

A Competency Model for Project Construction Team and Project Control Team

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Abstract

This study focuses on developing a competency model for project construction team and project control team service, which are the essential responsibilities of construction companies, in order to provide a basic framework for manpower development including employment, education, performance measurement, and organizational ability improvement. Together, these attributes comprise the basics of human resource management and reflect the key characteristics of construction companies. This study analyzed several previous competency model studies, and derived job competency items from a questionnaire-based survey of corresponding job performers centering on various existing competency items established with respect to the characteristics of construction companies. In addition, through interviews with a specialist group, this study derived weights for setting competency levels and facilitating competency evaluation and formulated a project construction team and project control team affair competency model for construction companies. This study tested the validity of the formulated model by analyzing its correlation with the performance of actual construction projects.

Keywords: *competency model, core competency by job, high performer competency model*

1. Introduction

1.1 Background and Objectives

During the course of many adversities, ranging from the worldwide economic depression in 1998 to the current global economic crisis caused by the recent subprime meltdown and resulting financial problems, most industries in the world desperately have searched for various ways to survive. The construction industry in Korea is no exception, and is currently faced with a number of difficult financial issues. In the present slackened market situation, because construction companies also experience decrease in revenues, it becomes essential to increase efficiency and improve profitability by decreasing costs. Consequently, the paradigm of company management has switched from growth to optimization. As is the case for many other industries, construction companies have introduced information systems and office automation in accordance with the new management paradigm, and have made efforts to improve work efficiency by redesigning work processes using BPR (Business Process Reengineering). These changes have resulted in short-term improvements in efficiency; the reduction of fixed costs such as those associated with labor, appear to improve the efficiency of company management. The efforts to reduce labor costs, however, have resulted in laying off employees, hiring temporary workers instead, reducing employee training costs by

hiring only people with previous work experience, and outsourcing various business functions. Although these management optimization activities produced the expected effects of saving on fixed costs and making leaner organizations, they have generated negative side effects such as loss of core competencies, which comprise the intangible assets of a company.

In general, the number of workers a company needs is determined by labor productivity per sale per person, and has been managed separately from various human resource management activities including education. Recently, however, with the growing importance of flow-centered human resource management that integrates the inflow, management, and outflow of human resources, it has become clear that there is a need for methods that clarify the relations among activities composing human resource development and management plans, including employee education. One such method is to utilize a competency model as a part of human resource management.

The present study aimed to provide a basic framework for human resource development for construction companies. Because hiring, educating, and retaining employees are the basics of human resource management, a well-developed framework can help the construction industry to build a competency model that reflects the characteristics of the core functions of construction companies. Using this competency model, the industry could improve performance measurement and efficiency.

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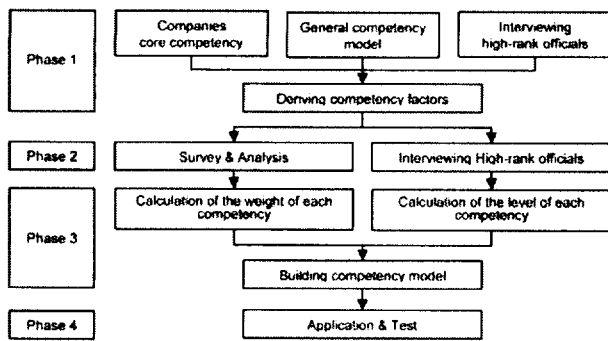


Fig. 1. Research Flow

1.2 Research Scope and Methodology

This study developed a competency model with specific foci on project construction team and project control team affair services, rather than a general model of competency including a job classification system. Because project construction team and project control team affair services and core functions of construction companies, the competency model focusing on these functions can be more readily and commonly applicable to construction companies. The current research was conducted in four stages as shown in Fig. 1.

- Stage 1 identified major competency factors after examining the qualities of key members of construction companies, reviewing elements of other general competency models, and conducting one-on-one interviews with top-management team members or supervisors in top-tiers.
- Stage 2 conducted a survey study with people who had worked at construction companies for more than 5 years and held their current jobs for more than 3 years. The survey data provided information on the relative importance of each competency factor. Additionally, interviews were conducted with top managers and the interview data were used to assign grades to each competency factor.
- Stage 3 finalized the competency model, integrating all the information gathered from the stages 1 and 2. The competency model specified core competency elements for each job or task type.
- Stage 4 tested the validity of the competency model by applying the model to targeted groups and examining the extent to which competency factors were related to performance measures.

2. Competency Model

2.1 Definition of Competency

As mentioned above, Korean construction companies have faced with numerous external challenges, and consequently, have hastily made performance-oriented reforms during these times of hardship. Such reforms produced positive short-term results, but now they appear to damage long-term performance. In this regard, it has become increasingly important for companies

or individuals to materialize and manage their competencies, as these are the sources of high performance.

The lexical meaning of “competency” is “an ability to do a work or the degree of the ability”. In 1973, David McClelland, a psychologist at Harvard University, first defined competency specifically in the context of human resource management (Boyatzis, 1982; Dubios, 1993; Jacobs, 1989).

Throughout the 1980s, many scholars in various areas of research have redefined the concept of competency. Among these definitions, core competency in many human resource management areas commonly refers to the consistently observed characteristics and inner quality of high performers’ behavior compared with those of average performers’ behavior. That is, core competency is a behavior that produces successful results through the combination of knowledge, skill, attitude and value (Lee *et al.*, 2003).

Based on similar concepts of competency established by many scholars, Sparrow in 1996 divided competency into different, but closely interconnected, categories: namely, core competency (organizational competency), management competency, and job competency (individual competency). More specifically, core competency refers to an organization’s general resources and the ability for those resources to be shared by all members of an organization. Management competency refers to individual jobs, specifically competency related to knowledge, skill and behavior that can be utilized in other companies. Finally, individual competency is one’s competency with respect to their job performance.

Among Sparrow’s categories, this study examined the individual job performance aspect of competency and focused on construction and public affair services that are specific to construction companies and are applicable to human resource management.

2.2 Definition of Competency Model

Competency, as defined above, reflect differences in the skill sets necessary for the relevant tasks. In general, performing a given job effectively can require a number of different competencies. Accordingly, a competency model needs to specify all the competencies essential for a job or a task and lay out each competency in a readily applicable form for various human resource management activities.

A competency model can take on various forms, depending on what the model is for and what stage of human resource development is in need of the model. Table 1 shows the five most commonly used forms of a competency model. This study developed a competency model specifically for project construction team and project control team affairs.

2.3 Procedure for Building the Project Construction Team and Project Control Team Affair Competency Model

Competency is composed largely of obvious qualities, such as skill, knowledge, and attitude, and hidden qualities, such as beliefs, personality, motives, value system, characteristics, and

Table 1. Types of Competency Models

Competency Model	Characteristics
High Performer Model	Built by studying and analyzing characteristics found in high performers but not in ordinary employees
Core Competency Model	Built with core competencies, which are the collection of a company's unique internal abilities and technologies
Process Competency Model	Built on processes for executing a specific business function such as sales, customer service, or distribution
Generic Job Model	A competency model applied generally to a job group. Applied commonly to all jobs belonging to the corresponding job group
Specific Job / Work Model	A competency model required for executing a specific job. Most specific and influential for individuals

mission. In general, companies set goals for such obvious qualities because they are, by definition, relatively easy to evaluate. On the other hand, hidden qualities are hard to change or acquire, and are managed at the stage of recruitment by screening applicants.

The competency model developed in this study included both external and internal competencies and covered the entire process from the stage of recruitment to the stage of operation for construction projects.

In addition, the competency model included basic characteristics necessary for all models. High performer competency models need a group of high performers as a reference group, and a core competency model should be preceded by the understanding of a company's originality. Further, process competency models need to be improved in the company's work process, and a specific job competency model requires a job classification system.

Developing a competency model also requires a competency classification system and a level definition for each classified

competency. In our model, the level definition was similar to job description and used as a criterion for competency evaluation. It was necessary to determine the weight of each competency for competency evaluation, and this weight was used to evaluate an individual or a project by integrating evaluated competencies.

This competency model in this study did not require the creation of a separate classification system because it was formulated for project construction team and project control team affair services, both of which are typical components of construction projects. Conducting a survey study enabled competency classification and weight calculation. Competency level definitions were based on interviews with employees with high performance records.

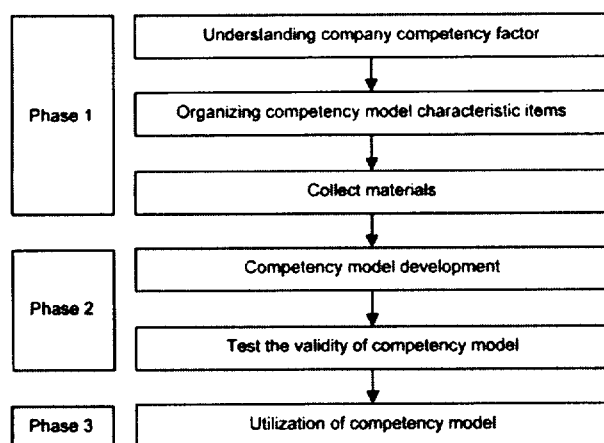
3. Core Competencies of Construction Companies

The core competencies of construction companies can be divided into three main types of competencies; 1) competency relevant to construction ability evaluation, 2) competency pertaining to company evaluation, and 3) competency focusing on intangible asset evaluation. First, core competencies relevant to construction ability evaluation have to do with the necessity of evaluating, a construction company for its construction abilities when contracting a construction work. Due to the characteristics of the construction industry, the evaluation of construction ability is considered as objective and essential information about a company's competencies. In general, evaluation of construction ability includes performance evaluations of previous construction works, management, and technological abilities, which are heavily influenced by the company's performance or financial shape. That is, a company's performance or financial shape does not represent the company's internal competencies. Because the current study focuses mainly on internal competencies in relation to human resource management this study did not include competencies relevant to construction ability evaluation in its model.

Second, the core competencies of a company's operation get evaluated in two ways: 1) evaluation done during the period of raising funds from financial institutions or mutual aid associations, and 2) credit evaluation in order to see if the company has ability to repay its issued corporate bonds. Since evaluations of a company's operation should be objective, many of the evaluation items are related to tangible assets, although a good number of items touch upon the company's internal value, such as feasibility, management skills, and technological power. Thus, the current study included the measurement indexes relevant to company evaluation.

Lastly, major competency items related to a company's members and their jobs are generally evaluated based on intangible assets. The management of such intangible assets is critical to a company's management. The intangible value of a company is generally evaluated through a Balanced Score Card (BSC), Scandia model, and Sveiby model.

Furthermore, the vision and mission of a company are often the necessary element of evaluating intangible assets because



* Rewritten using Park, W. S.(2002)

Fig. 2. Competency Model Development Procedure

they suggest the direction of the company. This study, however, did not consider the vision and mission of a particular company because the purpose of this study was to generalize the job competency model to various companies. Instead, this study examined the measurement indexes of intangible asset valuation for construction companies from a macroscopic viewpoint.

4. Core Competencies of Major Jobs

4.1 Setting the Scope of Core Competency Factors by Job

This study derived common competency factors from general competency models, and derived competency factors for each job from the core competencies of construction companies. In addition, this study derived competency factors for each job based on interviews with high-ranking officials.

This study generated a total of 183 competency items by analyzing four general competency models proposed by scholars and six competency models used by major companies. The general competency models proposed by scholars included about 20 to 35 competency items. On the other hand, most of the models used in companies only have 10 to 14 competency items. This difference may occur because general competency models reflect all possible factors, but those used in companies tend to either exclude many items due to a company's peculiarities or restrict the number of competency factors in order to achieve a more convenient operation.

Because this study used general models mostly when generating the 183 competency items, many items appeared redundant with one another. by using information obtained from interviews with a group of 10 specialists who had carried out project construction team and project control team services at companies for over 5 years, this study identified the redundant items and removed them. Then, this study restructured the competency factors into 36 items and used information from.

As shown in Table 2, this study derived the competency factors of a construction company from the job-based core competencies in construction company's valuation models.

As mentioned above, it was difficult to derive competency factors for each job because the items associated with construction ability evaluation were mostly related to performance and financial conditions. However, by using company evaluations, we were able to derive items such as the development of competent persons, change management, motivation, problem solving, and the utilization of total systems. Job competency items included intangible asset valuation, the development of competent persons, role and responsibility allotment, cost management, technology information collection management, practical application ability, QSE management, customer relation management, and the development of new customers. In this study, as one of major methods for building a competency model, we conducted additional interviews with 10 well performing employees who had over 5 years of experience with their current job.

As a result, in addition to the job competency items derived

Table 2. Job Competency Factors according to Job Characteristics

No.	Competency item	Evaluation model
1	Development of competent persons	Company evaluation, Intangible asset valuation
2	Change management	Company evaluation
3	Motivation	Company evaluation
4	Problem solving	Company evaluation
5	Use of total system	Company evaluation
6	Role and responsibility allotment	Intangible asset valuation
7	Cost Management	Intangible asset valuation
8	Technology information collection management	Intangible asset valuation
9	Practical application ability	Intangible asset valuation
10	QSE management	Intangible asset valuation
11	Customer relation management	Intangible asset valuation
12	New customer development	Intangible asset valuation

*QSE: Quality, Safety, Environment

Table 3. Job Competency Factors for Consideration of Construction Company Core Competencies

No.	Competency item	Reason for adoption
1	Contract Management	Frequent contract changes, such as design changes and ESC*
2	Process Management	Process management centering of the date of completion
3	Public complaint management	Necessity to manage public complainers as major stakeholders
4	Construction experience	Experience with various construction outcomes
5	Image management	Familiarity with various stakeholders
6	Adaptability	Working in conditions different from other industries
7	Presentation Skill	Improvement in customer's understanding
8	Administrative report	Coping with administrative conflicts such as claims by executing official documents

*ESC: Escalation

from the general competency models and company competency models, we derived several new items to incorporate construction concerns such as contract management, process management, public complaint management, construction experience, image management, adaptability, presentation ability, and administrative reporting ability. Most of these items show the characteristics of the construction industry and construction projects and provide a means to improve the applicability of the competency model.

4.2 Deriving Competency Factors by Job

In order to utilize the core competency and job competency factors, we divided the competencies into general competencies,

Table 4. Classification and Groups of Competency Items

Criterion	Classification criteria	Definition	Competency group
Characteristic	General competency	Competency existing commonly in the outside	Thinking ability, personality, self-management, organization management, and organization development
	Special competency	Competency reflecting the characteristics of each job.	Technology, general, project management, customer management, and communication management
Utilization	Internal competency	Competency used in executing individuals' works.	Thinking ability, personality, self-management, technology, general, and project management
	External competency	Competency expressed when interacting with the outside.	Organization development, organization management, customer management, and communication management

special competencies, internal competencies, and external competencies. As shown in Table 4, a total of 10 competency groups were formed based on their characteristics and scope of application.

Depending on their characteristics, competencies were divided into 1) general competencies usable in construction companies' ordinary jobs and 2) special competencies specific to project construction team and project control team affair services of construction projects. This division was expected to be highly useful in making employment or education & training plans based on a company's competency evaluation.

In addition, division of internal and external competencies was based on whether a competency was independently useful and whether it worked through interaction with the outside. Accordingly, internal competencies have a surface characteristic, and external competencies include a partial internal characteristic and are somewhat difficult to manage and develop. This division may function as a criterion for the development of the competencies of existing members and the inflow of competencies from the outside.

This study used the classification criteria and competency groups listed in Table 4 and organized the competency factors into 44 items and 10 competency groups as shown in Table 5.

General-internal competency, which exists commonly in jobs and has a surface characteristic, was composed of 12 detailed competencies regarding thinking ability, personality, and self-management. General-external competency was composed of 10 detailed competencies in the organization development and organization management competency groups. Likewise, special competency, which reflects the peculiarities of a given job, was composed of 12 detailed competencies in the skill, general, project management competency groups and 12 detailed competencies in the customer management and communication management competency groups.

4.3 Calculation of the Weight of Core Competencies by Job

In order to derive and test major (core) competency items for competency factors derived for each job, we conducted a questionnaire study with workers with 5 or more years of experience in the construction industry and 3 or more years in their current job. These workers were sampled from S Company,

which raised US\$11.3 billion in terms of order status in 2007 and was ranked within the top 50 constructors in 'Global Contractors 2007', according to data published by the Engineering News Record (ENR). A total of 211 people responded to the survey, 102 of whom were in charge of project control team and 109 of whom were in charge of project construction team.

The questionnaire was prepared such that the respondents could choose multiple competency items necessary for their job among the competency factors proposed above; the survey was conducted via the Internet. To ensure honest responses, the survey was conducted anonymously with sufficient explanation about its purpose.

We chose job competencies that deviated from the standard deviation of the response rate based on the mean response rate. From the results of the questionnaire study, the mean response rate of the items was 54.952%, indicating that the items exemplified in the questionnaire were in good agreement with job competencies. The standard deviation was 16.508%.

Accordingly, items exceeding a level of 71.460%, which is the sum of the mean response rate and the standard deviation, consisted of four general competencies and eight special competencies in project construction team affair service. Likewise, for project control team service, four general competencies and five special competencies were identified. These items were identified as highly important competencies for job execution.

Judgment, cooperation with other organizations, construction experience, and cost management were all derived as competency items that occurred in both project construction team and project control team affair services. Professionalism, role and responsibility allotment, practical adaptability, QSE management, process management, record management, public complaint management, and persuasion ability were derived as competency items necessary for project construction team affair service. Logical thinking, morality, planning ability, contract management, and bargaining ability were derived as items required of persons in charge of project control team affairs.

This study also set the weight of the derived core competencies for project construction team and project control team affair services. While determining weights for core competencies was not essential for our competency model, weights can be used as a means of improving the usability of the derived competencies in competency evaluation for individuals and projects. The weight

Table 5. Competency Items and Response Rates by Job

Characteristic	Expression	Competency group	Item	Project construction team affair	Project control team affair
General	Internal	Thinking ability	Logical thinking	66.97%	94.12%
			Flexible thinking	69.72%	55.88%
			Judgment	87.16%	81.37%
			Open thinking	33.03%	32.35%
		Personality	Confidence	68.81%	46.08%
			Morality	60.55%	72.55%
			Professionalism	77.06%	65.69%
			Adaptability	47.71%	27.45%
		Self-management	Self-control	44.04%	35.29%
			Physical strength	66.06%	43.14%
			Time management	62.39%	59.80%
			Self-development	51.38%	48.04%
	External	Organization development	Organizational ability	33.94%	36.27%
			Change management	37.61%	39.22%
			Continuous improvement	55.96%	39.22%
			Role and responsibility allotment	71.56%	48.04%
		Organization management	Cooperation with other organizations	72.48%	79.41%
			Teamwork management	68.81%	64.71%
			Development of competent persons	31.19%	18.63%
			Motivation	31.19%	22.55%
Special	Internal	Technology	Technology information collection management	69.72%	49.02%
			Practical application ability	71.56%	57.84%
Construction experience			87.16%	72.55%	
General		Document execution ability	46.79%	67.65%	
		Computer skills	62.39%	66.67%	
		Problem solving	66.97%	46.08%	
		Planning ability	25.69%	82.35%	
Project management		Use of total system	35.78%	66.67%	
		QSE management	81.65%	39.22%	
		Cost Management	77.98%	95.10%	
		Process management	90.83%	67.65%	
		Document management	72.48%	61.76%	
External	Customer management	Customer relation management	44.95%	45.10%	
		Contract management	22.94%	78.43%	
		Image management	33.03%	29.41%	
		New customer development	11.93%	11.76%	
		Public complaint management	77.06%	34.31%	
	Communication management	Bargaining ability	68.81%	75.49%	
		Persuasion ability	77.98%	57.84%	
		Language expression ability	50.46%	53.92%	
		Presentation	28.44%	49.02%	
		Administrative report	33.94%	61.76%	
: Items over 71.460%				12	9

of a given competency item was calculated as a ratio of the response rate over the sum of the response rates for the selected

competency items, as presented in Table 6.

Regarding the results of the weighting calculations, weights

Table 6. Weights of Core Competency Items for Major Jobs

Item	Weight	
	Project construction team affair	Project control team affair
Logical thinking		12.87%
Judgment	9.22%	11.13%
Morality		9.92%
Professionalism	8.16%	
Role and responsibility allotment	7.57%	
Cooperation with other organizations	7.67%	10.86%
Practical application ability	7.57%	
Construction experience	9.22%	9.92%
Planning ability		11.26%
QSE management	8.64%	
Cost management	8.25%	13.00%
Process management	9.61%	
Document management	7.67%	
Contract management		10.72%
Public complaint management	8.16%	
Bargaining ability		10.32%
Persuasion ability	8.25%	
Total	100.00%	100.00%

were distributed between 7.57%–9.61% for the competency items for project construction team affair service, indicating that importance among different items varied little. For the competency items for public affairs, the difference in importance between the lowest weight (9.92% for construction experience) and the highest weight (13.00% for cost management) was somewhat larger. This suggests that compared to project control

team affair services, project construction team depends more on specific competencies and requires higher-level competencies.

4.4 Calculation of the Level of Core Competencies by Job

In order to define the level of the 17 items identified as competencies necessary to carry out project construction team and project control team affair services, we interviewed a group of 10 specialists and subsequently derived the results shown in Table 7.

In this study, the “high” level was used to refer to values pertaining to the top 30% of job performers, “middle” referred to an essential level required for executing projects, and “low” referred to a basic level for executing the corresponding job.

Ten specialists derived a standard grading system according to responsibility and role. This system was created because even in the process of executing the same job, various levels of competency may be necessary according to role and responsibility, and if this variation is not reflected, the target level in the competency model may be either too high or too low. Accordingly, it is beneficial to set the level based on responsibility and role imposed on individual members rather than by position. Thus, as is shown in Table 8, the standard grade of competency was derived according to the role and level of responsibility, dividing individuals into categories of persons in charge and responsible persons.

According to our results, those responsible for project construction team affair services needed ‘high’ grade competency for judgment, practical application ability, construction experience, and public complaint management and ‘middle’ grade competency for other items. The required level of competencies was lower for those who were in charge of project construction team affair services.

In cases where a person must perform roles that implicate him as being both responsible and in charge of construction services, he or she is required to have high-level competencies regarding

Table 7 Grading Core Competencies by Job (Partial Exemplification)

Competency Item	Level	Definition
Cost Management	High	<ul style="list-style-type: none"> • Maximize stakeholders’ profits through managing the cost of projects • Establish plans through environment analyses to cope with likely problems • Analyze, manage, and assess impact of indirect factors such as quality and safety
	Middle	<ul style="list-style-type: none"> • Manage the entire project reflecting likely future problems • High-accuracy estimate-at-completion management • Perform cost management in connection to processes using EVMS
	Low	<ul style="list-style-type: none"> • Analyze factors increasing and decreasing costs; make coping plans • Carry out tasks using total systems • Derive cost-saving factors with respect to unnecessary items
Public complaint management	High	<ul style="list-style-type: none"> • Make and spread standard coping plans for similar cases • Keep the project from the influence of public complaints • Manage the image of the company to maintain a favorable position
	Middle	<ul style="list-style-type: none"> • Establish mutual trust by contacting public complainers • Prevent public complaints by understanding the characteristics of the project • Prevent the recurrence of public complaints by providing feedback for solutions to existing problem
	Low	<ul style="list-style-type: none"> • Resolve public complaints quickly through a standard procedure • Find the causes of public complaints and propose fundamental solutions • Manage key items continuously

Table 8. Standard Grading of Competencies by Job and Responsibility

Project construction team affair competency			Project control team affair competency		
Item	Responsible Person	Person in charge	Item	Responsible Person	Person in charge
Judgment	High	Middle	Logical thinking	High	Middle
Professionalism	High	Middle	Judgment	High	Middle
Role and responsibility allotment	Middle	Low	Morality	Middle	Low
Cooperation with other organizations	Middle	Low	Cooperation with other organizations	Middle	Low
Practical adaptation ability	High	Middle	Construction experience	High	Middle
Construction experience	High	Middle	Planning ability	High	Middle
QSE management	Middle	Low	Cost management	Middle	Low
Cost management	Middle	Low	Contract management	Middle	Low
Process management	Middle	Low	Bargaining ability	Middle	Low
Record management	Middle	Low			
Public complaint management	High	Middle			
Persuasion ability	Middle	Low			

the project.

When individuals with a small number of competency items are responsible for project control team affairs, it was necessary for them to exert "high" level competency in logical thinking, morality, cooperation with other organizations, and planning ability. Similar to project construction team affair services, a

lower level of competency was required for individuals in charge of project control team affairs.

Both project construction team and project control team affair services commonly required the competencies in the areas of judgment, cooperation with other organizations, construction experience, and cost management; however, the types of com-

Table 9. Project Construction Affair Competency Model (Part)

Classification	Competency Item	Definition
Competency model for persons responsible for project construction affairs	Judgment	<ul style="list-style-type: none"> • Maintain various perspectives and macroscopic viewpoints; choose the best • Forecast risk factors and induce consistent decisions by sharing factors among members • Derive common understanding of decisions made throughout the entire organization
	Role and responsibility allotment	<ul style="list-style-type: none"> • Evaluate and improve own works voluntarily • Execute high-level tasks in consideration of connections with other members • Understand other members' works and provide active cooperation
	Cost Management	<ul style="list-style-type: none"> • Manage the cost of the entire project by considering future factors • High-accuracy estimate-at-completion management • Perform cost management tasks connected to processes using EVMS
	Public complaint management	<ul style="list-style-type: none"> • Make and spread standard coping plans for similar cases • Keep the project from the influence of public complaints • Manage the image of the company to maintain a favorable position

Competency model for persons in charge of project construction affairs	Judgment	<ul style="list-style-type: none"> • Understand the fundamental causes of problems, and test the adequacy of decisions • Observe time limits for decision making • Adapt collected information for myself and utilize it as basic information for judgment
	Role and responsibility allotment	<ul style="list-style-type: none"> • Understand fully what is to be done. • Execute a job according to standardized job execution procedure • Maintain smooth cooperation and support with other members
	Cost Management	<ul style="list-style-type: none"> • Analyze factors increasing and decreasing costs; make coping plans accordingly • Carry out tasks using total system • Derive cost-saving factors by considering unnecessary items
	Public complaint management	<ul style="list-style-type: none"> • Establish mutual trust through contacting public complainers • Prevent public complaints by understanding the characteristics of the project • Prevent the recurrence of public complaints by providing feedback for solutions to existing problem

petencies requiring the high level varied with ob characteristics.

5. Development and Validation of a Project Construction Team and Project Control Team Affair Competency Model

5.1 Development of a Project Construction Team and Project Control Team Affair Competency Model

This study proposed a competency model for project construction team and project control team services which can be used in selecting workers appropriate for a job and training them for the job. Competency items were derived for each job, and competency levels were established based on responsibility and role, as shown in Tables 9 and 10.

5.2 Test of the Applicability of Project Construction Team and Project Control Team Affair Competency Model

The established competency model was tested in three ways, as shown in Table 11. Among the three methods tested, this study used simultaneous construct validation to test the established competency model. In order to validate the competency model, we tested 62 people in charge of project construction team and

Table 11. Competency Model Test Method

Test model	Test method
Simultaneous cross-validation	Test if the model can predict the performance of other groups executing the same job
Simultaneous construct validation	Test whether high performers' characteristics are well reflected by evaluating competencies and ranking the participants
Predictive validation	Select or train people by applying the competency model and test whether the people produce high job performance

Source: Kang, M. S. (2004)

project control team affairs working at one of 13 construction sites at S Construction Company, which this study used as the subject company to calculate the weight of core competencies for each job.

The test hypothesized that project (construction work) organization competency would be proportional to the sum of individuals' competencies, and that organization competency would have an effect on project performance. Through the procedure in Fig. 3, the hypothesis was tested by examining the correlation between the measurements of project performance

Table 10. Project Control Team Affair Competency Model (Part)

Classification	Competency item	Definition
Competency model for persons responsible for project control team affairs	Logical thinking	<ul style="list-style-type: none"> • Possess thinking ability for understanding and analyzing experiences in society and identifying likely risks • Maintain integrated power of observation for quick decision making from a macroscopic viewpoint • Suggest logical win-win directors for all stakeholders
	Cooperation with other organizations	<ul style="list-style-type: none"> • Create synergy through promoting works smoothly with other organizations • Induce voluntary support of other organizations by suggesting the scope and direction of works • Coordinate conflicting interests from the viewpoint of the entire organization
	Contract Management	<ul style="list-style-type: none"> • Understand contract-related items juridically and remove ambiguities • Collect reliable interpretations and materials from external specialists • Derive agreements through negotiation under the charge of a contract or conflicting interests
	Bargaining ability	<ul style="list-style-type: none"> • Remove obstacles by predicting stakeholders' interests in advance • Establish principles for coping with difficult obstacles and share them with internal personnel involved • Help stakeholders understand the benefits of negotiation and induce their active participation

Competency model for persons in charge of project control team affairs	Logical thinking	<ul style="list-style-type: none"> • Analyze organic correlation among related information through engineering and mathematical thinking • Maintain various viewpoints and deliberations on likely issues • Establish adequate logic by taking into consideration the stakeholders' viewpoints
	Cooperation with other organizations	<ul style="list-style-type: none"> • Cooperate mutually through full understanding of the company's businesses • Establish an organic business cooperation system by maintaining peaceful relations with other organizations • Establish a system for smooth cooperation
	Contract Management	<ul style="list-style-type: none"> • Carry out contract-related tasks through standard procedures • Suggest solutions for the smooth fulfillment of the contract in a contract-related dispute • Identify risk factors through clear understanding of special remarks
	Bargaining ability	<ul style="list-style-type: none"> • Identify key figures of the opposite party of negotiation and collect information to enhance bargaining ability • Derive various alternatives for drawing out an agreement • Use proper vocabulary and maintain a rational viewpoint during a negotiation

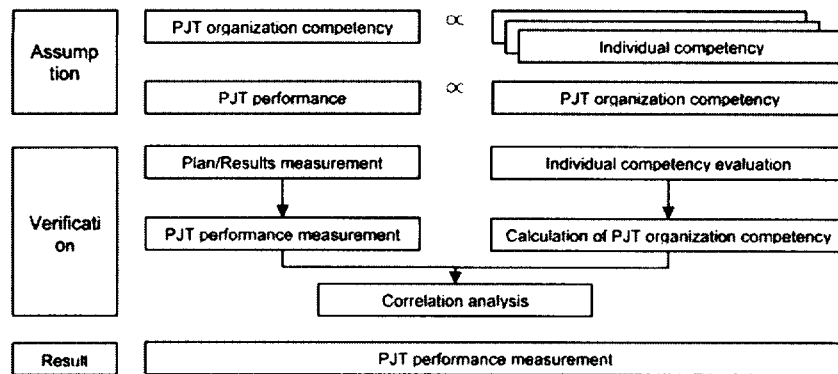


Fig. 3. Competency Model Test Procedure

using plans/results from an organization and the competency of that organization calculated through the evaluation of the

competencies of each employee.

In general, if a substantial amount of correlation exists between two variables, the proposed competency model successfully reflects the competencies necessary for executing the job. In order to calculate the competencies of individual employees and project organization, we scored individuals in-charge of project construction team and project control team affairs at 13 construction sites on a 10 point scale based on standard competency and ranked them according to the score. The results of this evaluation are shown in Table 12.

Table 12. Results of Calculating Organization Competency by Project

Construction Sites	Job	Job competency	Organization competency	
			Score	Ranking
A	Project Construction Team Affair	54.0	66.8	7
	Project Control Team Affair	79.5		
B	Project Construction Team Affair	60.8	69.3	5
	Project Control Team Affair	77.8		
C	Project Construction Team Affair	63.0	71.8	2
	Project Control Team Affair	78.5		
D	Project Construction Team Affair	68.5	61.4	13
	Project Control Team Affair	74.3		
E	Project Construction Team Affair	65.5	79.5	1
	Project Control Team Affair	93.5		
F	Project Construction Team Affair	63.5	63.8	11
	Project Control Team Affair	74.0		
G	Project Construction Team Affair	72.5	64.3	9
	Project Control Team Affair	64.0		
H	Project Construction Team Affair	49.5	62.0	12
	Project Control Team Affair	74.5		
I	Project Construction Team Affair	63.0	66.3	8
	Project Control Team Affair	69.5		
J	Project Construction Team Affair	63.0	67.3	6
	Project Control Team Affair	71.5		
K	Project Construction Team Affair	60.8	70.6	4
	Project Control Team Affair	75.5		
L	Project Construction Team Affair	63.0	64.0	10
	Project Control Team Affair	71.0		
M	Project Construction Team Affair	63.0	71.8	2
	Project Control Team Affair	80.5		

Table 13. Project Performance Evaluation Items and their Weight for S Company

Evaluation	Cost and process	Money collection	QSE	Contribution	Key tasks to be promoted
Weight	45%	20%	10%	15%	10%

Table 14. Results of Performance Measurement for Surveyed Construction Projects

Construction Site	Performance measurement	
	Score	Ranking
A	60.6	12
B	66.9	8
C	67.6	7
D	80.7	3
E	83.4	2
F	79.1	4
G	69.4	6
H	64.3	10
I	65.9	9
J	64.0	11
K	59.8	13
L	75.4	5
M	83.9	1

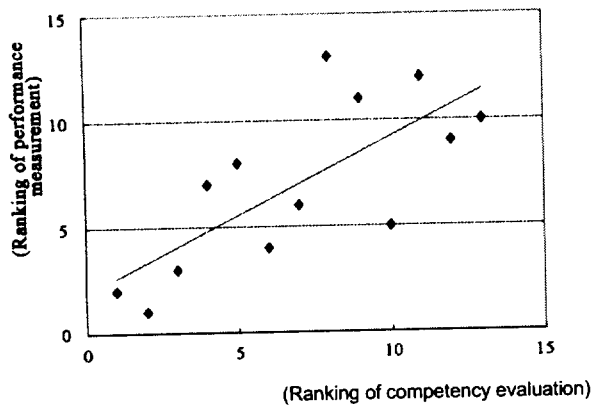


Fig. 4. Competency Model Test Procedure

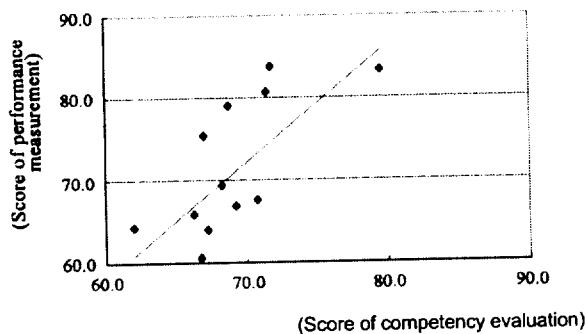


Fig. 5. Correlation between the Competency Evaluation Score and the Performance Measurement Score

In addition, project performance was measured using the weight of project performance measured for S Company, as shown in Table 13. Results were derived for the 13 construction sites and are shown in Table 14.

Based on the results of our simultaneous construct validation process for testing the role model, the competency model proposed in this study for project construction team and project control team services was determined to be valid, as shown in Figs. 4 and 5. A positive correlation was observed between the ranking of competency evaluation and that of performance measurement, as shown in Fig. 4. Further, the Pearson correlation coefficient between the two items was 0.731, which indicates a high degree of association between the two variables.

The correlation between the competency evaluation score and the performance measurement was somewhat less consistent than between rankings, resulting in a somewhat lower correlation coefficient (0.669).

The high correlation between project performance measurement and project organization competency supports the hypothesis that project organization competency is proportional to the sum of the competency of individual employees and project performance. This finding suggests the applicability of the competency model established in this study.

6. Conclusions

The present study developed and tested a competency model for project construction team and project control team affair services in order to provide a basic framework for manpower development and human resource management at construction companies, including employment, education and performance measurement, and organization ability improvement. To this end, we reviewed previous competency model research and derived job competency items for construction companies by administering questionnaire to employees.

Furthermore, through interviews with a group of specialists, we derived the weight of competency items and established a project construction team and project control team affair competency model for construction companies. Then, we tested the validity of this model by analyzing its correlation with the performance of actual construction projects.

The results of this study are as follows:

1. Competencies derived for executing project construction team were judgment, professionalism, role and responsibility allotment, cooperation with other organizations, practical application ability, construction experience, QSE management, cost management, process management, record management, public complaint management, and persuasion ability. Among these competencies, judgment, professionalism, practical application ability, construction experience, and public complaint management required a high-level of competency, which referred to competency pertaining to the top 30% of job performers.
2. Competencies derived for executing project control team affair services were logical thinking, judgment, morality, cooperation with other organizations, construction experience, planning ability, cost management, contract management, and bargaining ability. Among these competencies, logical thinking, morality, cooperation with other organizations, planning ability, and cost management required a high-level of competency.
3. The competency of individual employees affected the organization's competency and, consequently, the organization's project performance.

Information about human resource management of a given company, particularly information regarding evaluations, is confidential. Because of the confidentiality issue, the present study has limitations in building and testing the competency model, surveying cases, and sampling subjects.

In order to overcome these limitations, it will be necessary to form a joint effort among large-size construction companies to develop common competency models for academic and industrial use.

Furthermore, in order to enhance the validity of the model proposed in this study, we need to apply the model to various construction projects and generalize the model accordingly. Empirical case studies should be conducted in order to adapt this competency model for employment, career planning, succession

planning, education and training, performance evaluation and management, and reward management.

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