

Career Competencies and the Dual Ladder System for Corporate Researchers:ⁱ

the Case Studies of Nine Pharmaceutical Firms in Japan

April, 2008

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ⁱ *The research for this paper was supported, in part, by the research grant from the Promotion Fund for the Industrial Technology Research of the New Energy Development Organization, Japan.

ⁱⁱ This paper was presented at the 23rd EIASM Workshop on Strategic Human Resource Management, which was took place at the Hotel Kompas Bled, Bled, Slovenia, April 3-4, 2008. The contacting address about this paper is as follows. The contacting person is Professor Naoki Wakabayashi. His mailing address is the Graduate School of Economics, Kyoto University, Yoshida-Honmachi, Sakyo-ku, Kyoto City, 606-8501, Japan. The phone & fax number is +81-(0)75-753-3502. The E-mai address is wakaba@econ.kyoto-u.ac.jp.

Abstract

Career development for corporate researchers is of growing importance for at knowledge intensive firms, as skills, knowledge and the innovative efforts of well-developed corporate researchers may enhance their performance of research and development (R & D). Several scholars of human resource management have recently raised the question of what career development for corporate researchers will lead to the development of the organizational capabilities requisite to firm-level R & D (Farris & Corredo, 2002; Jones & Lichtenstein, 2000). Traditionally, many scholars and practitioners have argued that the dual career, or dual ladder, system – with both managerial and technical path – matches the career development needs of corporate researchers and keeps their careers from plateauing (Baugh & Roberts, 1994; Tucker et al., 1994). However, there are several problems with the dual ladder system regarding to corporate researchers' career development, not only because the technical path may be isolated and, unequal to the managerial path (Allen & Katz, 1986; Farris & Corredo, 2002; Igarria et al., 1999), but also because researchers' career paths become more dynamic and varied than it allows for. As DeFillipi & Arthur (1994) argue, that the concept of career competencies can shed lights on the relationships between cumulative career development and continuous organizational capability building. Assuming the actual situation that R & D departments are multi-project organizations and an increasing number of researchers, unlike technical experts on technical paths, experience several projects in their project-oriented careers, firms need many researchers with technical competence and basic project management skills. This paper attempts to examine whether, in terms of career competencies, firms desire for many of their researchers to develop such individual competencies through a career development process. This paper is divided into following four parts. First, reexamining the above argument regarding the dual ladder system, we are critical of its focus mainly on career orientation and satisfaction of corporate researchers, and its ignorance of dynamics that could multiply their career paths. Second, assuming that the concept of career contingencies reveals to us what individual contingencies firms demand to build organizational capability, firms may encourage many researchers to acquire appropriate technical competence and basic project management competence, responding to the increasing needs for project leaders and staffs. Third, using the case studies of nine pharmaceutical firms based in Japan, we will examine how their actual career path systems work and how these firms need and develop a mixture of technical and managerial competence to contribute to research projects. Finally, we will conclude that firms need specific career contingencies for corporate researchers to run multi-project organizations, and that they are attempting to develop them through their career management systems.

Keywords: Dual Ladder System, Career Development, Corporate Researchers, Career Contingencies

1. Introduction

Career development for corporate researchers is of growing importance for at knowledge intensive firms, as skills, knowledge and the innovative efforts of well-developed corporate researchers can enhance their performance of research and development (R & D). Several scholars of human resource management have recently raised the question of what career development for corporate researchers will lead to the developments of the organizational capabilities requisite to firm-level R & D (Farris & Corredo, 2002; Jones & Lichtenstein, 2000). Traditionally, many scholars and practitioners have argued that the dual career, or dual ladder, system – with both managerial and technical paths – matches the career development needs of corporate researchers and keeps their careers from plateauing (Baugh & Roberts, 1994; Tucker et al., 1994). However, there are several problems with the dual ladder system regarding to corporate researchers' career development because the technical path may be isolated, unequal to the managerial path or sometimes poorly matched to corporate researchers' needs (Allen & Katz, 1986; Farris & Corredo, 2002; Igbaria et al., 1999). Furthermore, their career paths have become more dynamic and multiple than the dual ladder system. Although many studies of the dual ladder system focus on whether or not it fits to career orientation of corporate researchers, however they pay little attention to how it affects on the enhancement of the organizational capability of R & D. Applying the competence-based view to career theory, DeFillipi & Arthur (1994) argue that the concept of career competencies can shed lights on the relationships between cumulative career development and continuous capability building. That is to say, specific patterns of career development by some corporate researchers may enhance the special energies, skills, knowledge and networks which firms desire to build their organizational R & D capability. In their discussion of technical leadership in R & D, Farris and Corredo (2002) point out two major competencies that are demanded of technical managers: effectively directing and intellectually empowering project teams. In the cumulative career development of corporate researchers, these two major competencies should basically be developed to enhance organizational capability for corporate R & D. This paper attempts to examine whether, in terms of career competencies, firms desire many of their corporate researchers to develop such individual competencies through the career development process.

This paper is divided into following four parts. First, reexamining the above argument regarding the dual ladder system, we are critical of its focus mainly on career orientation and satisfaction of corporate researchers, and its ignorance of dynamics that could multiply their career paths. Second, assuming that the concept of career contingencies reveals to us what individual contingencies firms demand to build organizational capability, firms meet increasing needs of project leaders and supporters, and may encourage many researchers to acquire appropriate technical competence and basic project management competence through cumulative career development. Third, using the case studies of nine pharmaceutical firms based in Japan, we will examine how their actual career path systems work and how these firms need and develop a

mixture of technical and managerial competence to contribute to research projects. Finally, we will conclude that firms need specific career contingencies for corporate researchers to run multi-project organizations, and that they are attempting to develop them through their career management systems.

2. Career Development and Contingencies for Corporate Researchers

2.1 Dual Ladder Systems and Career Development of Corporate Researchers

The dual ladder system, with its managerial and technical career paths, has traditionally been considered appropriate for the career development of corporate researchers. On the one hand, on the managerial path, some corporate researchers develop their managerial skills, organize people and move up a career ladder within the organization. On the other hand, on the technical path, those who would not prefer to follow the managerial path and organize people can focus on the development of their expertise and be evaluated with a different ranking system. A technical career path, with such career orientation, is designed to overcome the plateauing of corporate researchers' careers (Tucker et al., 1992). Engineers and professionals, who are not thought to have acquired enough managerial skills and knowledge, tend to be unable to keep their career motivation, worsen their skills and knowledge suffer, and they perform poorly (Feldman & Weitz, 1988). By providing their corporate researchers with a technical career ladder, firms can find a new way to evaluate them in terms of their expertise, and corporate researchers can remain highly motivated to develop their skills and knowledge. Many technology-oriented firms do make use of a dual ladder system and provide their corporate researchers with a technical career ladder. In Japan, 50.7% of the large firms (firms with over 5000 employees) implement a dual ladder system to develop their experts (2004 Japanese National Survey of Employment Management).

However, Allen & Katz (1986) point out that the dual ladder system often poses several problems for the career development of R & D professionals. First, senior technical experts on the technical career ladder are not often equally evaluated as managers with a similar ranking to persons on the managerial career ladder, potentially making them so that those may be less motivated than their counterparts. Second, the isolated nature of the technical career path often discourages scientists and engineers from pursuing it. Third, sometimes jobs on the technical ladders are sometimes used as waiting positions for management candidates or as receiving places for failed technical managers. Thus, sometimes the technical career ladder does not sometimes truly match the career orientation of technical experts and serve to enhance their technical competencies. The above discussion of the dual ladder system has a cognitional bias and tends to focus on how it may fit with the cosmopolitan career orientation of corporate

researchers as cosmopolitan and how it might offset the plateauing of their careers. But, Farris & Corredo (2002) point out that the actual careers of corporate researchers are more dynamic and more varied than the basic dual ladder system. This transformation of the career system is induced, in part, by a firm's strategic decisions to focus on specific R & D capabilities. In particular, in the biotechnology industry, many researchers find opportunities and spin off from their companies to start their own venture business, as large firms and institutions sometimes strategically focus on promising projects and restructure the hopeless projects and unfortunate researchers who are involved in them. With this in mind, we should pay much more attention to the particular conditions of their career systems and to firms' needs for the career development of their corporate researchers.

2.2 Dynamics and Multiplying of the Career System

As R & D organizations in the corporate sector expand, the careers of corporate researchers tend to become more dynamic and their career paths often multiply. In fact, expansion affects on the working conditions of the dual ladder system and the career development of corporate researchers.

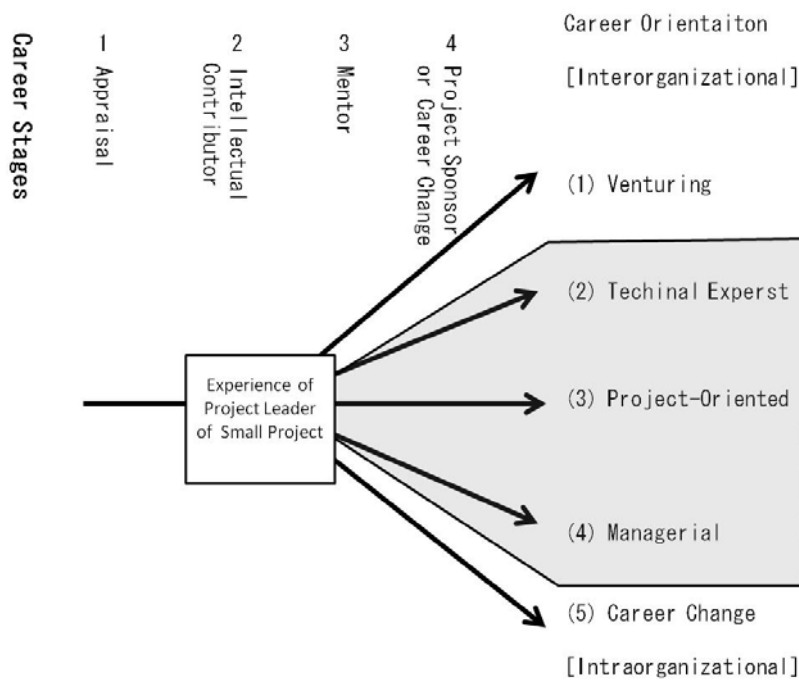
The careers of corporate researchers become much more dynamic than they were before, resulting in the need for a much wider variety of experiences, skills, knowledge and networks. Kidd & Green (2006, 230) suggest that researchers in the modern age frequently have great diversity in their daily tasks from "hands on laboratory work to managing large research projects." Therefore, in the short term, they often transform their skills and knowledge to correspond to the changes in their daily tasks. In terms of the career stages of researchers, Thompson & Dalton (1976) argue that they can typically be divided them into four stages: apprenticeship, independent contributor, mentor, and project sponsor (or the career change) stage. As R & D departments are usually designed as multi-project organizations, their career stages are constructed to develop the skills, knowledge and networks required to manage research projects effectively. In particular, the independent researcher stage is considered a basic and common milestone in the careers of corporate researchers. As described by Thompson & Dalton (1976), in the "independent contributor" stage, researchers acquire the basic skills and knowledge to independently manage all or a part of one project.

In terms of career paths, the paths of corporate researchers have become more varied than the dual ladder. Beyond the traditional discussion of the technical path and the managerial path, scholars have proposed three additional patterns for the of their career orientation of corporate researchers; the project- oriented career, transfer with specific technical competence, and the entrepreneurial path (Farris & Corredo, 2002: 18; Leibrowitz & Farren, 1992). First, some

researchers experience several projects, and are transferred among them without upward promotion in their careers. Furthermore, firms form alliances with other firms, or strategically acquire or divest research projects. Thus, some researchers commit to projects that are technically challenging even when those projects become sometimes become interorganizational rather than intraorganizational, and do not always obviously lead to intraorganizational career success. In the case of such a career, researchers commit to specific research fields more than to individual organizations. Second, some researchers leave their careers as researchers to take on engineering or consulting jobs within corporations, making use of their excellent technical competence. For example, in Japanese pharmaceutical firms, many researchers in their forties and above tend to move to other positions within development divisions, marketing divisions or intellectual property management divisions, as firms evaluate their high technical competences in keeping with the demands of these divisions. Researchers who want to continue a career within an organization frequently choose career changes to departments in areas other than R & D that will make use of their technical competence. Third, some ambitious researchers spin off from their firms and start new research businesses, making use of their research experience. This venturing or spinning-off of promising technical projects is increasing, aided by large, supporting firms, venture capitals and angel investors. The entrepreneurial path is a typical new career outside organizations.

Summing up these new trends in the career development of corporate researchers, we can reconceptualize their modern career ladder system as one with multiple stages and paths. However, since R & D departments are multi-project organizations, after the apprenticeship or trainee stage, the first common developmental goal is to acquire basic technical and managerial skills and knowledge to run small projects independently as an “independent researcher.” After that, corporate researchers’ career paths are more varied than the traditional dual ladder and they include project orientation, entrepreneurship and career changes, in keeping with on individual career preference. We have outlined these career tendencies in Figure 1.

Figure 1 Career Stages and Paths of Corporate Researchers



2.3 Career Competencies for Corporate Researchers

Many scholars mainly stress career orientation and satisfaction (i.e. Baugh and Roberts, 1994); however, they have not paid much attention to how career management affects on the building of R & D capability. From the viewpoint of human resource development (HRD), we must reexamine what skills, knowledge and competence building are demanded of corporate researchers by their firms during the course of their career development, and how they go about attaining it. Regarding the HRD of corporate researchers, Farris & Corredo (2002) point out two major leadership skills that are required of technical project team managers in contemporary competitive R & D activities; effectively directing and intellectually empowering scientists and engineers. Farris and Corredo refer to the first role of the technical leader as “captain.” This entails the effectively organizing and directing researchers in project teams and can be developed in a managerial career orientation. The second role they refer to as the “catalyst,” which means the intellectually empowerment of project teams, by evaluating other’s ideas and sharing their own ideas as well. Such leadership is also important because firms demand high performance of their project teams in the area of knowledge creation in addition to research efficiency. Farris and Corredo’s argument suggests that firms may foster the development of specific individual contingencies through specific career management.

We would also like to point out that corporate researchers may develop specific individual competencies through their individual career development and their firms’ specific career

management. The concept of career competencies reveals what individual competencies through cumulative career development may contribute to a given firm's competencies (DeFillipi and Arthur, 1994). Career competencies have as their basis the on competency-based view, the resource-based view and the capability approach. In their discussion primarily of "boundaryless" careers, DeFillipi and Arthur (1994) introduce the above career competencies when describing what individual properties may lead to career success and the enhancement of organizational capabilities. They specify three components of career contingencies; knowing why, knowing what and knowing whom. "Knowing-why" contingencies lead to career motivation, occupational identification and personal interests, which generate the motivational energy to continuously commit to a fixed career orientation. "Knowing-what" competencies involve specific skills and knowledge which lead to concrete competencies. "Knowing-whom" competencies involves social networking with people who provide valuable or effective information, skills and knowledge that further a person's competencies. DeFillipi and Arthur (1994, 317) describe intraorganizational career contingencies as well. The three competencies in an intraorganizational career are slightly different from those in an interorganizational career. First, in an intraorganizational career, the career motivation of corporate researchers is determined by the employer, while it is driven by the employee in the case of an interorganizational career. Second, while an employee is required to have organization-specific skills and knowledge in an intraorganizational career, greater flexibility is needed in an interorganizational career. Third, knowing-whom competencies are also determined by the organizational hierarchies within organizations. However, they can also be flexible, and will depend on the nature of tasks or of the technology in the case of an interorganizational career.

From the perspective of career contingencies, the dual ladder system develops two types of career contingencies for corporate researchers, namely the managerial and the technical (Jones and Lichtenstein, 2000, 156). Corporate researchers on managerial paths have experiences and are trained to acquire managerial competence to organize people and resources toward the attaining of a goal. Their careers are motivated by the desire to control people and resources within an organization, and their networking may be concentrated within the organizational hierarchy. Researchers with well-developed managerial competence effectively direct other researchers in project teams and promote the efficient operation of R & D activities. Meanwhile, on a technical path, researchers pursue the development of technical competence or experts. They identify themselves as experts in society, and tend to have networks with professionals beyond organizational boundaries from whom they acquire valuable skills and knowledge. They bring new technology, knowledge and ideas to their project teams and intellectually empower them. In addition to these two paths, corporate researchers within R & D departments tend to take at least one more career paths such as the project-oriented career path. In the case of the project-oriented career path, researchers are horizontally transferred from one project to another in the capacity of project leaders, sub-leaders or as members of the research staffs. They require and develop appropriate technical competence and moderate managerial competence as well.

Before choosing from among these paths, corporate researchers reach the independent researcher stage and acquire the basic skills and knowledge needed to run small projects. Farris and Corredo (1992) suggest that in the early stages researchers who have not only appropriate technical competence but also moderate administrative capacity tend to be promoted more than those who only have only technical or managerial capacity. Through career development, firms demand that independent researchers with the technical competence needed in research projects, and with moderate managerial competence as well. After this stage, firms encourage researchers to develop managerial or technical or project- focused competence while researchers develop their own individual competence. However, because modern R & D departments are multi-project organizations, firms need many project leaders and sub-leaders, project staffs and line managers and only a few full-time technical professionals. Thus, firms demand many researchers who have both technical competence and basic project management competence.

H1: In order to sustain a multi-project organization in R & D departments, firms encourage many corporate researchers to acquire the technical competence and basic project management competence that are essential for project leaders and staff.

3. The Career Development of Corporate Researchers in Japan-based Pharmaceutical Companies

3.1 Cases and Method

We collected data to empirically examine application of the Dual Ladder System and firm's demand for corporate researchers. The data is based on the in-depth case studies of the career development systems for corporate researchers at nine of the top twenty pharmaceutical firms based in Japan. We focused primarily on large firms because they tend to establish formal career development systems. The nine firms studied were Japanese firms or the Japanese subsidiaries of foreign firms that have operated R & D divisions in Japan for several decades (See Table. 1). From July to October, 2006, nine members of our research team interviewed more than twenty human resource managers in the drug discovery research divisions of the in nine firms. These human resource managers were mainly in charge of career development for their researchers. Our questions focused primarily on: (1) the career systems for researchers in the drug discovery research divisions, (2) the application of the dual ladder system, (3) the development of project leaders, (4) the firms' demands with regard to career development, and (5) specific incentive policies for researchers (see Appendix 1). In these interviews, we attempted to investigate how firms make use of the dual ladder system and what careers and competencies of their researchers they demand and develop. A semi-structured interview protocol was employed. We interviewed two or three managers for an average of two hours. The data collected from the nine firms was

organized in one itemized list, and the three authors of this paper then analyzed it. In addition to the above interviews, we interviewed a few researchers in these firms and managers at the pharmaceutical trade associations in Japan to acquire reference information for industrial context.

Table 1 Profile of the Nine Firms Studied

Firm s	No. of Research Sites	No. of Researcher s	Affiliation
A	several	400	foreign affiliated
B	4	730	Japanese
C	1	100	foreign affiliated
D	2	200	Japanese
E	several	1000	Japanese
F	1	380	foreign affiliated
G	1	150	Japanese
H	5	500	Japanese
I	2	230	Japanese

3.2 The Career Development of Corporate Researchers in Japan-based Pharmaceutical Firms

Before examining the data, we will provide a rough, general profile of the Japan-based pharmaceutical industry and the careers and competencies of its corporate researchers. In recent years, Japan-based pharmaceutical firms have needed to enhance their international competence in the R & D of new drugs. The Japanese pharmaceutical market has sales of 56.7 billion US Dollars, or 8.8% of the 643 billion USD world drug market (2006 Statistics by IMS Health). However, on average, Japanese pharmaceutical firms are smaller than global mega pharmaceutical firms like Pfizer and Glaxo Smith Klein. The largest Japanese firm, the Takeda Pharmaceutical Company Ltd., is ranked 16th in the pharmaceutical industry in total global sales. Japanese pharmaceutical firms have a smaller financial capacity, so they are unable to invest as much in R & D as their rival foreign mega pharma firms. Therefore, they have less international competence to develop new blockbuster drugs. Since many major foreign big firms have entered into the Japanese market for these two decades, Japanese firms are facing increasing growing

global competition and some Japanese firms have merged with or been acquired by other Japanese or foreign firms.

Japanese pharmaceutical firms have two main areas for the R & D of new drugs; drug discovery and clinical development research. In departments for new drug discovery, researchers make many efforts to pick up one or two seeds of new drugs from hundreds thousands of candidate substances and create the prototypes of new drugs. They are engage in extensive scientific and exploratory research. On the other hand, in departments that conduct clinical research, developers examine and testify to the effects and safety of new drug candidates, using them into trials in collaboration with large hospitals. For the purposes of this paper, we have focused on researchers in the new drug discovery departments and mainly collected data about their careers.

The creation of new drugs is a world of scientific research but one in which the possibility of innovation is extremely low. On average, the innovation of one drug takes a period of ten years, and one or two new drugs are developed from a hundred thousand candidate substances. In drug discovery research departments in pharmaceutical firms, there are an abundance of projects but only a few researchers can experience the successful discovery process of a new drugs. In fact, many researchers are working to eliminate hopeless substances and organizationally reduce the number of alternative substances. Thus, pharmaceutical firms may encourage researchers to organizationally commit to several projects in their research careers as a way of providing to them with several chances for career development. However, recently firms have also demanded acceleration of the R & D process and so that they have increased R & D alliances, the divestments of hopeless substances, and the acquisition of substances for which there are good prospects. For this reason, they require high competencies in the areas of project management and intellectual property management.

3.3 Career stages and paths

The careers of Japanese corporate researchers in the pharmaceutical industry have generally been consistent with the Japanese tendencies for long-term employment and low turnover. Many corporate researchers are recruited just after graduating from the master's course at a department of pharmacy or chemistry and are employed as freshmen in R & D departments, although many pharmaceutical firms have recently increased the number of persons recruited and have hired experienced researchers in special new areas. After less than one year of freshman training, in less than one year, they are assigned to the laboratories where they work as apprentices (Ogawa, 2006). Many of researchers become the position of small project leaders when they are in their mid-thirties and finish their laboratory life in their mid-forties and move to the other departments that are not doing R & D. In our nine case studies, the career patterns of researchers in research

departments were similar to the pattern. However, career changes on the part of middle-aged researchers were less common in the foreign affiliated companies than in the Japanese companies.

Most of the pharmaceutical firms we studied introduced the dual ladder system but career paths diverged at the independent contributor stage (See Table 2). Seven of the nine firms sampled implement the dual ladder system in R & D departments and provided both managerial and technical path. On the technical path, firms encouraged their researchers to advance their professional skills and knowledge on a technical ladder, so that technical managers could focus on their research without managing others and could be promoted, in keeping with the firm's evaluation of their technical achievements. One problem in the case of the technical ladder is that sometimes technical experts cannot accept the manner in which they have been appraised, because of ambiguities in the appraisal standard. Another problem is that some positions on the technical ladder may be waiting places for manager candidates while others may be and receiving places for technical managers (Hirakimoto, 1998). Actually, firms only provided a few positions for technical experts on the technical ladder. For example, in one of the companies researched, only two or three technical managers were in a research department comprised of one hundred researchers. Researchers generally in the range of thirty-five to forty years of age may choose their career path from two options if they do not choose to transfer to other departments. This first choice coincides with the stage of the independent contributor. After becoming independent researchers, some researchers take the managerial path, many take a project-oriented path, and a few continue to pursue a technical path. Rarely do researchers take an entrepreneurial path because the companies surveyed do not provide opportunities for entrepreneurship nor do they encourage the spin-off of researchers. Many researchers are involved with several projects as project leaders and staff members. After their mid-forties, a small number of managers and experts remain in research departments but most are encouraged to transfer to other departments that make use of their technical expertise but are not than working on drug discovery. Researchers changing careers tend to move to departments involved with clinical development, production management or medical marketing, where they can make use of their career competence. Some are transferred to positions as managers of scientific information managers in medical marketing departments. Finally, career changers rarely return to departments that are performing drug discovery research.

Table 2 Career Development System

Firms	Implementation of Dual Ladder System	Training for Researchers	Career Counseling	Special Incentives for Researchers
A	yes; five Paths	mainly OJT	yes; by managers	n/a
B	yes	training programs organized by firms, departments and employees	no	-bonuses -bonuses for patenting
C	no	OJT	yes by HR managers or outsourced	-bonuses -bonuses for patenting -stock Options -awards
D	no	OJT	individual career plan made and discussed	-bonuses -bonuses for patenting -stock options, -project-building
E	yes	mainly OJT	mentoring and counseling	-bonuses for patenting, -academic conferences -supports obtaining a degree -academic conferences, -studying at university
F	yes	a customized training program for researchers	no	-Supports obtaining a degree -awards
G	yes	mainly OJT	outsourced	-bonuses / bonuses for patenting -supports obtaining a degree -academic conferences, -studying at university
H	no	mainly OJT	yes but with little effect	-bonuses -bonuses for patenting
I	yes	mainly OJT	no	-bonuses -bonuses for patenting

3.4 Career Development and Incentives for Researchers

In developing employees' careers, organizations perform career management practices such as training, mentoring, appraisal and competency management (Heery & Noon, 2001, 34). As appraisal policy affects the conditions of the incentive system, it also directs career development to a certain extent. In our case studies, we collected information about training, mentoring, appraisal and special incentives for researchers (See Table 2).

First, in the Japanese pharmaceutical industry, many firms develop the research skills and knowledge of their researchers through On-the-Job- Training (OJT). Researchers in the pharmaceutical industry face and have to adapt to rapid technological innovations especially in the area of biotechnology, and they need to learn novel technical skills and attain knowledge independently. The firm's support for their learning is needed and may lead to organizational competency building in R & D. However, the sampled firms commonly provided general freshman training programs and management skill training programs but only two firms provided special training programs for their researchers. Regarding special Off-JT for researchers, one Japanese human resources (HR) manager said to us that the researchers needed to have special, tacit knowledge to perform the pharmaceutical research and that they had to learn it from the supervisors and senior staffs in their workplaces. Second, only one of the nine companies surveyed in this study provided a formal mentoring system for its researchers. However, most of the companies hoped for informal mentoring and encouraged their young researchers to informally contact the senior staffs, to discuss the planning of their careers and to get advices about it. Several companies formally provided opportunities for career counseling. HR managers or outsourced HR agents organized career planning seminars for researchers, checking on and advising them with regard to their mid-term career plans.

Third, pharmaceutical firms in Japan do not generally place emphasis on the academic performance of their researchers. In appraising the technical competence of experts who are on the technical ladder, firms do refer to academic performance. For example, when judging the level or degree of their expertise, firms take into account of the number of academic papers they have written, the number of times they have been quoted in other publications, and the impact of their academic papers, however, this information does not directly lead to salary increases or to promotions. Fourth, firms motivate researchers by not only with bonuses based on their individual performance but also with intrinsic rewards such as awards, supports in attaining for taking academic degrees, opportunities to study abroad or at a domestic university and so on. Pharmaceutical firms implement monetary rewards for patents but only a few researchers have the opportunity to enjoy such this rewards because most researchers cannot commit themselves to actual drug discovery. Because, in the pharmaceutical firms, only a very small number of

researchers experience drug creation, it is sometimes difficult for researchers to be continuously and enthusiastically committed to this research over a long period of time. Thus, it is very important for firms to encourage researchers to maintain their commitment to research over the long term. Many firms try to intrinsically motivate researchers, appraising them with researchers by longitudinal evaluations, and setting up opportunities for researchers to experience feelings of self-development and success.

3.5 The Strong Demands for Project Leader Development

In our case studies, the HR managers at most firms stressed the demand for many independent researchers capable of leading projects and managing teams rather than for professional researchers with high technical competencies working independently. The main functions of project leaders were to manage project protocol, monitor progress and organize the members of their team. However, firms did not expect them to take responsibility for personnel development and the evaluation of other staffs, which were functions of the line managers. In particular, the firms in this study made much of building the capacity to organize people in a team because it requires the ability to organize different professionals across departments.

When appointing project leaders, most firms evaluate such competencies as researchers' professional skills, their project-related experience, achievements and contributions, the degree of their motivation, their ability to think strategically and to networking (See Table. 3). On average, researchers are first appointed as project leaders around their mid-thirties. Toward this end, firms provide to researchers with training of project management skills through OJT and other trainings. One of the HR managers interviewed explained that because project management in pharmaceutical research is very specific to the industry, researchers cannot use standard project management skills. Rather, they must acquire tacit knowledge in the course of their pharmaceutical research project experiences.

Table 3 Development of Project Leaders

Firms	First Experience of Project Leaders	Training for Project Leaders
A	Approx. 35 years old	OJT
B	Approx. 35 years old	special management training program
C	team leader in early 30's	OJT
D	early 30's	n/a
E	n/a	n/a
F	n/a	special management training program
G	n/a	n/a
H	team leader in early 30's	mainly OJT
I	from late 20's to 40's	OJT

As DeFillipi and Arthur (1994) point out, researchers' networking abilities are one main indicator of career contingencies. Networking with project owners, other project managers, inside technical experts and outside technical experts may provide valuable information resources and may be of value when problem-solving. In the development of project leaders, the sampled firms encourage their researchers to foster intraorganizational networking with managers, technical experts and other members of the staffs. However, they place little emphasis on account of networking with outside experts through participation in academic events. This may be one major cause of their R & D's weaknesses.

4. Conclusion

The surveyed pharmaceutical firms in Japan want most of their researchers to acquire basic project management skills early in their early careers. They implement a dual ladder system and facilitate the development of project management skills, but do not aggressively pursue the development of advanced technical competence and expertise. As described in Farris & Corredo's discussion of effective direction and intellectual empowerment in research project management, firms make much of the development of these competencies by the career stage of

their independent researchers. After this stage, many researchers then experience several projects as project leaders, staffs or professionals, and take on project-oriented careers by their forties.

As regards career competencies, current research departments are multi-project organizations so that firms need a large number of project leaders and staffs. For this reason, firms believe that the development of basic project management skills will lead to the enhancement of organizational competencies to run many projects in their R & D departments. Rephrasing Corredo & Farris's (1994) discussion of the promotion of technical managers with moderate administrative competence, it can also be said that firms desire project leaders with moderate technical competence. Using OJT, firms encourage their researchers to develop project-leading skills. However, since not so many researchers can be promoted to middle and top level management positions, firms do not want for a large number of researchers to develop excellent management capabilities. Rather, career competencies for project-oriented careers are needed because many researchers become project leaders, because there is current huge demand for project leaders, and because researchers with well-developed project leading skills may have advantage in transfer to other departments. However, Japan-based pharmaceutical companies have become aware of needs for high quality of technical experts who can intellectually empower projects and evaluate their technical values. There are two main reasons for this demand. First, current drug discovery research needs more advanced technology, including biotechnology, and project leaders and staffs with moderate technical skill cannot keep up with advanced technology. Second, alliances with and the acquiring or divestment of research projects with institutes or other rival companies have increased in recent years, and technical experts can facilitate them. Pharmaceutical companies in Japan are now facing need to a large number of technical experts.

Table 4 Research Summary

Career Development Tendencies
-up to 35years of age, basic project management skills
-older than 35, Technical / Managerial / Project-oriented Paths
-first team leader experience in early 30's
-competencies: basic project management skills and moderate technical competence
-older than 40's, transfer to Department of Development, Production, Marketing
-trainings mainly OJT
-some mentoring,

At the last, we should note that this case study has certain limitations. Because samples of our research focused on pharmaceutical firms in Japan, we should reexamine the industrial and national contexts. Since pharmaceutical R & D tends to take a long time and is strictly restricted by the governmental standards, it can lead to only a small number of successful results. In this regard, our pharmaceutical cases may be unique. Because the organizational size of Japanese pharmaceutical companies is relatively smaller than that of the global mega pharma companies, the needs for technical experts in Japan-based firms may also be smaller than it is in US or EU based companies. Further, customs related to career changes may be very specific to the Japanese context. Finally, we need to make furthermore observations with regard to the development of career contingencies.

Appendix 1 List of Primary Interviewed Questions

- (1) Does your firm implement a dual ladder system and set up technical careers?
- (2) What are your firm's aims and conditions in implementing the dual ladder system?
- (3) What is a model career for your researchers?
- (4) What does your firm seek with regard to the competencies of its project leaders?
- (5) What career competencies do you seek for corporate researchers?

References

- Allen, T. J., and Katz, R., 1986, "The Dual Ladder: Motivational Solution or Management Delusion?" *R & D Management*, No.16 Vol. 2, pp.185-187.
- Allen, Thomas J., and Katz, R.,1992, "Age, Education and the Technical Ladder," *IEEE Transactions on Engineering Management*, No. 39 Vol. 3, pp.237-245.
- Baugh, S. G., and Roberts, R. M.,1994, "Professional and Organizational Commitment among Engineers: Conflicting or Complementing?" *IEEE Transactions on Engineering Management*, Vol. 41 No. 2, pp.108-114.
- Blau, G.,1999, "Early-career Job Factors Influencing the Professional Commitments of Medical Technologists," *Academy of Management Journal*, 42(6), pp.687-695.
- Cordero, R., Ditomaso, N. and Farris, G. F.,1994, "Career Development Opportunities and Likelihood of Turnover among R & D Professionals," *IEEE Transactions on Engineering Management*, Vol. 41 No. 3, pp.223-233.
- DeFillipi, R. J. and Arthur, M. B.,1994, "The Boundaryless Career: A Competency-Based Perspective," *Journal of Organizational Behavior*, Vol.15, pp. 128-52.
- Farris, G. F., 1988, "Technical Leaderships: Much Discussed but Little Understood," *Research Technology Management*, Vol.31 No.3, pp.12-16.
- Farris, G. F. and Cordero, R., 2002, "Leading Your Scientists and Engineers," *Research Technology Management*, Vol.45 No.6, pp.13-25.
- Feldman, D. C. and Weitz, B. A.,1988, Career Plateau Reconsidered, *Journal of Management*, Vol.14, pp.69-88.
- Hall, J. L. and Munson, M. and Posner, B. Z., 1992, "Training Engineers to be Managers: A Transition Tension Model," *IEEE Transactions on Engineering Management*, Vol. 39 No.4, pp. 296-302.
- Heery, E. and Noon, M., 2001, *A Dictionary of Human Resource Management*, Oxford, UK: Oxford University Press.
- Hirakimoto, K., 1998, "Dual Ladder System Policy and R & D Engineers," (in Japanese), in Y. Goto (ed.), *New Frontiers of Management and Accounting Research*." Tokyo: Chuo Keizai Sha.
- Igbaria, M., Kassicieh, S. K. and Silver, M., 1999, "Career Orientations and Career Success among Research, and Development and Engineering professionals," *Journal of Engineering and Technology Management*, Vol.16 No.1, pp.29-54.
- Jones, C., and Lichtenstein, B. M. B., 2000, "The 'Architecture' of Career: How Career Competencies Reveals Firm Dominant Logic in Professional Services," in Peiperl, M., Arthur, M., Coffee, R. and Morris, T. M, *Career Frontiers: New Conceptions of Working Lives*, Oxford, Oxford University, pp.153-176.
- Kidd, J. M. and Green, F., 2006, "The Career of Research Scientists: Predictors of Three Dimensions of Career Commitment and Intention to Leave Science," *Personnel Review*, Vol. 35 No. 3, pp.229-251.

- Leibowitz, Z. B., Kaye, Beverly L. and Farren, C., 1992, "Multiple Career Paths", *Training & Development*, Vol.46 No.10, pp.31-35.
- Ogawa, N., 2006, "Human Resource Development of Corporate Researchers," (in Japanese), in K. Koike, *Human Resource Development of Professionals*, Kyoto: Nakanishiya.
- Page, A. L., 1993,, "Assessing New Product Development Practices and Performance: Establishing Crucial Norms." *Journal of Product Innovation Management*, Vol.10 No.4, pp. 273-290.
- Roth, L. M., 1988, "A Critical Examination of the Dual Ladder Approach to Career Advancement," In Tushman, M. L. and Moore, W. L. eds., *Readings in the Management Innovation*, New York: Harper Business, pp.75-292.
- Schein, E.H., 1985, *Career Anchors: Discovering Your Real Values*, San Diego, CA: University Associates
- Thompson, P. H. and Dalton, G. W., 1976, "Are R & D Organizations Obsolete?" *Harvard Business Review*, November-December 1976, pp.105-116:
- Tucker, R., Moravec, M., and Ideus, K. ,1992, "Designing a Dual Career-track System." *Training and Development*, June, pp.55-58.