Modularization of Work and Skills Evaluations: Two Cases of IT Companies

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In recent years, the IT industry is considered to be undergoing work standardization towards open and modular structures that are tailored for mobile workers and outsourcing. We conjecture that in this industry, companies may be transforming themselves to achieve industry standards with regard to required employee skills and evaluation criteria for these. Bearing this hypothesis in mind, we conducted case studies of two IT companies and looked in detail at the state of the modularization of work and skills evaluations. As a result of this research, we have found that the standardization of skills evaluation has progressed to a significant extent, but that the modularization of work is proving difficult in some areas, depending on the attributes of the job, and that some companies are clearly choosing not to restructure jobs towards a modular design in certain areas. We conclude that these companies are strategically custom-designing work processes and skills evaluation in order to differentiate themselves from others.

I. Introduction

In product architecture theory, "work" is a cluster of interdependent tasks which is also embedded in the system of interdependent "works." "Modularization" is one of the main principles defined (by Aoki [2002]) as "dividing a complex system or process[1] based on pre-specified connection rules into semi-autonomous subsystems that can be independently designed." Fujimoto (2001) defines "openization"[2]—another main principle—as the industry standardization of an interface between two subsystems across corporate boundaries.

[1] In a complex system, there is a high level of interdependence among the components that make up that system; system complexity is a state in which any changes to the parameters that define the system will necessitate a significant amount of changes in other parameters (Aoshima and Takeishi 2001, 34).

[2] More specifically, there are two sub-types of product modularization: *closed modular architecture*, in which the interface connecting the modules is firm-specific, or "closed" within a single company, and *open modular architecture*, in which, conversely, the interface among modules becomes an industry standard and is able to connect beyond the level of a single company. "Openization" is used in this paper to mean that the interface among components in a product is transitioning towards an open architecture.

The reasons behind modularization are as follows: among other things, (i) modularity increases the range of "manageable" complexity, (ii) modularity allows different parts of a large design to be worked on concurrently (iii) modularity accommodates uncertainty (Baldwin and Clark 2000, 90-92).

An important complementary principle within modularization is the fact that there should be interdependence within and independence across the module. In other words, a module is a unit whose structural elements are powerfully connected among themselves and relatively weakly connected to elements in other units. There are clear degrees of connection, thus there are gradations of modularity. To put it another way, modules are units in a large system that are structurally independent of one another, but work together. The system as a whole must therefore provide a framework—an architecture—that allows for both independence of structure and integration of function (Baldwin and Clark 2000, 63).

Architecture is defined as the basic concept behind the design of both modularizing and interfacing the subsystems that make up complex systems (Ulrich 1995; Baldwin and Clark 2000; Aoshima and Takeishi 2001). Henderson and Clark (1990) defined product architecture as "the method of integrating the individual structural elements of a product into a system," and indicated the importance of innovation in line with changes in product architecture in maintaining corporate competitiveness. In addition, research by Ulrich (1995), which played an important role in the creation of basic frameworks for the debate over product architecture, focused on the efficiency of product development according to the degrees in interface between functions and structures, and defined an opposing concept to modular type, in the form of integral type. Ulrich described the attributes of each type of product architecture, as well as frameworks for organizations and functions that applied to these.[3]

Fujimoto (2001, 2003, 2004, 2005) theorized that the categorization of system product architecture requires functional design (dividing overall system function into sub-functions, and establishing target criteria) and structural design (establishing interfaces related to the integration of functions or components, and designing the system as a whole), and developed product architecture theory from the perspectives of integrating function and structure, and integrating components. In other words, there is a distinction determined, firstly, by whether the functions and components exist in an overall relationship to one another (*integral type*) or whether they are individually connected (*modular type*), and secondly, by whether the interfaces of components are unique to a specific company (*closed type*), or standardized to the industry (*open type*). For example, automobiles and small household electronics tend to be *closed/integral* type, while multipurpose computers and industrial machinery are *closed/modular* type, and bicycles and internet products are

[3] According to Ulrich (1995, 420), "the architecture of the product is the scheme by which the function of the product is allocated to physical components, which is defined more precisely as : (i) the arrangement of *functional elements*; (ii) the mapping from *functional elements to physical components*; (iii) the specification of the *interfaces* among interacting physical components."

open/modular type.

Product architecture theory can be applied to organizational architecture design. Furthermore, there is a tendency to equate product architecture and organizational architecture (Baldwin and Clark 2000; Fujimoto, Takeishi, and Aoshima 2001). Organizational architecture determines corporate activities, the division of these activities into tasks for which responsibility is taken by individual members of staff, and the organizational structure that enables the implementation of coordination between such tasks (Taniguchi 2006), and an affinity between product architecture and organizational architecture will determine the competitive advantage of the company. As a result, the complementary between product and organizational architecture can be extrapolated into an explanatory principle of comparative industrial superiority. In other words, in comparison with the United States in the 1990s, where economic growth was based on digital goods, new financial instruments and other open/modular type goods, Japan maintained its competitiveness through integral-type products such as automobiles and precision instruments. The fact that individual countries have differing competitive industries can be explained by the fact that each country's organizational architecture is impacted by its initial conditions and history of development, which eventually makes a uneven distribution towards countries with specific types of organization (Aoki 2001; Fujimoto 2001).

In light of these previous studies, notably in consideration of the relationship between product architecture and organizational architecture, in this paper, we consider to what extent skills evaluation criteria have been elaborated and standardized by IT companies from the perspective of their relationship to the *openization* and *modularization* (referred to as O/M, below) of work. Furthermore, we consider the actual state and the logic behind whether the standardization of skills is taking place at the individual company level or at the industry level. Our study focused on two IT companies, one, a U.S. company's subsidiary in Japan, and the second, a Japanese company, as case studies.

If we rely on product architecture theory, the "modularization of work" could be defined as "partitioning" (von Hippel 1990) a set of related tasks to a specified member of the organization, out of the overall, complex system that makes up the organization. Excessive segmentation of work, however, results in additional costs at the point at which each part has to be coordinated to the whole once again. As a result, when modularizing work, the specification and interface (coordination) relating to the work (set of tasks) allocated (partitioned) to each member of the organization needs to be determined in advance of, not subsequent to, the partitioning, and the organization must aim for optimized design in order to achieve standardization and facilitate intensification wherever possible.

In short, product architecture theory indicates that if a product architecture shifts to open modular type, it is reasonable to shift to the modularization of work (highly standardized, allowing work to be completed independently without a significant need for coordination with other areas) and openization of work (industry standard) according to that. The IT industry is well suited to American companies, which have the superior ability to con-

ceive an entire system in advance, create rules, establish industry standards for interfaces, implement mergers and acquisitions freely, and expand business at high speed. The ability to do this is complementary to working in an open/modular style (Fujimoto, Takeishi, and Aoshima 2001). On the other hand, typical large Japanese companies, which have maintained high levels of competitiveness through operating in a closed/integral style of organizational architecture, are likely to face the need to implement O/M in their work in order to engage with the IT industry (where open/modular style is advantageous).

Despite this, we must not ignore the emphasis of the strategic theory of the "resource-based view," which states that a company's sustained competitiveness lies ultimately in its "rarity value," which is difficult to imitate and transfer for other companies (Barney 1991, 2001; Peteraf 1993). Put another way, differentiating oneself from other companies by creating firm-specific and unique resources is a way to obtain a sustainable competitive advantage. From this perspective, the industry standardization of a company's core competence (Prahalad and Hamel 1990) along with the substance of its human resources, who are responsible for realizing this competence, may in fact result in self-imposed damage to its organizational abilities. If so, what sort of adjustments are being made to internal organizational structures by IT companies in the face of these changes and issues? This paper is based mainly on this simple question, and on the detailed considerations of how the IT industry conceives its "work architecture," the essence of its work, and the evaluation of skills.

II. Work Architecture

Within the IT industry, where the product architecture type leans strongly towards being open and modular, it is thought that the work of the project teams follows a similar style. Whether an individual product is modular or integral, however, differs depending on what level of component it is,[4] and if we examine the various jobs that are undertaken within a corporate organization at a more detailed level, it becomes possible to categorize them according to their attributes in line with architecture theory. If we apply product architecture categorization to work within an organization, and conceive of a "work architecture" for IT companies, it is possible to create an image of four types of work, as shown in Figure 1, and the type of skills required for each (here, we refer to these as "knowledge types").

The horizontal axis of the diagram is designed to identify whether work is "highly independent" (modular) or "highly dependent on other processes" (integral). People working in the former type of job tend to be engaged in completing single, highly independent

[4] For example, the microprocessors contained in Intel computers cannot be divided into open modules, despite the fact that other components of the computers are all open type (Fujimoto 2001).

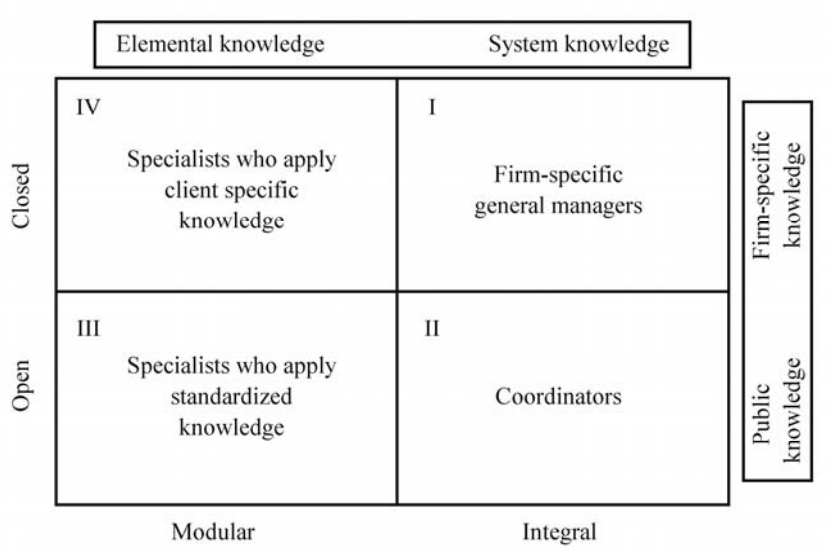


Figure 1. Work Architecture and Knowledge Types

components within the system design process, using a high level of "elemental knowledge."[5] People working in the latter type tend to be engaged in the design of systems, using carefully integrated specialist's elemental knowledge, and are required to have "system knowledge" (Aoshima and Nobeoka 1997) or "structural/architectural knowledge" (Matusik and Hill 1998).

The vertical axis identifies whether the project implementation process is "industry standard" (open) or "unique to the company" (closed). People in positions identified as the former are specialists who are masters of "public knowledge"[6] (Matusik and Hill 1988) within industry standardized best practices. People in positions identified as the latter are well versed in "firm-specific knowledge" (routines, work processes, human resources and organizational knowledge, and culture unique to the company) that is embedded in either their company or their client companies. Such people are most likely required to customize components through a close collaboration of processes with their client companies. Firm-specific knowledge is dependent on the history of the company, and is built up over

[5] Aoshima and Nobeoka (1997) described two types of knowledge that are required for product development. One is knowledge related to the development of the elemental and component technologies that constitute the product system, and this is necessary for developing high-level sub-systems. The other is knowledge related to the overall structure of the product system, and this is necessary for determining the relationships among the components and for compiling a system that has product integrity. The first of these types of knowledge is called "element knowledge" and the second is called "system knowledge."

[6] Public knowledge is not unique to any one company. It resides in the external environment and is, in essence, a public good. Public knowledge includes such items as industry and occupational best practices. (Mastusik and Hill 1988, 683)

time within the organization and individuals, through experience with various projects that take place. It therefore also possesses the attribute of being "process knowledge" (Aoshima and Nobeoka 1997).

Project Managers (referred to as "PMs" below) are categorized into the first quadrant (closed/integral type), as "firm-specific general managers." Firm-specific general managers here are as defined by Hirano (2006, 18), as people who have what are referred to as "firm-specific general skills," in addition to their own expert techniques for skillfully processing designated tasks. These comprise "contextual skills" (skills that have been learned and stored up in specific contexts applicable to the company in question), "integrative skills" (knowledge related to the operations peripheral to a specific job) and also "malleable skills" (general problem-solving, communications skills, and flexibility).

PMs, who are categorized in the first quadrant, are required to provide a significant amount of understanding of, and coordination with, the unique aspects of both the work of their project members and of their client companies, and need therefore to have both system knowledge and firm-specific knowledge.

The second quadrant (open/integral type) describes projects that are dependent on industry standards for their implementation processes, but which involve the integration of the sub-systems or components. Workers in this quadrant therefore need system knowledge and public knowledge in order to function. For now, we will refer to workers in this quadrant as "coordinators."

System engineers (referred to as "SE" below), who are often known as IT specialists, are required to have high levels of specialization, based on elemental knowledge that has been modularized and standardized within the work process. This type of work is open, and can therefore be categorized into the third quadrant (open/modular type). However, there is another type of SE who engaged in the design of systems highly customized to specific industries or clients by using firm-specific knowledge. This means the processes they use at work are closed. Work involving this type of staff can be classified into the fourth quadrant (closed/modular).

In this way, even in the IT industry, where product architecture is open/modular, there can be a variety of work within a project. For this reason, while it is common to refer to the IT industry as highly opened and modularized in its work, and if we look deeper inside the organization at how each piece of work is carried out, it is clear that while some work has implemented O/M, there is also some work where that is not the case. Specifically, work contained in quadrant 3 has undergone high levels of O/M, and in accordance with this, skills evaluation is sophisticated and standardized. On the other hand, there are some areas in which it is extremely difficult to implement O/M, where work is closed and integral. In light of these points, we established the following two specific research questions (RQ).

(RQ1) Within the IT industry, is there a difference in the extent of work O/M depending on the attributes of the job? Does the industry feature some areas in which work O/M is possible and some in which it is not?

(RQ2) Within the IT industry, what sort of the relationship exists between work O/M and the sophistication and standardization of skills evaluation?

III. Trends in Modularization of Work and Sophistication/Standardization of Skills Evaluation Criteria in IT Companies

1. Outline of Research

The answers to the RQs are clarified by describing trends in work O/M and skills evaluation in IT companies, through multiple descriptive case studies achieved via interviews with the people responsible for designing human resources systems and specialist technicians. The reason for using this method was that there had been, to date, little research that had focused in detail on work O/M from the perspective of work architecture, and as such it was considered that an initial observation of the state of work, without setting a fixed prior hypothesis, and subsequent detailed compilation of points arising from such observation, would be the most appropriate method of clarifying the RQs in relation to the IT industry, which was thought to be ahead of other industries in the implementation of work O/M.

The companies where research was carried out were Systems Company A, a U.S. company's subsidiary in Japan, and Software Company J, a Japanese company. Interviews were carried out with the two members of staff responsible for human resources (May 2008) and a PM in the Systems Development Service Division (April 2008) in Systems Company A, and with the director of the Training Center (April 2008) of Software Company J and the sales manager of Company J, which is the parent company of the group to which Software Company J belongs (March 2011). The reason that the two companies were selected was that the evaluation system used by Systems Company A has become the basis for ITSS (IT Skills Standard), which is now making its way throughout both public and private sectors as the standard for cross-sector corporate skills evaluation within the IT industry.

The Ministry of Economy, Trade and Industry (METI) heads up ITSS, which has clarified and systemized the skills required for the provision of various types of IT and related services. ITSS has been developed with the objective of creating skills standards that will equate to industry criteria over and above the framework of individual companies, in order to deliver a yardstick (set of common parameters) that is useful in the education and training of IT service professionals in both industry and academia. Version 1.1 was published in December 2002, and Version 3 (the most recent version) in March 2008.[7]

The ITSS skills criteria creation approach involves an elemental breakdown of the skills required to deliver each type of IT service, and the organization of these from the perspectives of whether they are objectively observable, and whether they can be utilized in

[7] From Ver. 3 onwards, an information processing technicians' examination has been used in regard to evaluation levels 1-3 within each specialization, in order to ensure increased objectivity and sophistication within evaluations.

education and training. More specifically, (i) IT services are classified according to type of occupation/area of specialization, (ii) for each type of occupation/area of specialization, "attainment level indicators" are defined, describing experience and results, as objectively observable indicators, (iii) the skills required for each type of occupation/area of specialization are organized into "skill categories," which are broken down into elements from the perspective of utilization in education and training, and "skill maturity levels," which indicate the level of maturity attained for each skill category, and the required "knowledge categories" are developed, and (iv) in addition to the above, a "skills framework" is created as a means of providing an overview of the whole.

Software Company J was one of the earliest to adopt the ITSS in its human resources evaluations and reward systems.

Both companies, in other words, are considered suitable as the subjects of research in relation to the state of their work O/M and the standardization of their skills evaluation. In addition, observing both Systems Company A, which has its headquarters in the U.S., and Software Company J, which is based in Japan, is thought to provide an opportunity to test the commonly held theory that American IT companies are further ahead in the implementation of work O/M and the sophistication and standardization of their skills evaluation criteria than their Japanese counterparts (although this case studies are not a pure comparison of the two countries).

In line with the RQs, members of the two companies were interviewed based on the following three points: (i) what types of work exist within the IT company, (ii) how the companies standardize and make the evaluation of skills among the staff who undertake such work more sophisticated, and (iii) whether, at the same time, there are areas in which the sophistication and standardization of skills evaluation is not possible.

2. Design and Operation of Skills Development/Evaluation at Systems Company A

Systems Company A is a U.S. company's subsidiary in Japan, and comprises a computer-related hardware, software and service business. In Japan, the company achieved operating profits of 154 billion yen in fiscal 2007, and has a staff of 16,000. Since 1991, the company, along with its global group, has been implementing a "Professional Specialist System," and has been in the process of changing over to training and evaluation systems that are appropriate for its employees' specialized types of work. Furthermore, the company applies a multi-track career path for its line staff (section manager and above) and specialist employees. The human resources system is constantly being updated in order to respond swiftly to changes in the market. At present, the points regarding professional specialist systems within the company are as follows.

(i) The basic flow of a career path for a specialist staff member (up to directorship level) involves training, including OJT, subsequent to entering the company, leading to accreditation as a specialist in some field, and then additionally passing professional accreditation according to the Systems Company A global common

Table 1. Specialist Staff Titles and Relationship to Bands within Systems Company A

Band	Consultant	IT Specialist	IT Architect	Project Management	Learning	Sales (Solution Sales)	Project Executive
Entry	Graduate	Graduate			Graduate		
6	Consultant	Entry IT Specialist		Project Leader	Learning Specialist	Business Solution Sales Rep.	
7	Senior Consultant	Advisory IT Specialist	Associate IT Architect	Associate Project Manager	Advisory Learning Specialist	Advisory Business Solution Sales Rep.	
8	Managing Consultant	Senior IT Specialist	Advisory IT Architect	Advisory Project Manager	Senior Learning Specialist	Senior Business Solution Professional	Advisory Services Program Manager
9	Senior Managing Consultant	Consulting IT Specialist	Senior IT Architect	Senior Project Manager	Consulting Learning Specialist	Consulting Business Solution Professional	Senior Services Program Manager
10	Associate Partner	Senior Consulting IT Specialist	Executive IT Architect	Executive Project Manager	Senior Consulting Learning Specialist	Senior Consulting Business Solution Professional	Executive Services Program Manager
Executive	Partner	Distin-guished Engineer	Distin-guished Engineer	Delivery Executive (Director)	Partner/ Delivery Executive (Director)	Sales Executive (Director)	Delivery Executive (Director)

Source: Systems Company A, company documents.

accreditation system.

(ii) Five bands (levels) are defined for each professional occupation, and employees can rise through the bands through self-assessment (requiring the approval of their superiors or other assessors) of their skills, based on the company's global, commonly defined skills assessment criteria ("skills dictionary"), along with attainment levels (results evaluation) for each project they are involved in. A combination of these two assessments results in approval for promotion (see Table 1).

(iii) In addition to this, since around 2003, in some departments, human resources training and assessment has been implemented using skills evaluation criteria known as Professional Development Frameworks (PDF). Categories assessed using PDFs include "Core Capabilities," which are required of all specialist staff, "Dimension Capabilities," which are required in order to produce excellent results

in specialized fields, and "Functional Skills," which include knowledge and specialized techniques related to solutions, industries and products, and which are required in order to solve individual issues posed by clients. A staff member's PDF Overall Level is determined through a combination of Core Capabilities and Dimension Capabilities.[8]

Skills evaluation criteria have been created for staff in sales, but compared with those for other occupations, their skills evaluations are less sophisticated and standardized since there are many skills that are more complicated and difficult to quantify.

The most unique aspect of the training and evaluation of specialists within this company is the PD (Personal Development) Tool, which allows staff to self-assess their own specialized knowledge and skills, and based on this, to create an IDP (Individual Development Plan). Information from this is recorded on the individual career information database within the company, known as the "Professional Marketplace," allowing staff to make regular updates along with developments in their own work experience. Put simply, the company encourages its staff to both manage their own careers and train themselves. What is particularly interesting about this is the fact that, as seen by the name "Professional Marketplace," this database functions as an internal procurement venue, in other words an "internal spot market" (Williamson 1985, chap. 10).

3. Design and Operation of Skills Development/Evaluation at Software Company J

Software Company J was incorporated after the software business was split off from the information processing department of a major Japanese computer manufacturer. It has operating profits of 7.41 billion yen (fiscal 2007), and approximately 6,000 employees. The company introduced its human resources system, which was based on a job grading system for each job description, but subsequently, in 2004, it introduced a human resources system based on the new job descriptions, in line with METI's ITSS. The main features of the company's system are (i) its level structure and occupational categories are the same as those in ITSS (11 occupations, 7 levels), and (ii) it features additional evaluation elements for specialist employees with regard to elements other than their IT skills (in contrast to ITSS, which only relates to IT skills). More specifically, in addition to the "attainment target index" and "skill maturity level," which are indexes used for evaluation within ITSS, rank-and-file employees (level 4 or below) are evaluated against "behavior criteria," while management employees (level 5 or above) are evaluated in "other important issues," giving some additional evaluation elements that are unique to the company (Figure 2). Furthermore, as with Systems Company A, the company uses a multi-track career path for both line and specialist staff (of Department Manager class and above).

[8] In order, for example, for a staff member to be assessed as PDF Overall Level 4, he or she is required to be "Experienced" in all three categories of Core Capabilities, and to have reached the highest level (Level 4) in at least one of the categories of Dimension Capabilities. Reaching PDF Overall Level 4 is a precondition for promotion to Band 8.

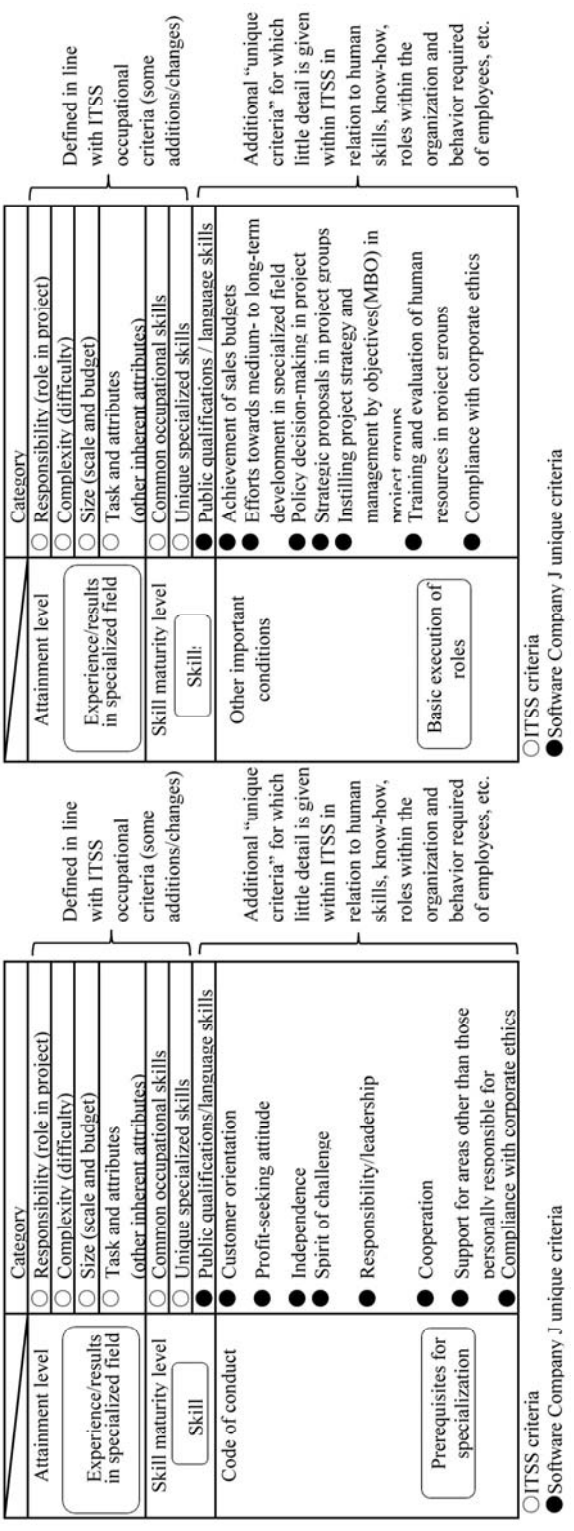


Figure 2. Job Requirement Forms Used at Software Company J

Source: Software Company J materials, interpretation by the authors.

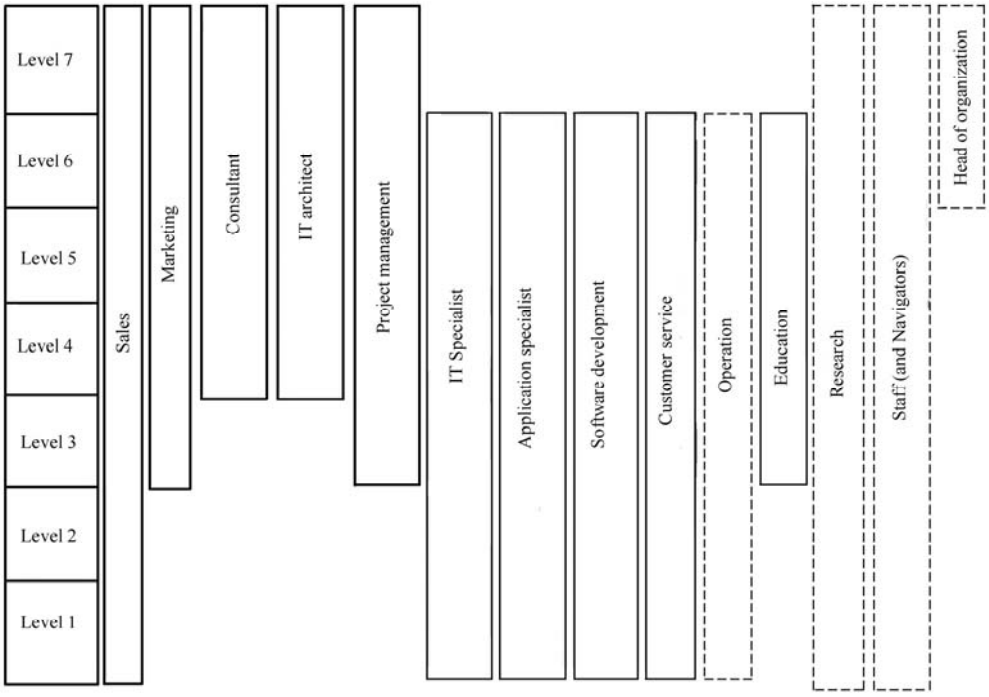
In addition to this, not only does the system feature additional categories not contained in ITSS, it also features some areas where changes or additions have been made to categories contained in ITSS, in line with the particular circumstances of the company. These, specifically, are as follows.

(i) Adjustments have been made to the ITSS category of "size" (scale of human resources, and budget) within each individual department. In other words, each project is not evaluated by an absolute value in regard to scale of human resources and budget. Within ITSS, "size" is taken as having a high degree of corroboration to "complexity" and "responsibility," and in principle, since the larger a project becomes, the greater its complexity and responsibility in terms of coordination of technical ability and project execution, it is considered that staff handling such projects will require extremely high-level skills. However, there is not necessarily a linear link between "size," "complexity" and "responsibility." Two projects that have the same budget, for example, may have differing degrees of complexity depending on whether a project is a new one or an ongoing one, while the issue of whether the project is supplying the public or private sector also has an impact. Based on reasons such as this, it is considered that regulating for skills levels based only on the scale of human resources involved and the budget may not allow for an accurate assessment of the project's value or complexity.

(ii) Evaluation categories have been added to the skills attainment category to assess skills that utilize process knowledge within "Skills in the specialized field" (for example, highly specialized knowledge related to the SCM (Supply Chain Management) of a certain convenience store company, or unique risk management skills for building large-scale IT systems for the financial industry. These are not included in ITSS.

(iii) ITSS does not contain evaluation categories for quality control, so a "navigator" is appointed to coordinate project quality control across each entire project (the "navigator" must have experience as a PM and be of level 4 or above) (see Figure 3).

To summarize the above, in addition to the evaluation of IT skills at Software Company J, elements relating to other aspects, such as attitude to clients, cooperation and profit management, which are not included in ITSS, are evaluated under the additional categories of "Code of conduct" and "Other important conditions." This indicates that Company J is aware of the value of skills required for the actual execution of work, despite the fact that these are not part of ITSS. Furthermore, categories relating to coordination skills—such as those required for a quality control navigator—are not part of ITSS, and as such evaluation criteria have not been defined for these areas.



Source: Software Company J materials, interpretation by the authors.
Notes: 1. Occupation titles shown within the dotted lines are not defined within ITSS.
2. The occupation listed as "Operation" is defined within ITSS as one specialist area within "IT Service Management."

Figure 3. Job Titles and Relationship to Level within Software Company J

IV. Discussion

1. Similarities between the Two Companies

When looking at trends in the modularization of work and the sophistication of skills evaluation, there is a similarity between these two companies. That is, there is a difference in the level of standardization applied to skills evaluation, depending on the type of occupation.

In Systems Company A, skills standards are applied to the entire corporate group and have been defined for each specialized occupation type based on the occupation structure. Furthermore, within the company, skills evaluations are done based on self-assessment, which requires a high level of skills evaluation standardization, as well as the compilation of a "skills dictionary" in order to make the system function. At the same time, however, it is acknowledged that applying sophisticated and highly standardized systems for evaluating

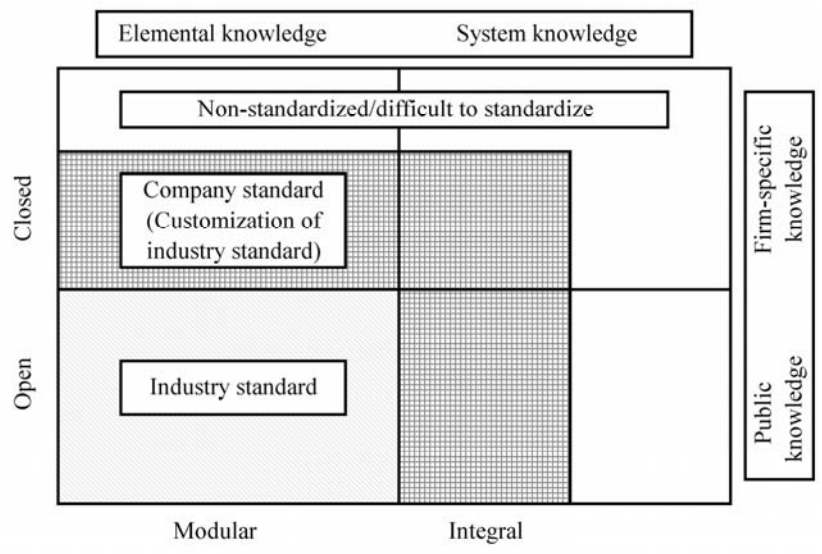


Figure 4. Image Showing the Extent of Standardization of Skills Evaluation

skills among specialist sales staff is more difficult than for other occupations, since they are required to interact with customers to a greater extent. In addition, IT architects, for example, who are in an IT technical occupation, are divided into general "IT Architects" and "Client IT Architects," who are required to be well-versed in the needs of one or more designated (particular) clients. This categorization hangs on the key term "degree of connection with the client," and it is thought that the degree of interface with the client is a factor that prescribes the extent to which skills evaluation can be standardized.

At Software Company J, the industry standard skills evaluation index ITSS has been applied as the basis for evaluation, but has been uniquely customized through the adoption of skills evaluation indexes that have been devised to fit the organization and work types engaged in by the company. In other words, the skills required at work are seen to be not only those to which industry standards can be applied (open), but also those that ought to be company standards (industry standards customized to the company), and so the level to which skills evaluations can be standardized differs.

In both of these two companies, issues related to client contact and the coordination and integration of work tend to be recognized as difficult targets for the standardization of skills evaluations. Stated in terms of the framework of this paper, in other words, the more the work is closed or integral in type, the more difficult it will be to modularize or standardize the evaluation of related skills (see Figure 4).

2. Differences between the Two Companies

On the other hand, some notable differences were observed between Systems Company A and Software Company J. Table 2 gives a simplified overview of these differences.

Table 2. Differences between the Two Companies in Terms of Work O/M and Standardization of Skills Evaluations

	Systems Company A	Software Company J
Skills evaluation standards	Company standards (PD tool)	Industry standard (ITSS) + Customization that fits the company
Method of evaluation	Self-assessment	Assessment by superiors based on self-written report
Settlement/Internal transfer of staff	Internal spot market	Placement/Rotation designed by Human Resources Department
Separation of career ladder for line and specialist staff	Section Manager and above	Department Manager and above

Both companies operate multi-track career ladders for both line and specialist staff, and while criteria have been established for specialized skills evaluations, significant differences are observed in their methods of evaluating their staff, as well as the handling of the placement and internal transfer of staff. At this point, we will consider these differences in more detail, and attempt to clarify a theory of why they may have occurred.

At Systems Company A, as seen earlier, a human resources database known as the "Professional Marketplace" is used as a venue for internal procurement of staff. This system means that in addition to the conventional vertical organizational structure of staffing, it is possible for any project to recruit or search for the most suitable staff members on a company-wide basis, without being restricted by the frameworks of the existing organizational unit. It therefore plays the role of an internal spot market. If, for example, there is a need to assign a project specialist with thorough knowledge of networks to the building of a financial system, but there is no appropriate staff member in the department concerned, the manager of the department responsible for financial systems can recruit a network specialist via the Professional Marketplace. The required skills, band level and experience, etc. are published as part of the recruitment information, allowing staff members to apply for the job. The manager can refer to the information on these applicants registered in the Professional Marketplace and procure the most appropriate staff member from among multiple candidates. According to the interviews, a certain proportion of project team members are currently procured using the Professional Marketplace, and the manager of Systems Company A's human resources department indicated an intention to develop the system so that this proportion can increase further in the future. Under this system, the human resources department does not, in principle, get involved in the process of staff procurement, acting only as an intermediary if a problem occurs (if, for example, a member of staff is subject to a dispute between two departments).

At Software Company J, on the other hand, there is no similar system in place, and

staff members are allocated to projects in more conventional organizational units. Of course, in some cases the need may arise for staff to be moved to another department, and in such cases the organizations involved coordinate between themselves.

These differences in the practice of placing and transferring staff within the two companies also give rise to differences in employees' careers, and in the role played by the human resources departments. We already mentioned the fact that both companies have multi-track career ladders in place for both line and specialist staff, but whereas Systems Company A implements a multi-track system for line and specialist staff at the section manager level and above, Software Company J only clearly categorizes staff as specialists once they are in charge of an area, from the department manager level. In other words, since Systems Company A has a clearer definition of the difference between line and specialist staff, staff members have fewer opportunities to broaden their careers, and they tend to have a higher incentive to improve their specialist skills in one occupational area compared to Software Company J. In addition, Systems Company A operates the Professional Marketplace. This means that specialist staff members are required to demonstrate employability in order to ensure that they are recruited within the internal spot market, and therefore the system makes the specialists develop their careers by self assessment and deepen their specialties in relatively narrow occupational fields. On the other hand, Software Company J implements more conventional internal human resources management, and as a result it is important for them to ensure that staff deployment is done in a way that is flexible with regard to the environment, in order to remain competitive. In other words, since there is a significant need for the company to take the lead in optimizing the organization overall, while it is of course important for staff members to improve their specialist skills, it is also important to promote the formation of broad career paths through rotations, which facilitate the flexible deployment of human resources. This means that the human resources department at Company J is involved in the placement and internal transfer of staff to a greater extent than it is in Systems Company A.

A particular sign of this is seen in the difference in PMs' career paths between the two companies. According to interviews, many staff that reached PM status in Software Company J had experienced a range of other specialist occupations beforehand. This shows the thinking that a certain amount of career breadth is a prerequisite for undertaking the role of PM in this company. This reflects an awareness that a PM requires, to a certain extent, a similar level of skills to the level demanded of a line manager. According to the framework of this paper, these are jobs categorized in quadrant 1. In Systems Company A, the work undertaken by a PM is standardized to a great degree, and the main requirement is to coordinate the project in line with these standards, to as efficient a degree as possible. According to the manager of System Company A's human resources department, "Considered from the perspectives of coordination and integration, this is indeed integral work, but the process is implemented on a highly openized basis." For this reason, PMs in Company A are categorized in quadrant 2. Furthermore, Company A's human resources manager stated that "PMs

are not, in principle, involved in interactions with customers in Systems Company A, so standardizing a PM's work is not the toughest issue. It is much harder to standardize the very specialized skills required of sales and consulting staff, who have high levels of interaction with customers." However, there was a slightly different perspective from an incumbent PM at this company, who stated, "It is true that PM work has been standardized to an extremely high level, but we often find that that type of standardized management methods do not in fact fit actual individual projects, or that things do not function exactly according to the standards. Furthermore, even if we work according to standardized methods, there are cases where these do not fulfill the preconditions of our clients for service provision, or where our clients cannot fulfill the roles the standards expect of them. PMs are often assigned to client sites, and we struggle to work out how to bridge those gaps" (Systems Company A Systems Development Service Division PM). This opinion, from a PM who actually does interact with the clients, further indicates the difficulties in implementing standardization in areas that involve interaction with clients, despite the progress of standardization that has been made in management techniques and other areas.

As can be seen from the points above, in Systems Company A, the efficient utilization of the Marketplace—in other words, the efficient procurement of staff—is a priority issue, and significant levels of sophistication in skills evaluation criteria will be required to achieve this. On the other hand, Software Company J implements conventional internal human resources activities that are common to typical Japanese companies, but at the same time, it is engaging in the further elaboration of its skills evaluation criteria as a way to efficiently train and evaluate its specialist staff.

The difference in the construction of skills evaluations systems in these two companies can be inferred as coming not only from their policies and practices of placement and internal transfer of employees as described above, but also from the differences in customer segmentation and policies for client relations. Software Company J often manages its projects as a subcontractor of the parent company (Company J) in SI (System Integration) work, and a high proportion of the company's business is with government departments or Japanese communications carrier group companies.[9] Furthermore, since only about 25% of Group J's sales are overseas (as of 2009), the entire Group, including Software Company J, is largely dependent on the Japanese domestic market. According to a sales manager from Company J, "With the exception of certain occupations, Japanese business practices have not been standardized to the degree that this has been done in the U.S. and Europe, and this trend holds true for SI business in the government and public infrastructure sectors. Software Company J, which is in just this situation, and also heavily dependent on the Japanese domestic market, must increase the levels of customer satisfaction by implementing its work in a way that gives its clients and the industry the highly specific customization that is required." Furthermore, the sales manager from Company J often sees smaller and me-

[9] From Company J's Accounting Report for the fourth quarter, March 2009.

dium-sized clients on limited budgets often introduce packaged software systems and align their needs to those (non-customized) systems for small projects. However, Software Company J, which usually deals with relatively large companies in the public sector, has a relatively high proportion of clients that require very firm-specific customization in building their systems.

Company A, on the other hand, was incorporated in the U.S., and a large proportion of its group companies conduct business overseas. The Japanese market is big, but it is only one sector within the global market, and as such, there is likely to be a basic difference in Company A's SI business operating policies compared with Software Company J. It is Company A's policy that competitive efficiency should be achieved by implementing SI based on globally standardized trade practices, expecting clients to align with such systems to some extent. The points outlined above, however, are merely conjectural considerations based on the results of these case studies, and it will be necessary to continue to study both companies, as well as to obtain detailed results from studies and analyses of other companies, in order to establish exactly why this difference in the extent of work O/M and skills standardization has occurred in two companies.

Next, in regard to the standardization of skills evaluations, questions must be asked regarding why all work within a company cannot be evaluated using only an industry-standardized tool such as ITSS, and why companies consider it necessary to customize the tool to their own situations, as well as why companies are making a large amount of effort towards work O/M and skills evaluation standardization regardless of the possibility that there are areas where standardization cannot be easily made or where standardization is impossible (very closed work, very integral work, or both). Seen from another perspective, these areas of work can be considered their own unique corporate know-how (the possible resource for a competitive advantage). Why do they act in a way that might prejudice their own competitive advantage? The following can be inferred from this situation. The process of either applying industry standards for work or required skills, or customizing such standards to fit a particular company, involves reconfirming the areas of work to which O/M cannot be applied (the areas that give the company its competitive advantage). Then, they apply industry standards to all other work and required skills except for the above. Areas standardized in this way will be imitated and learned from by other companies, but if the company has been at the front lines of implementing standardization, then it will be able to differentiate itself further while other companies are merely imitating it, and engage in unique measures to strengthen its business resources. The manager of the human resources department at Systems Company A comments in regard to this, "Since technology and skills in our industry become obsolete in much faster cycles than those of other industries, we are in a situation in which it is vital to either create new standards before any other company does so, or to build de facto standards. We are in a repeating cycle in regard to this. Systems Company A is engaged in constant efforts to be the first to create standards of this sort."

V. Conclusions

In this paper, we analyzed case studies regarding work O/M and the sophistication and standardization of skills evaluations taking place in the IT industry, which is considered to be typical of an openized and modularized industry. The main purpose of these case studies was a comparison between a U.S. company's subsidiary in Japan, where work O/M is considered to be progressive, and a Japanese company, which is conventionally known for its closed-integral style work, and where the introduction of work O/M is said to be delayed. Our conclusions, gained from the case studies and observations of examples, are as follows, organized in response to the original RQs.

Based on the results of interviews, it is clear that the attributes of work within the IT industry can be explained by the work architecture described in the framework of this paper. In other words, work in the IT industry is mostly divided into modular-type work. Despite being divided into modules, work in those two companies still requires highly firm-specific knowledge, and integral-type work, in which a high degree of coordination and integration is required between modules. Work processes in the industry can be categorized as openized (industry standard) or closed (firm-specific). Closed areas include the work that requires high levels of interaction with clients and work that requires knowledge that is specific to that company.

Standardization of work O/M and skills evaluation in the IT industry are considered, at least from the results of these case studies, to have progressed to a significant level, with both companies indicating that they intend to develop them even further in the future. Explained in terms of the framework of this study, this means that areas categorized as open/modular-style work (quadrant 3) are expanding, while the standardization of skills evaluation is progressing to a significant degree. Industry standardization is progressing, as seen in the example of Software Company J, where open/modular type work and its evaluation are carried out using skills evaluation criteria such as ITSS. At the same time, however, both Systems Company A and Software Company J find that the areas of their work that demonstrate more integral and closed attributes have not been standardized by the companies (and even less so by the industry), and may even be difficult to standardize. This is indicated by the fact that Systems Company A notes the difficulty of providing company standards for the evaluation of skills held by sales staff, and that Software Company J has introduced its own customized version of standards for evaluating skills required for customer interaction and coordination, but also finds that there is a significant area of work for which evaluation cannot be implemented without coordination between different departments.

To summarize the above, findings from the comparative study of the two companies indicate that the extent of implementation of work O/M and standardization of skills evaluation differs from company to company. In Systems Company A, both work O/M and standardization of skills evaluation have progressed to a high level, and there is a strong inten-

tion to implement industry standardization of their work execution processes and skills evaluation. In contrast, while Software Company J also indicates the intention to switch to industry standards, there is a stronger emphasis towards the appropriate customization of industry standards for work execution processes and skills evaluation criteria so as to achieve customized standardization, and towards achieving a balance between standardization and the building of firm-specific and client-specific skills for areas to which standardization cannot be applied. The major factor that determines this difference is the human resources management system, and more particularly the system for the placement and internal transfer of staff. At Systems Company A, the emphasis is placed on the "optimal placement of human resources," while at Software Company J it is on "efficient development of human resources."

In other words, at Systems Company A, they have been building a system that functions as a quasi-occupational labor market, and skills assessment criteria have been defined in order to promote individual skills assessment, the development of employability, and career management. It is necessary to exclude firm-specific aspects unique to individual organizations or clients, and implement standardization as far as possible, in order to successfully utilize the staff procurement and deployment facilitated by this quasi-occupational labor market. This is because non-standardized individual skills information and information related to work execution processes belong within the individual or workplace. It would cost inordinate amounts of time and money for an individual line manager to collect such specific human resources information from each department in order to implement staff procurement or placement across the company as a whole. It is virtually impossible. If this were to happen, this sort of system would no longer function as a "marketplace." On the other hand, using the marketplace in order to deploy human resources, rather than a staff transfer plan led by the human resources department, requires an even greater degree of industry standardization in regard to individual skills and work execution processes, since these are the basis for staff placement. Furthermore, if the separation of career path ladders between specialists and line managers starts at an early stage as in the case of Systems Company A, it becomes easier to specify the skills demanded of specialist employees more particularly, and to implement work O/M and standardize skills evaluation.

In comparison with this, Software Company J has maintained a conventional career development system (periodic rotation designed by the human resource department). When this happens, in the formulation of skills evaluation standards, it is no problem for a certain amount of firm-specific content to be included in the designation of work processes and skills. It is needless to clarify so many skills to individual employees, since the human resource department will collect the firm-specific skills and work process information embedded in the individual workplace or employee for rotation.

The separation of career path ladders between specialist and line staff at Software Company J takes place relatively late—at department manager level or above—and since the human resources department implements rotation as one aspect of its training program,

even specialist staff are required to experience and gain skills in closed/integral work as part of their career development process to a higher degree than is the case at Systems Company A. Furthermore, at Software Company J, it is felt that a high level of firm-specific and client-specific skills are required for the execution of work, in line with to the customer segment. As a result, work and skills evaluation is not done to thorough industry standards, but rather, the emphasis is on maintaining a balance between the training and evaluation of specialist and line staff, and on the creation of standards that are customized to the organization from industry-standard skills evaluation, in line with the human resources management policy and the characteristics of the client.

However, it is clear that the standardization of skills evaluations is required in areas of work where O/M has progressed, no matter what purpose the effort of skills standardization is being made for, since technical skills swiftly become obsolete in the IT industry. At the same time, it is also vital to consider how to ensure that skills and work, which eventually turn into commodities (that are easy to imitate for other companies), should be uniquely customized and updated in order to build and maintain a competitive advantage in such a rapidly changing industry.

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