine skill development methods. Internal training is important for cultivating technology, but the point is how much importance is placed on this and how well reinforced OJT and other methods for internal training are, as well as the level of implementation of off-the-JT training with new technology in mind.

Internal training at Japan's companies JA and JB generally place special importance on OJT. Employees cultivate their knowhow at the job site in order to build experience and grow. There is also technical and management skill training.

Company JC referenced ITSS, which is the nationwide technical standards for IT engineers, starting systemized professional job categories, but in the past we were unable to grasp how many people were categorized in each job. Therefore, the weight of off-the-JT training is low, at only ten days per year, and the educational focus is on OJT at the development site itself.

As one can see, the focus of skill development in the three Japanese companies is OJT and the off-the-JT systems are weaker with a low level of systematization.

Next, in South Korea's company KA, internal OJT is the main focus, but in addition to a strong internal training system, there are doctorate and masters programs available for employees through scholarship support. Company KB has three internal training courses including OJT, mentoring (training support program), and coaching. There is also manager training plus training for key technical tasks related to software. There is also a system to dispatch exceptional employees to U.S. universities for a month.

Company KC defines the duties and skills of IT engineers in detail for internal training. In addition to OJT, efforts are also put into off-the-JT training and skill development support is offered through a variety of systems. Employees are obligated to devote 10% of their work time to skill development.

As one can see, there is also a keen focus on internal training in South Korea and while efforts are made to promote both OJT and off-the-JT training, the latter is especially extensive. The scholarship system for graduate school and sending employees to U.S. universities are particular standouts.

Next, China's company CA focuses mainly on internal training, but they have gradually started to focus on external hiring as well. There are specialist training systems for employees with good performance and general skills. The career-building management position course promotes exceptional employees. On the one hand, there is an "in-firm university" which provides educational training for managerial skills. On the other hand, their standardization and division of labor of development work has advanced and they are building development organizations and labor divisions systems suitable for engineers hired mid-career.

Company CB utilizes both internal training and external hiring. While personnel training is focused on OJT, off-the-JT training is also applied uniformly throughout the company in the form of project manager education and there is also a qualification certification system in place.

Company CC utilizes both internal training and external hiring. In addition to OJT, efforts are put into off-the-JT training as a means of talent development. Duties and skill requirements of IT engineers are defined in detail and training is conducted according to those definitions. If an employee lacks technical skills, there is a system that allows him to undergo training at the internal training center and he is thus tested before continuing work. There is also a system to

send employees to graduate school to earn degrees. 30% of exceptional new graduate engineers are trained with a concentration in management support.

As one can see, even in China, while the main setup includes job and skill requirements defined in a job grading system, there are extensive off-the-JT opportunities in addition to OJT and they have management education and graduate school programs in common with South Korea. PM internal qualifications, early recognition, and concentrated training as candidates for executive positions are characteristic systems in Chinese corporations. This may be similar to the U.S. fast-track system, but Chinese corporations are still in a growth stage and since the age bracket of the personnel is low, the function of this system is likely to train the employees quickly in order to fill upper management roles.

According to the questionnaire surveys pertinent to this point, policies considered to be effective for engineer skill development were common between all three countries including instruction from superiors and senior employees, and experience in various development methods. Japan valued instruction from superiors and senior employees the most, while very little value was placed on sending employees to graduate school, which matched the results of the interviews.

Japan also stood out as having an extremely low rate of off-the-JT training, a trend that was especially conspicuous in the information systems field. Concerns still remain regarding new technology that cannot be learned through OJT.

4. Granting Incentives

Next, let us compare the granting of incentives. The main points in this section include how remuneration is determined, what the indexes for evaluation are, and what is reflected in the assessment. Table 6 provides a summary of the methods for determining remuneration at the nine companies.

First, Japan's company JA was one of the corporations that implemented pay-for-performance at a relatively early stage and has also experienced the ill-effects of it. Then, after trial and error, they finally achieved stable organizational operations by moderately incorporating process evaluations. The base salary is "basic pay and responsibility wages." Personnel evaluations are conducted by goal management twice a year. The results of one's evaluations are reflected in salary increases, but the previous year is included in the assessment, so aspects of continuation and experience are also included. The ratio of basic pay and responsibility wages is weighted more in responsibility as one's grade increases. The evaluation system itself incorporates process or effort and instead of only short-term results, incentives are also granted for medium-term initiatives. Furthermore, middle management positions (and higher) are paid wages for their roles.

In company JB, many non-management levels apply a pay-for-performance-type of monthly wage system called "challenge course." The various allowances were abolished, making way for a 32-rank system, characterized by a simple design where the monthly salary amount is determined for each individual rank. Evaluation categories include results, growth, and behavioral assessments; if consistent results can be maintained for two years running, the employee may be promoted. If performance is good, high wage levels are possible, regardless of age. It is also worth noting that there were very few employees whose salary has decreased.

At the same time, the base salary for management positions is a combination of

TABLE 6. INCENTIVES

	Japan	Korea	China
Mobile phone	JA, Co.	KA, Co.	CA, Co.
Reward	Net base salary = Base salary + Duty wages. The amount by which the base salary is raised is determined on the basis of the evaluation and performance results. Duty wages are raised on the basis of the evaluation results. The process is also reflected in the remuneration without exhibiting bias toward the short-term performance evaluation.	Annual Salary (= monthly salary) + Merit pay + Special incentive. Monthly salary is base salary + ability-based wages. Gainsharing for each department is by merit pay. The objective of special incentives is retention.	Job-based salary. Base salary for general employees and on-site managers is mainly based on performance. Upper-level employee wages are based on potential ability to develop and contribution level.
LCD TV	JB, Co.	KB, Co.	CB, Co.
Reward	For general employees, base salary is (job salary + added salary + basic salary) + benefits. Ability and behavior evaluation are reflected. Management position salaries are a sum of the monthly performance salary (based on the performance evaluation results) and monthly duty wages (based on duties).	Base salary + variable salary. Personal performance is reflected the most. Variable salary is incentive-based (outstanding individuals) and organization merit pay (project team). Range of amount is large.	Base salary (70% + performance (bonus) salary (30%)) Base salary is determined by duty wages (50%), ability (15%), and performance (35%).
Information system	JC, Co.	KC, Co.	CC, Co.
Reward	Base salary = Qualification grade salary + results addition + regional addition. Performance evaluation is reflected in bonus. Overall evaluation is reflected in base salary addition and promotion. There is very little difference based on ability.	Annual salary system is averaged over 12 months. Job grade is reflected in base salary (60%) and performance evaluation is reflected in individual merit pay (15%) while competency evaluation is reflected in duty volume grade (25%).	Annual salary. Duty grade (40%), ability wages (30%), and merit pay (30%). A large difference can be found in salary based on results, even for employees with the same duties and same grade.

Source: Analysis and modeling by author

qualifications (i.e., performance monthly salary) plus job (i.e., responsibility monthly wages). Performance assessment and behavioral assessment are reflected in promotion, raises, bonuses, and retirement contributions.

The base salary at company JC is determined by wages, bonuses for results, and regional bonuses. Individual results and skills improvement are reflected in salary and promotion, but the level of influence is small. Bonuses for results vary and reflect the results of the comprehensive evaluation. However, overall evaluations are conducted as per performance and behavioral assessment, and if performance is mediocre, behavior can serve as a complement. Therefore, most people get regular raises. JC has the highest seniority elements of all three companies.

As one can see, the above three Japanese companies are incorporating elements of results and process evaluation within the scope of an ability-based grading system, but there is still not a lot of performance reflected in these systems. While companies JA and JB do incorporate pay-for-performance-type elements, they include process assessment as well as performance assessment, eliminating shortsighted competition and maintaining elements that promote cooperation within the organization.

Next let us examine the South Korean firms. Remuneration at company KA is determined by annual salary (or monthly salary) and merit pay (i.e., incentives). Monthly salary is calculated from base salary plus capability wages. Base salary is determined by job group and then position, and increases with age. Ability-based salary is determined by the division manager after evaluating individual performance. Performance assessment and ability assessment are reflected at a 6:4 ratio and evaluations pertaining to projects are not directly reflected in wages. Merit pay includes a “productivity bonus” and a “profit distribution system,” and overall company earnings are distributed to each organization according to contribution, afterwards being further distributed to individuals. The maximum allowed productivity bonus is 150% of annual salary and the maximum allowed profit distribution is 50% of annual salary. These large numbers serve as a strong incentive.

Furthermore, there are “special incentives” for the core development personnel, in order to prevent transfers to other companies or extraction of these employees. This has not been disclosed to general employees. Evaluations include performance assessment and ability assessment (i.e., volume assessment), each of which are conducted annually. The former is an individual marker related to the department goals, while the latter is an assessment of individual core abilities, which differ depending on duties.

Remuneration at company KB is determined on the basis of the base and variable salaries. Individual performance assessment results are reflected in the salary. Variable salary types include “individual incentive wages” and “merit pay. On the one hand, “individual incentives are paid to exceptional individuals at times and the range of amount paid is wide from KRW 1 million to 100 million.” On the other hand, organization merit pay is annually paid on the basis of the business results of the organization as a whole, and there are differences depending on organizational and individual evaluations.

Personnel evaluations consist of performance assessments and capability assessments and determine wages and promotions. Promotions are determined after three years of this assessment. There are also employees who are able to skip over ranks when promoted.

Company KC employs the method of paying an annual salary, averaged over twelve months. Annual salary is made up of a base salary, duty ability wages, and merit pay. The base salary is the same for everyone with the same job group and ability level, and makes up 60% of annual salaries. The remaining is determined by job skill salary (25%) and merit pay (15%). There is a 40% gap between annual salaries in the same grade. There are standard accumulated years required for promotions, but there are also a number of exceptional employees who skip promotion ranks based on results and ability.

As one can see, the three South Korean corporations employ the method of an annual salary in an ability-based grading system, which is averaged out over twelve months. Using capabilities and results as the base for salary is similar to Japan’s system. However, unique characteristics included results of the company, department and individuals being evaluated and that performance being reflected in wages (companies KA, KB, and KC), as well as focusing on incentives, incorporating measures to distribute profit by department and by individual, along with the large amount of these incentives (companies KA and KB). Furthermore, we see that there are also opportunities for employees to skip ranks in promotion, showing that seniority elements are in decline.

Next, let us examine China. China’s company CA uses a duty salary that is determined on the basis of duties and technical ability. Base salary for general employees and on-site

managers is determined as per performance, and upper management wages are determined according to potential abilities to develop and level of contribution. Those with good performance are promoted quickly and since the salary and bonuses are also high, there is a big difference in wages in just 2–3 years. Personnel assessment is done on the basis of performance four times a year using a goal management system. The result of this process is that a term of 1–3 years is looked at to determine raises, annual bonus, and promotion. Through the system of eliminating the lowest-ranking performance assessment cohort, 10% of managers, who are not appropriate for their position, are demoted or transferred to a specialist course.

In Company CB, salary is comprised of base salary (70%) and performance wages (30%). The base salary is determined by duty (50%), ability (10%), and performance (30%). When employees are assigned to the management course, the proportion of performance wages increases and at the department head class, 60% of remuneration is determined according to performance. Each quarter, employee performance is calculated with monthly results data and the result is reflected in one's performance salary.

Company CC's wages are annual salaries that are determined on the basis of duty type and grade (40%), ability (30%), and results (30%). There is a 60% salary gap even for employees with the same duties of the same grade. Age is irrelevant for promotion and employees are recognized for excellent results and ability if they meet all conditions in the job skill definitions. There are also many exceptional personnel, including a 35-year-old VP.

As one can see, the three Chinese companies determine wages on the basis of duty and job ranking, and a high level of performance is reflected in the amount as well. Also, as personnel evaluations are conducted four times a year, the performance management cycles are quick and there are many employees who skip ranks for promotions.

Regarding granting of incentives, according to the questionnaire survey results, China and South Korea valued "favorable treatment in monetary terms through raises and bonuses," and "favorable treatment in terms of job post through promotions and increase in ranking," as effective methods for motivation. One characteristic of Japan is more focus on favorable treatment by allowing employees to do work they prefer, rather than through monetary or job post incentives.

South Korean and Chinese firms offer a number of positive incentives such as reflection of the performance evaluation in wages, distribution of company results, and promotions that skip ranks. This scheme means that motivation is provided in several forms, but there are also a number of negative incentives such as demotion of the lowest-ranking individuals, so in the end competition is encouraged overall.

V. Relationship between HR Management and Product Architecture of the Three Countries

So far we have compared personnel systems, their relationship with the external labor force, skill development, and remuneration by country. Next, we will look at the characteristics of overall HR management with these elements integrated, by country. We will also consider the relationship with those characteristics and product architecture. A summary of the product architecture for the nine companies and HR management is given in Table 7.

TABLE 7. SUMMARY OF HUMAN RESOURCE MANAGEMENT FOR NINE COMPANIES

	Japan	Korea	China
Mobile phone	JA (Mean age: 39)	KA (Mean age: 30)	CA (Mean age: 28)
Architecture	Integral	Separate use	Modular
Personnel system	Ability-based grade system	Similar to ability-based grade systems but contains job groups	Job grade system
External labor market	Low mobility	Moderate mobility	Moderate mobility
Development of abilities	Long-term training	Long-term training	Long-term training and hiring
Incentive	Long-term incentive	Medium-term incentive	Short-term incentive
LCD TV	JB (Mean age: 39.8)	KB (Mean age: 34.2)	CB (Mean age : -)
Architecture	Integral	Separate use	Modular
Personnel system	Ability-based grade system	Similar to ability-based grade systems but contains job groups	Job grade system
External labor market	Low mobility	Moderate mobility	High mobility
Development of abilities	Long-term training	Long-term training and hiring	Long-term training and hiring
Incentive	Long-term incentive	Medium-term incentive	Short-term incentive
Information system	JC (Mean age: 35.7)	KC (Mean age: 35)	CC (Mean age: 27.2)
Architecture	Integral	Modular	Modular
Personnel system	Ability-based grade system	Similar to ability-based grade systems but contains job groups	Job grade system
External labor market	Low mobility	Moderate mobility	High mobility
Development of abilities	Long-term training	Long-term training	Long-term training and hiring
Incentive	Long-term incentive	Medium-term incentive	Short-term incentive

Note: The sign “-” denotes that information was unavailable.

Source: Analysis and modeling by author

1. Japan

First, in Japan, ability-based grading systems are implemented company-wide, there is no favorable treatment for engineers, and specialist systems are not widespread. The relationship with the external labor market is also weak so forces are working to maintain the order of the company as a whole. The reflection of results is also very low. On the one hand, we can see that there is far less focus on monetary motivation for engineers compared to South Korea and China. On the other hand, since there is no system of dismissing lowest-ranked employees, while engineers can feel secure in their work, there is a problem in that there is inappropriate treatment for high performers.

From the various perspectives depending on product, while companies JA and JB employ pay-for-performance-type systems, overall the systems are ability-based grading systems with some minor changes.

When it comes to product architecture, Japanese employees use a mostly integral architecture for all target products in our interview.

The belief until now has been that engineers would be motivated intrinsically by the joy of

development. However, in recent years, thanks to advanced research, we now understand that engineers are aware of extrinsic motivation, especially monetary rewards (Nakata, 2009). In recent years South Korean corporations have suddenly started to implement merit systems and pay-for-performance and, while they have slightly more experience in personnel training and skill-based management compared to Chinese corporations, their rigidly favoring of long-term incentives is deeply concerning. There is need for further exploration through research of engineer awareness.

2. Korea

Next, let us take a look at South Korean firms. While ability-based grading systems and long-term perspective of internal training are maintained, there are also ample positive incentives through favorable treatment of engineers and pay-for-performance-type remuneration and on the other side of the coin, negative incentives such as the system of eliminating the lowest ranked engineers in performance assessments. Furthermore, since the example corporations we used were leaders in the technological advances in South Korea, they also had personnel training systems in place. Also, they were creating a competitive environment by setting up points with the external labor market.

Regarding product architecture, on the one hand, South Korean corporations use integral architecture for high-spec models of mobile phones and LCD TVs, and modular architecture for items with general specs. On the other hand, it is modular in the information systems line. While nearly all Japanese product architecture is integral, and nearly all Chinese product architecture is modular, South Korea utilizes each type of architecture effectively. It is possible that this combination of flexibility, long-term, and short-term incentives, reward, and punishment incentives in this type of architecture creates a balanced HR management, resulting in higher performance. The pursuit of technological ability and HR management catch-up likely leads to higher performance, too. However, for this competitive method of HR management, it is necessary to investigate and explore the awareness of engineers themselves going forward.

3. China

Next, the personnel systems of Chinese companies are often job grading systems that allow for the favorable treatment of engineers. While the labor market is defined as having a low average age and high liquidity, training is conducted for the internal labor market format with an eye on skill accumulation. However, there are concerns regarding training for the product manager class and as a supplement for this situation. Indeed, many employees that skip ranks during promotions and product managers who have a marketing background.

Incentives are of the short term, and while skipping ranks and the amount of individual incentives are high, there are also demotions and the lowest-ranking employees are let go, so the environment is competitive. According to the view, "Both the company and the engineers are only thinking of careers in three-year spans" (company CB), both incentives and training are extremely short-term.

The entire process related to product architecture is modular for all products and it is possible that the modular method was the only option due to resource issues rather than modular being selected strategically. There may be some consistency with short-term incentives

involving high liquidity, but there is a weakness in that only modular product strategies are possible. The key is how to develop talent going forward.

4. Summary

Here, we can examine the two extremes of Japan, where product architecture is integral and firms are gradually straying from the seniority systems, testing out ability-based grading system revisions, and China, where the product architecture is modular, coupled with a job grading system and short-term results are demanded. In contrast, South Korea also maintains flexibility in terms of architecture, and we can observe that HR management includes a combination of compensation for both long-term training and short-term results. We do not know whether this is intentionally done by individual companies; however, it is certainly not a coincidence that there is an increase in profit that seems to be tied to expanded share based on these efforts.

VI. Conclusion

Finally, let us review the four Marsden types again, considering where South Korea and China lie in that model.

First, Japan, which is often the polar opposite of China, is generally a job grading system, wherein a work-post rule is likely. Wage payments are based on duties; performance is evaluated and reflected in raises and promotions. There are also examples where America's hay system has been implemented, which are clearly reflected in the "work-post rule."

How about South Korean firms? The influence of Japan's ability-based grading system is also strong and since job definition is not tied to wages, it is considered to use a competence-rank rule. However, in South Korea's case, it is worth noting that even with such rules, favorable treatment is implemented for engineers depending on the job group, the seniority elements are minimized and incentives such as pay-for-performance are used. This situation could be called a hybrid between a "competence-rank rule" and a "work-post rule."

According to the Marsden model, a "competence-rank rule" requires that a job definition be vague and thus draw-out team cooperation, so an element of additional incentives must be ensured, too. The point here is that neither Japanese nor South Korean companies have eliminated the long-term element. Taking this fact into consideration, this method is one way that the "competence-rank rule" characteristic of Japanese and South Korean corporations may incorporate pay-for-performance elements. And it happens on a grander scale in South Korea than in Japan.

As previously mentioned, Marsden states that in transitioning from one social rule to another there is a risk of the scheme becoming unstable. However, he mentions that it is possible if there is a system and conditions to supplement such a transition. While South Korean corporations implement competence-rank rules and incorporate an element of work-post rules, the competitive and dynamic external labor market may be what complements them.

If Japanese firms merely maintain their internal corporate system (without allowing for much difference in it) and its social order (favoring long-term employment and not implementing systems in which its lowest scoring employees are let go), then it may hinder their ability to

survive in the globalized competitive market. There are many elements of the tests that both South Korean and Chinese firms have gone through for Japan to use as a future reference.

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