Comparative Study on Quality Assurance of Construction Project in Taiwan and Japan

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Abstract

Construction project is the foundation of economic development where it represents the index of a country’s development. The degree of its quality relates to national image and further closely related to public life, property and living quality. Taiwan’s construction quality is not yet ideal that they were often denounced by users. How to establish a quality assurance system and implement the quality assurance system for overall upgrading of the construction quality has become a very essential topic. On the other hand, the mechanism of laws and standards related to construction industry in Japan, which ensuring quality is mortgaged to some degree. However, a lot of problems concerning quality occur actually in construction projects. The intention of this study is to probe into the profound attention of the overall construction quality under currently practicing framework of the construction quality control system in order to develop a reasonable quality assurance model suitable to construction environment, social structure, traditions and culture. Moreover, the study is also processed with the comparison and analysis of the quality control operation status and differences of construction projects in Taiwan and Japan. In this paper, the mechanism where the quality problems occur is presented as a failure model. Then, a failure model is compared with the mechanism of ensuring quality under the laws and standards which relate to construction industry in Taiwan and Japan, and the problems of the mechanism of ensuring quality are clarified. Finally, some conclusions and recommendations shall be obtained from the comparison for further improvement of problems solving in order to ensure the advantages toward the construction quality.

Keywords: quality assurance system, mechanism of ensuring quality, construction industry, failure model
1. Background

Construction project is the foundation of economic development where it represents the index of a country’s development. The degree of its quality relates to national image and further closely related to public life, property and living quality. Taiwan’s construction quality is often claimed and unsatisfied by users. How to establish a quality assurance system and implement the quality assurance system for overall upgrading of the construction quality has become a very essential topic. Most of the reasons claimed to the construction quality are ①Market – low pricing in biddings ②Money – insufficient money that constructors should survive with additional projects ③Management – the domination without professional management ④Men – personnel is lack of technical training ⑤Materials – no integration of different working interfaces for various materials ⑥Motivation – apply only used method without any pursuit of innovation ⑦Machine and Mechanization – improper timing of machine and mechanization application ⑧Modern Information – related work plan fails to catch up with the information technical ⑨Mounting Product Requirement – apply lower grade material or process skipping operation.

On the other hand, the mechanism of laws and standards related to construction industry in Japan, which ensuring quality is mortgaged to some degree. However, a lot of problems concerning quality occur actually in construction projects. Most of the reasons claimed to the problems are ①Multilevel subcontractors of design and construction ②Unclear responsibility of design and supervisory ③Ambiguous contract relationship ④Low pricing in biddings weaken the capability of general contractor ⑤Short of training and quantity of engineer and skilled labour.

The intention of this study is to probe into the profound attention of the overall construction quality under currently practicing framework of the construction quality control system in order to develop a reasonable quality assurance model suitable to construction environment, social structure, traditions and culture. Moreover, the study is also processed with the comparison and analysis of the quality control operation status and differences of construction projects in Taiwan and Japan.

2. Quality assurance of building project

As shown in Figure 1, in order to prove the assurance of construction quality, the proper process plan, management of process and correct contents which are compatible with plan are requires. And, the process reflects on the project base may be shown as the model of Figure 2 for the different stakeholder and different project phases. This study is based on the process of Figure 1 and the model of Figure 2 to discuss the concerning topics in Taiwan and Japan.
3. Quality assurance of building project in Taiwan

The regulations on Government’s Procurement Laws Clause 70 (Public Construction Commission of Taiwan, 2007) for the Construction Procurement Quality Control and the regulations as specified in “Quality control system of construction project” for ensuring the construction outcome in compliance with the quality requirement of the design and specifications. This system is processed through the 3-level quality control systems such as the construction quality inspection system executed by the construction authority, the construction inspection system executed by undertaking party (Client) & the supervisory party and the construction quality control executed by the contractor. The framework of 3-level quality control systems is shown as Figure 3 (Public Construction Commission of Taiwan, 2003).
The quality control system of public project in Taiwan can be divided as: construction quality control system, construction quality assurance system and construction quality evaluation mechanism. These 3 levels of quality control are described as follows.

### 3.1 Construction quality control system

For accomplishing the construction quality target, the construction quality control system should be established by the contractor. Prior to construction commencement, the contractor should draft the construction plan in compliance with the project nature and contract requirement, produce construction drawings, setup construction operation outline and propose the quality control plan and establish QC organization. Various items of construction quality control standard, material and construction inspection procedure, self inspection checklist, defects remedy record and document records management system should be established to enable working personnel getting familiar with drawings, specifications and every item of quality control operation regulation for realizing the quality control.

### 3.2 Construction quality assurance system

To ensure the construction outcome of a project in compliance with the quality target of the design and specification, the Client (or Supervisory party) should establish construction quality assurance system and setup quality management (supervision) organization. Moreover, the quality management (supervision) plan should be established for implementing the supervision of construction and material/equipment inspection operation. Further, the inspection result should be recorded for reviewing the efficiency and defect; through sustainable repair and improvement to achieve the target of overall upgrading of construction quality.
3.3 Construction quality evaluation mechanism

For confirming the execution result of the construction quality management, the construction authority should apply construction quality evaluation. The result of the evaluation can be applied as basis for evaluating the authority and it also can be used as reference for improving the contractor’s quality control operation and selection of excellent bidder. Moreover, by convincing the Client (or supervisory party) and contractor’s substantial practice of quality control, it is intended to achieve the target of upgrading construction quality. Project inspection operation should be established with “Construction Evaluation Team’s Operation Regulations” 7). The regulations were established in accordance with the Government’s Procurement Laws Clause 70, Sub-clause 4 and “Project construction evaluation team”. In this evaluation, the team should confirm the process in compliance with the construction quality control system which is relevant to laws & regulations and the requirement of the contract conditions. Further, by referring to the construction evaluation operation reference standards in their evaluation on the items such as construction quality and progress, etc. The major evaluating items to be performed by the Evaluation Team are as follows.

① Quality directing mechanism of the authority, the record of the reviewed supervision plan, construction progress management measures, handling of construction defect and the defect improvement tracing.

② Supervision organization of the supervisory party, the review procedure of construction plan & quality plan, the evaluation procedures and standards of material/equipment random inspection and construction evaluation, quality audit, document record management system from the supervision plan content and executed condition; the executed condition of defect remedy tracing and construction progress supervision, etc.

③ Contractor’s quality control organization, construction outlines, quality control standard, material & construction inspection procedure, self inspection checklist, control of unqualified product or work, remedy & prevention, internal quality audit, document record management system, etc.

④ Construction planning & designing, environmental protection, material & equipment, significant defects of drawings & specifications, necessity of design change, whether the architect, contractor’s professional engineer and quality control personnel perform their obligations in compliance with relevant laws & regulations and contractual requirement, etc.

3.4 Operation procedures of 3 levels of quality control

The implementation of 3-level quality control systems aims at upgrading the construction quality. Effective quality control system should be established for motivating, remedying, preventing the defects of the contractor’s quality control. The content of the establishment are 3 parties respectively as the authority, the client supervision party and the contractor. The operation procedure of the construction quality control systems are as shown in the Figure 4. The construction quality must be independently completed and guaranteed by the contractor, i.e., the contractor must be capable of
processing the quality control system through self inspection, quality assurance, quality directing and quality audit.

Figure 4: Operation Flow Chart of Public Construction Quality Control System
4. Quality assurance of building project in Japan

Basically, the concept of quality assurance in Japan is different with that in Taiwan. The law is stipulated concerning with the area of economic behaviour to secure the product’s process is correct in Taiwan. But, Japan lays the stress on the professional activities and responsibility as shown in Figure 5.

The Figure 4 of the Taiwan’s stipulation may explain to pay attention on the lower portion of Figure 1, and Figure 5 of Japan’s stipulation may explain to pay attention on the upper portion of Figure 1.

<table>
<thead>
<tr>
<th>Design</th>
<th>Construction</th>
</tr>
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<tbody>
<tr>
<td>Tender Document</td>
<td>Tender Document</td>
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Figure 5: Regulations of Japan in construction phases

4.1 Construction quality control system

Basically, the quality control system of Japan follows the stipulation of Building Code, Technical Specification and Project Plan, and has the same concept of the quality assurance system with tedious checks by multi-level subcontractors. As shown in Figure 6, the quality control of project is one example executed in jobsite due to the Building Code, Technical Specification, Project Plan and the guideline of project participants’ contracts which may describe the relationship of instruction, design drawings and shop drawings. But the structure of tedious checks by multi-level subcontractors also may cause the ambiguous contract relationship and unclear responsibility of all parties. This situation
also makes the fails of product’s quality as the final result of the example of Figure 6 (Hirano and Furusaka, 2008).

**Figure 6: Descriptive failure model of construction quality**

### 4.2 Construction quality assurance system

A multi-level subcontract to secure the quality of construction project is not only used by general contractor, but also by design office. As shown in Figure 7, the number of multi-level subcontracts may be 3 or 4. This situation makes the complicate communication and information delivery among main contractor and subcontractor. And, the coordination and delivery method become very important to all participants. This quality assurance system is compatible with the regulation system as shown in Figure 5. Actually, the specialization of construction professionals is a normal situation in construction industry of Japan. But, it also leaves the problem to client who may not know how to handle this vague project environment.
5. Comparison of analyses

5.1 Topics of Taiwan

(1) Professional work division

Insufficiency of information and technical exchanges among professional engineer, QC personnel and supervisory engineer make the difficulty to integrate difference of drawings in jobsite and immediate remedy coordination. Site instruction of architect during the construction enables a probe into whether or not the designing, planning are easy for construction. But this system should be identified at early stage of designing & planning for preventing the conflicts between the drawings and site construction.

(2) Personnel training

The good or bad of quality depends on “manual” execution. Therefore the self inspection of the contractor at the first level of quality control system is the key factor of successful upgrading of construction quality.
(3) Site Inspection System of Private Construction

Review of working manpower to increase supervision responsibility may be contracted to architect and professional engineer to go to the site for inspection and certification, but related incentive or penalty should be stipulated for binding and demand their enthusiastic execution.

(4) Legalization and stipulation of private sector’s 3-level quality control system

A set of quality control of public project related laws & regulation should be established for private project, and quality control of private project also should be maintained in uniformity in order to enable each quality management more systematic.

5.2 Topics of Japan

(1) The structure of multi-level subcontract in design and construction

As mentioned above, the structure of multi-level subcontractors may cause the ambiguous contract relationship and unclear responsibility of all parties. Also, it is very difficult to describe the failure model and to find out the causal effect of poor quality.

(2) Unclear boundary of design and supervisory

There is very clear concept for professional definition in the Building Code of Japan, but it is intended or not intended to neglect in the real project. On the other hand, low pay for design and supervisory compared other country also makes the uncompleted design document be used until construction commence. Sometimes the designer should use design fee to compensate the short of expenses of supervisory phase.

(3) Ambiguous contract relationship of participants

The long-termed relationship business in the construction industry of Japan creates very unique contract environment. Basically, few participants look seriously to the contents of contract and own very strong knowledge concerning with contract.

6. Conclusion and suggestion

This study made the comparison of different concepts on quality assurance of construction project in Taiwan and Japan. In Taiwan, the process may be concerned as important due to the quality is the issue of law level, but not commercial level. But in Japan, the qualification and who is in charge may be concerned as important due to quality is the issue of social coconscious concerning with skill tradition and mutual reliability of participants. There are still some problems should be clarified in the future study.
1) Who should take the responsibility and make the quality plan?

2) Who should make sure the property of quality plan?

3) What is the method to make sure the property?

4) What is the complete description of the failure in quality assurance?

5) What are the solutions of these failures?

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