

# Sharing roles and responsibilities of construction project delivery methods in Taiwan

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## Abstract –

**This study explains the procurement of construction projects for public and private in Taiwan firstly. And introduce a complicate project delivery system of PCM (Professional Construction Management) which combine pure CM and Design-Build and defined by Government Procurement Act of Taiwan. This project delivery method widely used for large engineering projects and clients who have little experience of construction projects. Then the relationship of the participations was used to illustrate the sharing roles and responsibilities of project delivery methods in Taiwan. The framework of management in execution level is examined completely in case study. Finally, the deficiencies of this system will be discussed in conclusion for the reference to improvement of other systems.**

## Keywords –

**delivery method; PCM; procurement; roles and responsibility**

## 1 Introduction

This study explains the procurement of construction projects for public and private in Taiwan firstly. And introduce a complicate project delivery system of PCM (Professional Construction Management) which combine pure CM and Design-Build and defined by Government Procurement Act of Taiwan. This project delivery method widely used for large engineering projects and clients who have little experience of construction projects. Then the relationship of the participations was used to illustrate the sharing roles and responsibilities of project delivery methods in Taiwan. The framework of management in execution level is examined completely in case study. Finally, the deficiencies of this system will be discussed in

conclusion for the reference to improvement of other systems.

In Taiwan, the governmental agencies that are responsible for making policies and systems to the construction industry can be roughly classified into two groups. The first group plays as owners, who perform as the clients for asking engineering professionals to conduct planning, design, and supervision jobs, constructors to construct facilities, or professional construction management (PCM) to act as a technical substitute or surrogate of owners in ascertaining their interests during the project delivery process. The ministries of Transportation and Communication, Economic Affairs, Education belong to this group. Every ministry may have specified necessary technical codes (such as specifications of materials and scale magnitude, composition of materials, or tested methods and criteria) for the construction companies to deliver the facilities they need.

The next group plays as the policy maker, or designer and regulator of the systems for the construction industry. The Public Construction Committee (PCC) of Executive Yuan and the Construction and Planning Agency (CPA), Ministry of Interior fall into this group. PCC is primarily in charge of the regulations of engineering professionals (including professional engineers, professional engineer firms, and engineering consultant companies), Government Procurement Law, and Promotion of Private Participation. The regulations of constructors and architects, and buildings are conducted by CPA.

## 2 Budget introduce process of Public project

On the national budgeting basis, PCC will review all the proposals of public investment of construction facilities, either buildings or civil works, by checking the necessity and budget amount of the required facilities. As shown in Figure1, basically it is very

similar to most of projects. Feasibility study is necessary in plan stage, especially economic efficiency is enough to project is going or not going. The fundamental design and detail design should have complete information to revise the preliminary budget of plan stage, and to set up the contract budget. One another important job in design stage is to get the construction permit by regulation. The major issue in construction stage is to make sure every activity in site is fully the requirement of contract document. Finally, the supervisor should assist the client to inspect and survey the project is acceptable, for client can complete the project.

Basically, in public procurement, there are three ways to issue the bid.

1) Open tendering procedures: the procedures under which a public notice is given to invite all interested suppliers to submit their tenders.

2) Selective tendering procedures: the procedures under which a public notice is given to invite all interested suppliers to submit their qualification documents for pre-qualification evaluation basing upon specific qualification requirements and, after such evaluation, the qualified suppliers are invited to tender.

3) Limited tendering procedures: the procedures under which, where no public notice is given, two or more suppliers are invited to compete or only one supplier is invited for tendering.

And, there is little different to select the contractor in Public Procurement and Private Procurement.

The principles of awarding contract in Public Procurement are as bellows.

1) The Lowest Bid with government estimate: the lowest tender within the government estimate.

2) The Lowest Bid without government estimate: the lowest tender within the budget amount.

3) The most advantageous tender: may or may not consider tendering price when evaluating, tenders are allowed to submit tenders for construction work, property, and services with different qualities.

4) Multiple award: awarded to different renderers by different items or different quantities

The lowest bid is the major type of awarding contract.

Normally there is only one type of awarding contract in Private Procurement. The tendering procedure is invitation bid in generally, and principle of awarding contract is the most advantageous tender for client.

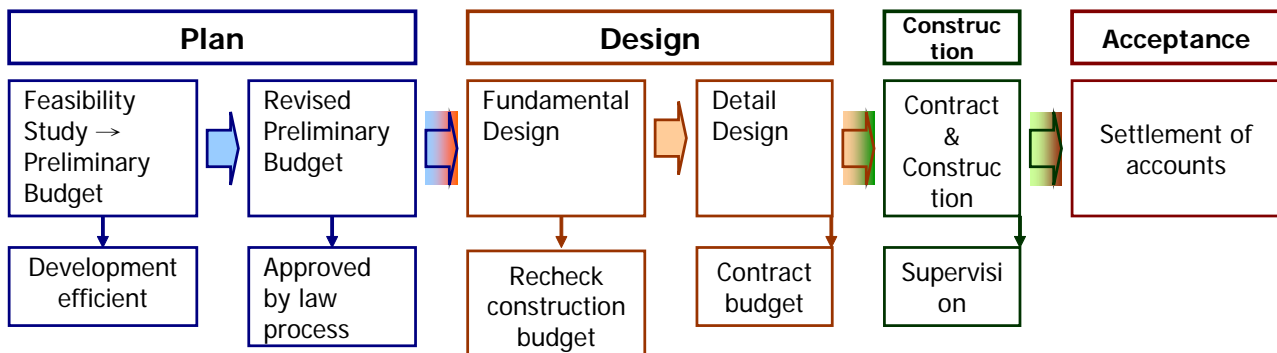


Figure 1. Budget introduce process of Public project

### 3 Sharing roles and responsibility in PCM

The major construction companies in Taiwan include: architect firm, professional engineer (PE) firm, engineering consultant company, construction company (contractor), PCM firm, and developer company, as listed in Figure 2. An architect firm shall have at least one registered architect. Several architects can jointly run an associate architect firm. If necessary, an architect firm can hire in-house professional engineers for conducting specified technical works such as structural engineering

works. Otherwise, the structural engineering works have to subcontract to other PE firm or engineering consultant company. PE firm shall have at least one registered professional engineer, while engineering consultant company shall have many registered professional engineers with different professional expertise so that the engineering consultant company can provide services that are matched with the expertise areas of the professional engineers. PCM firm shall hire engineering professionals who have same qualifications as that required for architects or registered professional engineers.

Construction company (contractor) shall have at least one registered professional engineer in the areas of civil engineering, structural engineering, hydraulic engineering, survey engineering, geotechnical engineering, environmental engineering, or architect. In order to operate its business, a constructor company has to hire registered professional engineer who has practical experiences of more than 2 years. At construction sites, constructor companies must hire a chief site manager, who has related engineering background and taken a training course designed by CPA, is responsible for all the activities. Quality control engineer is also required at the construction sites to make sure the desired quality is

fulfilled. The registered professional engineer of a constructor company is primarily responsible for the issues of technical and safety at the sites. All the professional engineers at the sites must follow the process requested by government, conduct tests on materials specified in construction codes, and fill out necessary documents for recording construction details. The main professional service is interface management, including the interfaces of cost, schedule, quality, etc. The main technical services may have building, civil work, mechanic, electric, plumbing, elevator, lighting, security, landscape, Eco. Certification, etc.

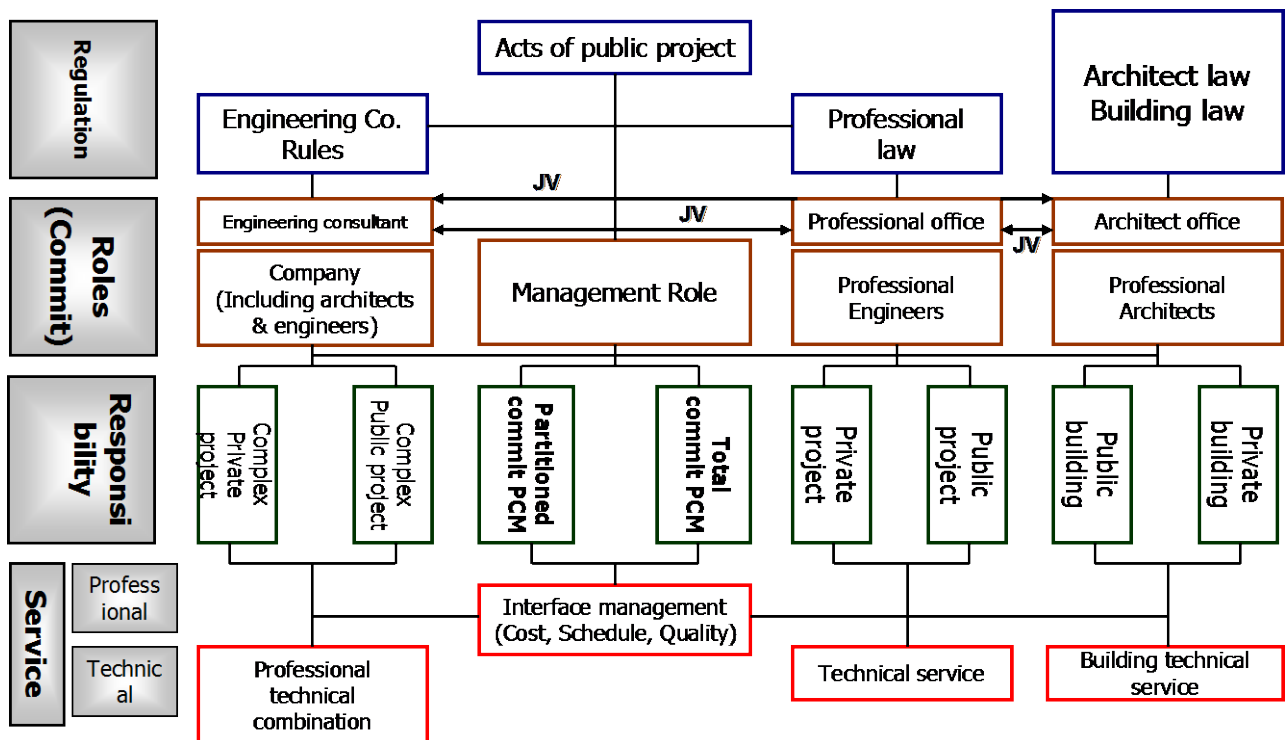


Figure 2. Sharing roles and responsibility in PCM

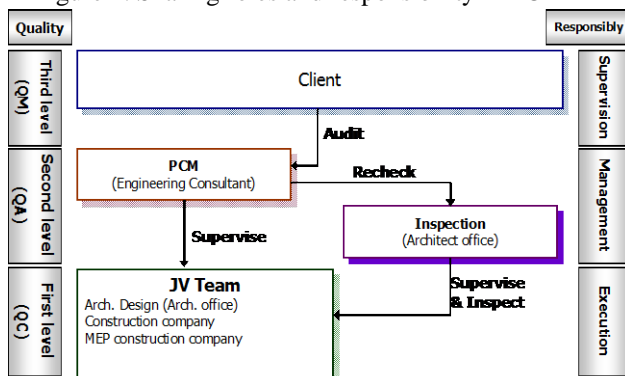


Figure 3. Quality management in PCM

For example the quality management in PCM delivery method is implementation of 3-level quality control systems aims at upgrading the public construction quality. Effective quality control system should be established for motivating, remedying,

preventing the defects of the construction company's (contractor's) quality control. Three levels of public project quality control systems are established to enhance public construction quality control. The content of the establishment are all parties respectively as the authority, the client supervision party, PCM, architect inspection and JV team ( design architect, construction company, and MEP construction company). Their construction quality controls are as shown in the Figure 3. The construction quality of public projects must be independently completed and guaranteed by the JV team, i.e., the JV team itself must be capable of processing the quality control system through self inspection, quality assurance, quality directing and quality audit. The target of contractual construction quality shall be completed under such a system.

For confirming the execution result of the construction quality management, the construction authority should apply construction quality evaluation through a very objective manner. The construction

quality's degree of good or bad should be determined according to the appropriate quality evaluation standards. 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". The regulations were established in accordance with the Government's Procurement Laws Clause 70, Sub-clause 4 and "Project construction evaluation team" shall be stipulated according the laws. In their evaluation, the said team should process in compliance with the construction quality control system announced by the Public Construction Commission, Executive Yuan, relevant 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 etc 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 measures, internal quality audit, document record management system etc. in the quality plan content and execution condition; the execution condition of construction progress management, catch up plan, safety/hygiene & environmental protection measures etc.

4) Construction planning & designing, ecological 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.

#### 4 Case study

As shown in Figure 4, the case study is a complex building with 11 blocks of public project. The site area

has 77,667 M2, and the budget is 5.7 billion NTD. The JV (joint venture) team should complete geotechnical, structure (RC), finish for exterior wall and interior partition, basic mechanical/electrical/plumbing, and facilities of site landscape.



Figure 4. Introduction of case study

The schedule, shown as figure 5, from land acquisition, realize project requirement, boring investigation for earth condition, basic design for construction permit, detail design for coordination with electric/fire/communication/water/sewage system, approval for issue the contract to commence the project, inspection for project completion, and to handover is 1170 calendar days. The main project participations, shown as figure 6, are client, PCM, supervisor and contractor (JV team). As shown in Figure 2, this delivery method has very complicate relationship for all participations. But the major roles in the framework of management are PCM and supervisor. Because the PCM involve in the project on very early stage. And settle the management system for project which will be executed through the project. The framework of management is also developed by this management system. The supervisor plays as the role of inspection architect, whose rights and obligation are stipulated by Building Code and Architect Law, but not by Government Procurement Law. The conflicts of these regulation systems also make the defects of sharing roles and responsibilities of this delivery system. The framework of management and these two major roles will be discussed in detail to illustrate this delivery method. And, the deficiencies will be discussed in conclusions.

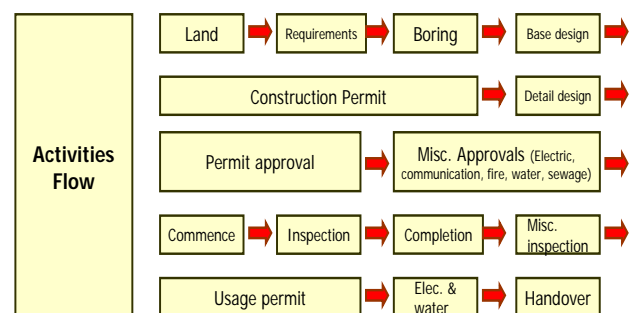


Figure 5. The main activities of case study

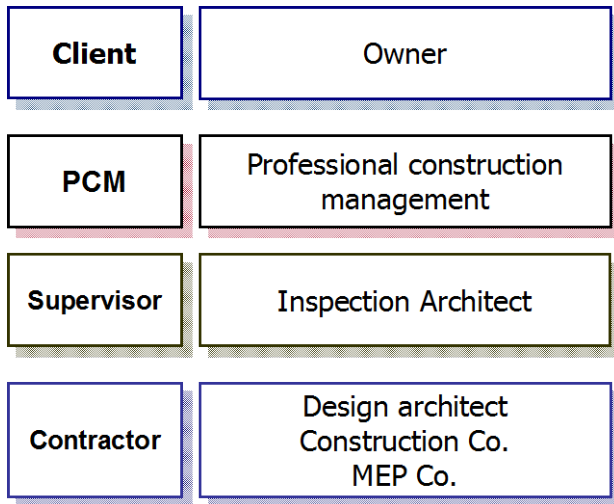


Figure 6. The main project participations of case study

settle the management system for project, to assist the client selecting contractor, to manage the construction of contractor, and to coordinate the building handover. From the view of time series, PCM should settle management system for project to review design drawings, specification & budget, inspection plan of supervisor, approval flow of material & equipment, etc. And coordinate with client to make the decision whether issue the contract or not. In contract stage, PCM should review the proposals from contractors, and decide which contractor is proper to client, then coordinate with client to sign the contract. A lot of activities which are supervision, approval, execution, review will be processed concurrently to reach the objectives of project. Which objectives are concerning with cost, schedule, quality, and safety. The most important responsibility of PCM in construction stage is to coordinate designer and contractor to produce the completion drawings, then to get the usage permit. Finally, in handover stage, PCM should coordinate other participations to handover the project and complete records for client.

#### 4.1 The main responsibility of PCM

The main responsibilities of PCM in case study, shown as figure 7, are to get the charter from client, to

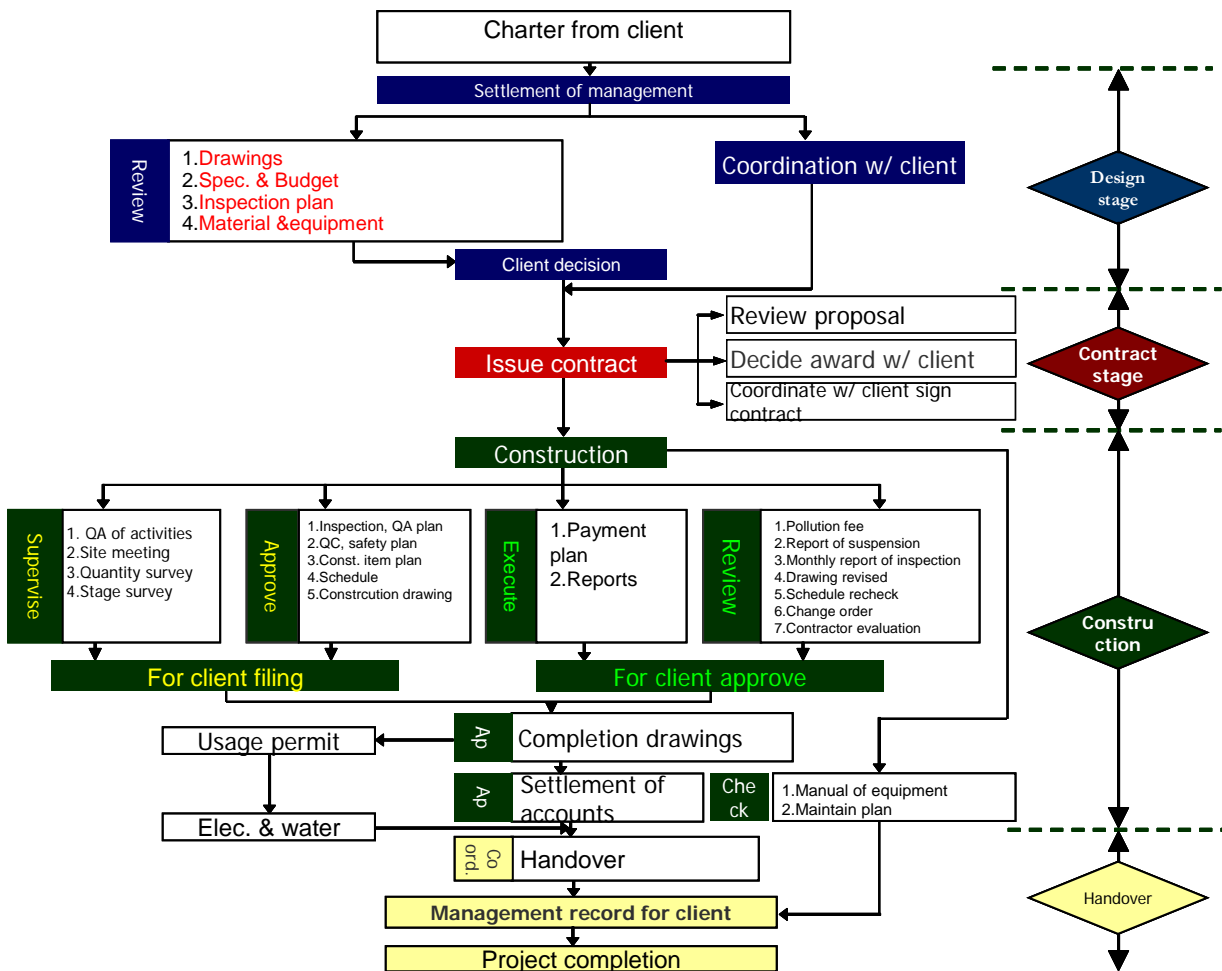


Figure 7. The main responsibilities of PCM



## 4.2 The main responsibilities of inspection architect

The main responsibilities of supervisor in case study as shown in Figure 8.

1) Providing inspection plan and bid document to explain quality assurance and information to estimation for contractors. And client can issue the bid and sign the contract in order to commence construction project and inspect construction activity.

2) Setting up the regular meetings which explain the details of project in order to build mechanism of project control through Q&A of specification and drawings, and coordination of interfaces among the contractors or subcontractors. In the same time, reviewing the construction method, construction plan, quality management plan, etc.

3) Structuring the document review system with other project participations on the principles of review then inspection, efficient and effective.

4) Making the conscience with client, PCM, user, contractor and inspector to realize the work standards for

contractor, subcontractors, suppliers, specialists. And expedite the materials and equipment can be inspected then used in the job site.

5) Drawing out the major working items to discuss the construction method for the details of construction processes & checkpoints, quantified management for quality control and tracing & control base on concurrent management.

6) Inspecting the deficiency of activities and recoding on construction & inspection reports to require improvement.

7) Collecting the record document and rechecking the site condition to assist the client survey the real quantity of working items then asking client to sign the payment.

8) Constructing the working flow of change order to deal with conflicts between client and contractor rationally, completely and effectively. And making effort to tell the clear story of whole project for every party, in order to make the completion inspection smoothly.

9) Assisting the client to accept the project according to the specification and drawing, and handover to settle the account and make sure this project can be operated immediately.

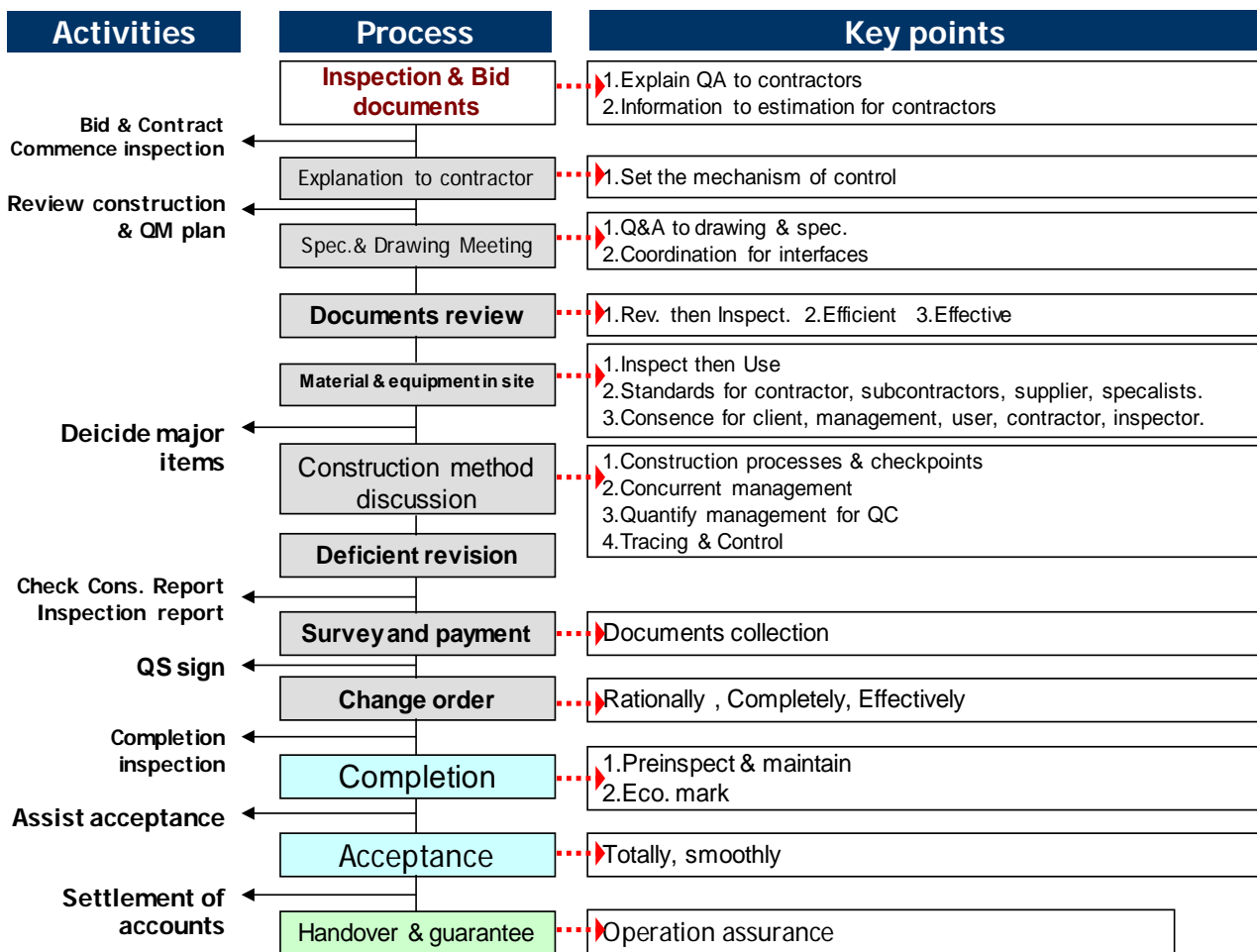


Figure 8. The main responsibilities of inspection architect

### 4.3 The framework of management

The framework of management for construction, shown as figure 9, basically is for quality assurance, quality control, surveying, and payment. The processes consist with review then inspect, inspect then use, construction inspect, and revise for every activity, material, equipment etc. used in site.

1) The main purposes of review then inspect are to make sure of the qualification of contractors, subcontractors, suppliers, etc., and review the construction drawings & plans. The tools may have review list, activities & QA process & list, weekly examination and monthly control. The frequency will be depended on the schedule of production and inspection of materials or equipment. Normally, the proposals or samples should be submitted two months before construction in site.

2) The main purpose of inspect then use is to realize the construction team, including contractors, subcontractors, suppliers and specialists. The tools may examine the ability of production, supply, construction method, etc. to build up the standards of inspection. The frequency will be different in working items, including civil works, architecture works, MEP works etc.

3) The main purpose of construction inspect is to do quality assurance of supervisor and contractor. The tools may have quantified management using spread sheets with quantity and weight division of working items, inspection mode whether complete or sampling, management mode from mobile to trust.

4) The main purposes of revise are to stipulate the time of improvement and to prevent the repeat deficiency. The tools may have control improvement from payment, engineer in chart for improvement, household control in finish stage and record deficiency & difference in handover for guarantee.

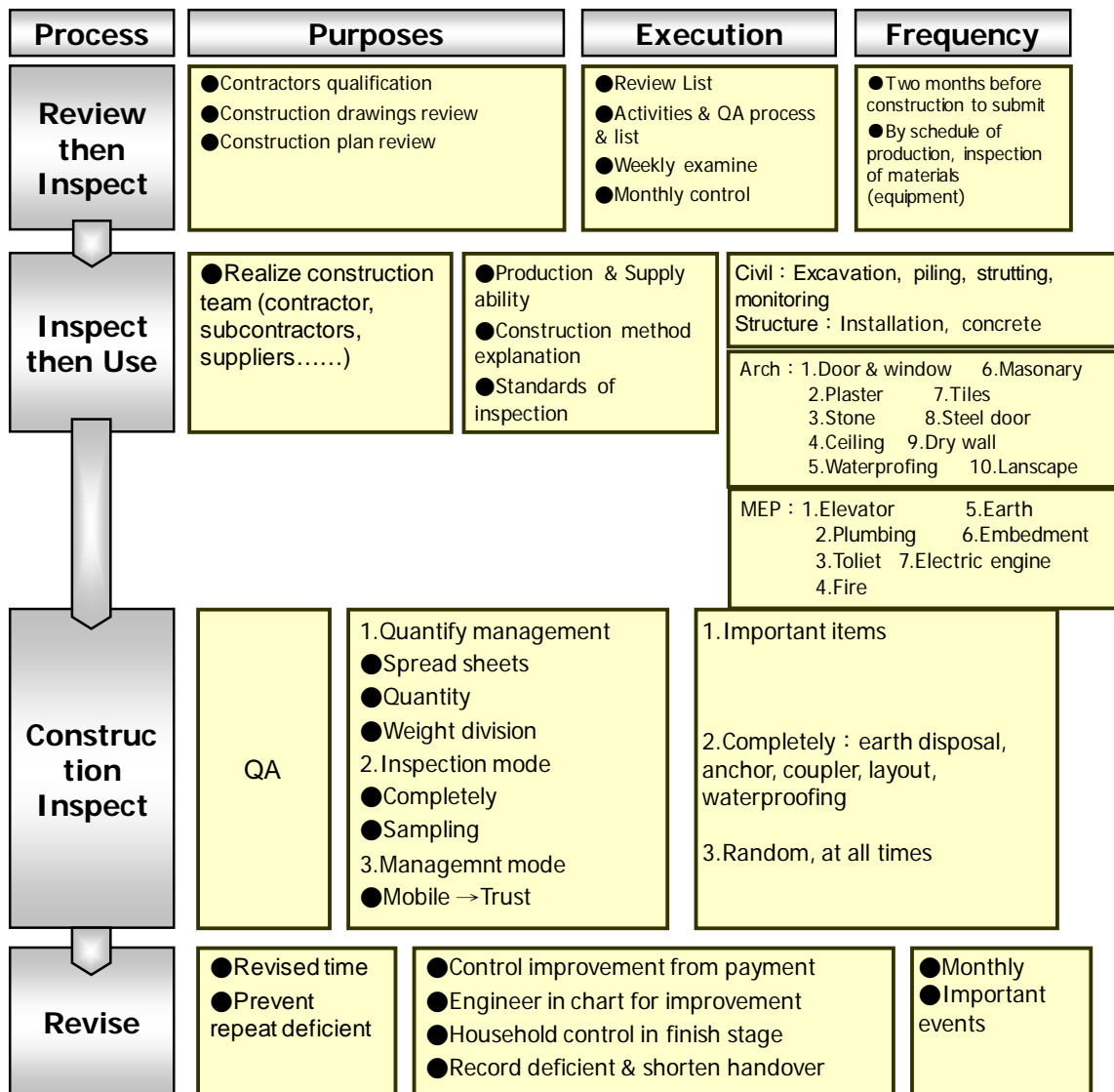


Figure 9. The framework of management for construction

## 5. Conclusions

As described before, the PCM project delivery method is widely used large engineering projects and clients who have little experience of construction projects. But the complicate and huge relationship of project participations and conflicts of professional law and Government Procurement Act make the confusion and ambiguous of sharing roles and responsibilities in this project delivery method. And this paper may mark some conclusions as below.

1) The combination of pure CM and Design-Build defined by Government Procurement Act of Taiwan.

2) The providing the three levels management, especially for quality management to large engineering projects and clients who have little experience of construction projects.

3) But, extending the management process of project and increasing the interfaces of roles/responsibilities of project participations.

4) PCM may positively take over the role of inspection & supervision, but on the contrary, PCM may reluctant to take the responsibilities because the role conflicts with architects.

5) PCM may only response the views of client, and neglect reasonable processes, professional judgments, dispute treatment, etc.

## Acknowledgment

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