CHAPTER 3

Research Background and Problems

3.1 Introduction

This chapter focuses on the project background, current project management practice of the case company, and problems and solutions for the current problems. Firstly, project background of the company is discussed to have a better understanding of what type of projects the company is dealing with. Secondly, discussion of the current project management practice which focuses on project planning, scheduling, and resource allocation. Lastly, the problems that are currently happened in the areas discussed in the second step and recommend the theoretical tools and techniques which can be used to solve the problems.

3.2 Background of the Project

The project is a part of the construction of water treatment plant in western province of Bangkok. The project was being offer to public to bid and the bidding was won by a company who then subcontracts the mechanical and electrical installation out. The case company then won the bid for mechanical and electrical installation. The whole project of constructing water treatment plant includes civil works and mechanical and electrical installation works, however the case company is only responsible for supplying materials and installation works. The case company divides the project into two parts which are mechanical and electrical.

3.2.1 Materials Supply

The materials supply for the project is divided into mechanical installation and electrical installation materials supply. The price of materials for mechanical is about 45 million baht from the estimation. The price is considered to be around 50.5% of the

mechanical price. The material supply for electrical is estimated around 16 million baht or 65.3% of the electrical price.

3.2.2 Installation Works

The installation works can be calculated from the labor hours multiply by labor rates. Installation work for mechanical is estimated at 44 million baht or about 49% of the mechanical installation price. The installation work for electrical is about 8.5 million baht from the estimation or about 34.7% of the electrical installation price.

By summing the mechanical and electrical together, the total project value is around 115 million baht. The ratios of material supply to installation works for mechanical is almost identical however for electrical, the ratio is around two-to-one. However, this is the proposed price or bid price for the company. As the project progresses, the scope of the project has been reduced. The project value after the change has been reduced to 38 million baht. The reduction in project value comes from reduction in scope on both materials and installation. The company must adapt and change the schedule according to scope change.

3.3 Current Project Management Approach

The current project management approach for the company is shown in the table and details below.

Table 3.1 Current Project Management Approach

No.	Activities	Definition of Activities
1	Study basic design and scope of Work	- Study basic design and scope of work - Survey the location - Gather the information at the site and other sources
2	Prepare bidding	- Produce materials take-off, manpower, and Equipment - Set up work schedule - Study draft contract on engineering and payment condition - Submit construction question to the project owner - Fill tender form
3	Bid negotiation	- Negotiate with project owner in pricing and technical term
4	Receive contract	- Receive and sign the awarded contract
5	Mobilization	- Construction of site office, store yard, and lay down area - Materials take off and prepare Bill of Quantity (BOQ) for construction and procure-ment purposes - Engineers set up work schedule, S curve, and material schedule - Produce organization chart - Set up construction area - Check engineering design, data sheets, drawings, and specifications - Perform the project accounting
6	Construction management	- Assign construction work, procurement - Assign sub contractors - Build up work progress report - Project monitoring
7	Construction completion	- Project handover and demobilization

3.3.1 Study basic design and scope of work

This step includes survey the location and gather the information at the site and other sources. This step also includes studying the bidding documents and the feasibility of the project. As mentioned earlier, the project is owned by government unit, therefore the company does not have to create the project themselves. The scope and some basic designs are being offered to the bidder (contractor) which then have been given to the case company (subcontractor). After received the bidding documents, the case company studies the documents and related materials. The case company also sets up project initiation meeting to facilitate the project.

3.3.2 Prepare bidding

After having studied the project thoroughly, now the company is ready to prepare for the bidding. The first step in bidding preparation is to produce material take-offs, including manpower and equipment. This step in producing take-offs is considered to be very important and it also takes a long time to complete. The reason for being very important is because the take-offs will be used in calculating the total costs of the project and later used to prepare the bid price. Inaccurate take-offs could result in losing the bid because the price is too high or accepting to do the project at a loss because the price is too low. Another activity in prepare bidding is set up work schedule or it could be call the work breakdown structure. This work breakdown structure can be generated after carefully studying the scope of the project and knowing exactly what to do and when. While preparing take-offs and producing work schedule are done by the engineering team of the project, studying draft contract and payment condition is being carried out by the commercial team. The commercial team is in charge of contacting the contractor and suppliers. The commercial will also direct any questions regarding the technical aspects to the contractor, fill out the tender form, and put together bidding documents.

3.3.3 Bid negotiation

After submitting the bid to the contractor, the commercial team, senior management, and project manager is in charge of negotiating the bid price with the

contractor. At this step, the company has negotiated with the contractor to scale down the scope of work. The result is the project value has been reduced to around 39 million baht.

3.3.4 Receive contract

The company was selected by the contractor to be mechanical and electrical installation subcontractor. Both the contractor and subcontractor then study the contract, drafted by contractor, and sign it.

3.3.5 Mobilization

Mobilization means construction of site office, store yard, and lay down area. The mobilization lasts for a month then the project team can move to the site office. During mobilization, engineers have to do the material take-offs again. This time the take-offs will be used for bill of quantity (BOQ) and procurement purposes. The take-offs should not be much differed from the first one because this could mean profit or loss to the project. Engineers also sets up work schedule, s-curve, and material schedule. The commercial is responsible for constructing an organization chart which is shown in figure 3.1, while accounting prepares the project accounting or cash flow statement.

3.3.6 Construction management

Once the construction is ready to set off, project manager should assign construction work, procurement, and subcontract according to the work schedule. Work progress report is put together by the commercial team and is delivered to the contractor monthly.

3.3.7 Construction completion

At the end of construction, the case company hands the project back to the contractor and demobilizing.

Above are the steps that company has taken in managing the mechanical and electrical installation project. Now the details of what are the current practices of project

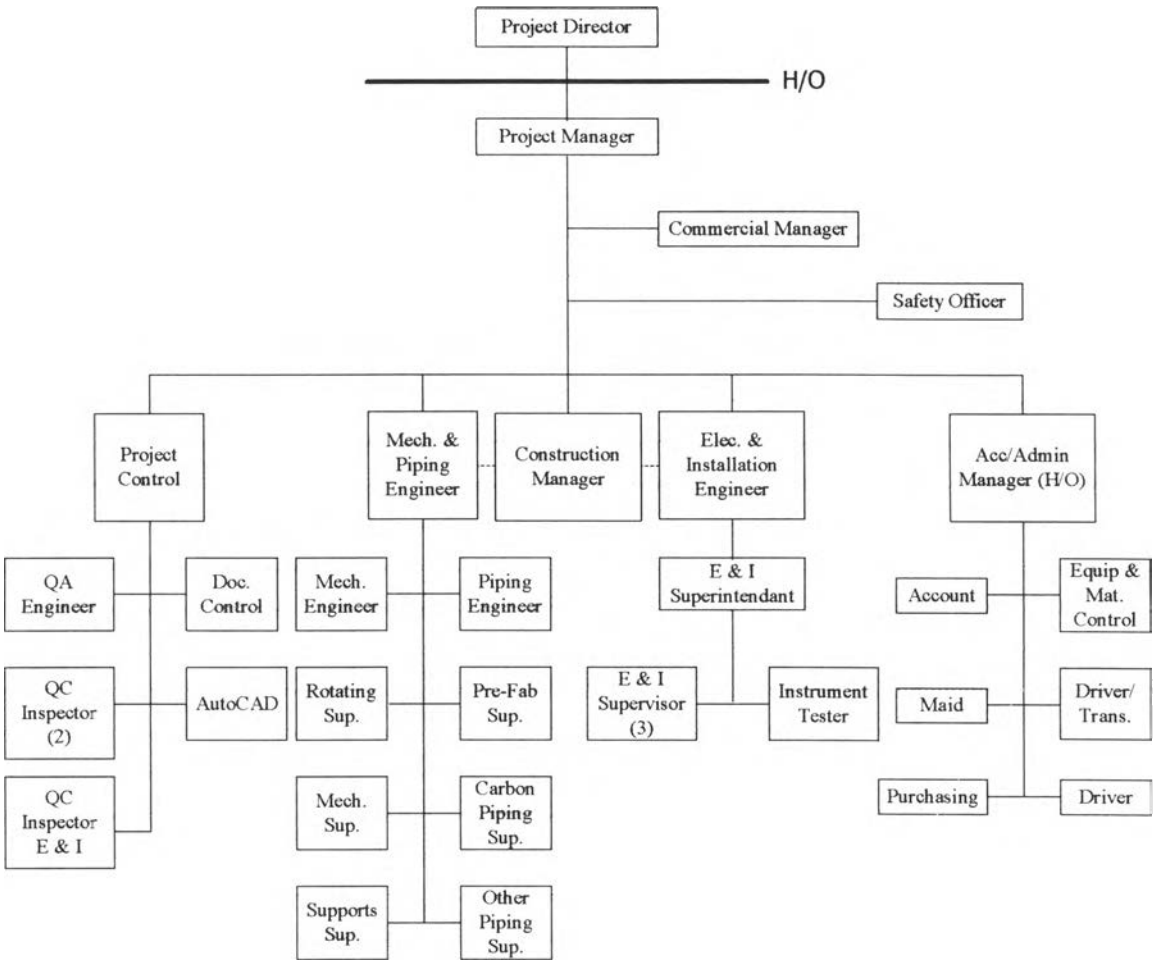

Figure 3.1 Company Current Organization Chart

planning, scheduling, and resource allocation for this project and the current problems are approached.

3.4 Current Problems in Project Planning

According to the steps in managing projects of the company shown above, the project planning lies in both step 1 study basic design and scope of work and step 2 prepare bidding. The company is not concerning with designing the project because the scope of the project is already given by the contractor. What the company has to do in the planning phase is to study the scope and prepare for the bidding.

3.4.1 Study basic design and scope of work

The very first step in all the steps in managing project for the company is to study basic design and scope of work of the project. Once the company received the bidding documents from the contractor, they need to study the documents thoroughly, this step is also known as feasibility study. The bidding documents normally contain scope of work, basic designs and drawings, qualifications for bidders, contract, and other related documents. The scope of work and drawings are divided into sections in which they are assigned to those who are responsible, for example mechanical engineers, electrical engineers, etc. The commercial department is in charge of studying the contract and making contact with the contractor. An internal project initiation meeting is set to take place to divide the works.

3.4.2 Survey the location

During the study of scope of work and drawings, engineers might need to go to the site to get the feeling and gather some more information. The information received from the survey will be used in material take-offs.

3.4.3 Gather the information at the site and other sources

While surveying the site, surveying team, which might consist of engineers, gather the information needed for material take-off as stated earlier. At the same time, the firm might need to consult other sources for necessary technical and commercial information. Examples of this information could be the technology used in the project or geographical characteristics of the location which can be obtained from local government.

3.4.4 Produce material take-off, manpower, and equipment

Using gathered information, engineers are now able to produce material take-offs. The process of producing take-offs is based on historical information and engineers' experience. If there is an activity that has never been done before, then the company

needs to consult outside source for the information as stated earlier. Then, this take-offs will be used in calculating the bid price.

First of all the company produces the material take-off to see how much materials do they need for each activity. Then the manpower and equipment can be calculated. While doing that, the company has generated a list of equipment that they already have. After the take-offs are finished, the company now have the action plan or work breakdown structure of the project. The WBS will be used to schedule the project in scheduling process.

3.4.5 Study draft contract on engineering and payment condition

The draft contract is part of the bidding documents received from the contractor. It contains the information involving engineering and commercial requirements. On the engineering side, the company has to verify the procedures and requirements so that it is practical. For the commercial, payment condition is most important. The company has to know when will they get pay so that they can plan the work accordingly.

3.4.6 Current Project Planning Problems

The planning process involves everybody namely management, project manager, engineers, accountants, commercial manager. Everybody does his or her job as they were assigned but it seems like there is no coordination between departments which results in unproductive time and extra cost. The planning process will be more efficient if everybody gets together and plans together.

Many authors have only given guidelines or steps in planning the project in which they will be discussed later in the chapter. WBS and responsibility matrix are example of tools that can be used during the planning period. The company has created and used its own version of responsibility chart which proves to be complicated to read and not very practical. The current responsibility chart is shown in figure 3.2.

Lacking good planning for the case company also generates problems for scheduling and control areas. With the project management process developed along with supporting information system, it is hopeful that the company can achieve better planning in the future.

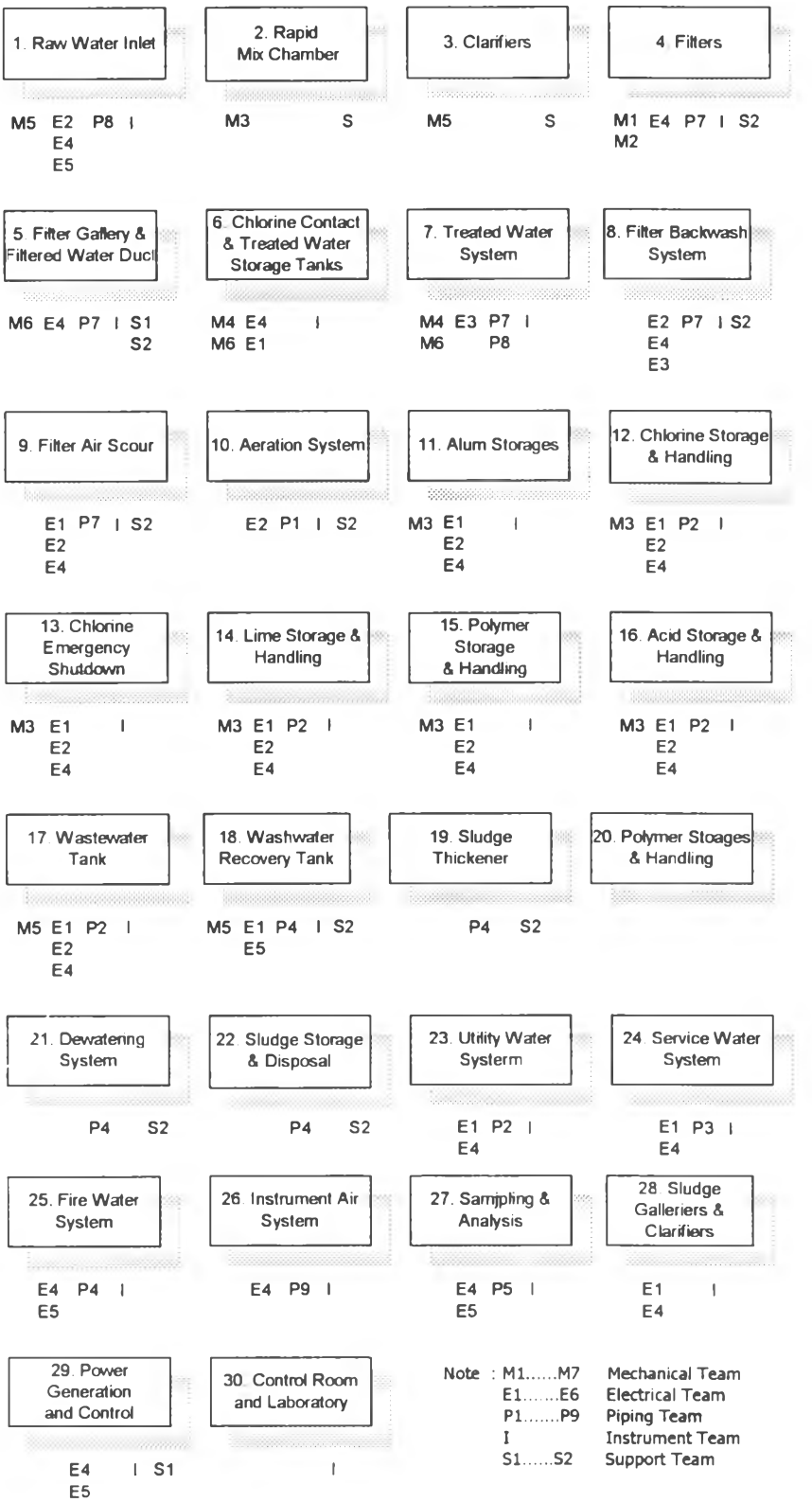

Figure 3.2 Company Current Responsibility Chart

3.5 Current Problems in Project Scheduling

The project scheduling takes place in both step 2 prepare bidding and step 5 mobilization. It could be said that in step 2 the schedule is only preliminary or a guideline. The schedule is generated by engineers who are using WBS and schedule from previous project as guidelines. Microsoft Project is used to fill out each activity and generate Gantt chart.

Current Project Scheduling Problems are the followings. The company is currently unable to use project management software to its fullest. One of the problems is that the company does not have planners who can plan and able to make use of the project management software. There are many techniques for project scheduling available that the company is not using. Examples of these techniques are PERT, CPM, precedence diagram, and GERT. The full-use of project management software and scheduling techniques can control both time and cost for the company.

Another problem that the company has been facing is there is no communication between the contractor and the company. The major area involves in this problem is access areas. It has been the case that sometimes the company has not been granted access to some areas by the contractor when it should. This problem can solve by improve communication between the contractor and the company so that they can synchronize their schedules to the greatest benefits.

It is apparent that currently the company is not paying enough attention to scheduling while it is very important to the project. At the end of this research, a template for scheduling will be generated and hopefully the company can make use of project management software more effectively.

3.6 Current Problems in Resource Allocation

The resource allocation for the company is done according to the WBS and the schedule. The company does not plan for resource allocation problem that could happen during the project. The resource is assigned to each task or activity when the material

take-off was produced. Therefore, the company knows exactly what and when resources are required but they do not know if there were conflicts between allocated resource.

Resource allocation is one of the major problems that company is facing today. The reason behind that is, again, the company does not have any tools or methods to manage resource allocation.

There are tools and techniques such as resource loading and resource leveling that could be used to see if the resources were overused and balance the resource usage over the project. Techniques such as mathematical programming and heuristics are also available for the company to use in scheduling and resource allocation.

3.7 Applying project scheduling and resource allocation tools and techniques to the case company

In order to apply tools and techniques to the case company, it is more convenient to combine the scheduling and resource allocation together. In project scheduling and resource allocation, tools to help in scheduling and allocating resources in the project have been discussed. The area of focus here is probably project scheduling since the company seems to have major trouble in this specific area.

3.7.1 Project scheduling and a time and cost control

The first problem of the company is not able to control both time and cost of the project. For the time aspect, the root of the problem seems to come from the lack of communication between the contractor and the company itself. This problem will be discussed in detail later.

For the cost control, a scheduling techniques such as PERT or CPM can help the company in keeping track of the cost and control the budget. In Microsoft Project, resources can be entered when we create the schedule so that the cost can be allocated.

CPM or critical path method is another tool that can be very helpful in monitoring time and cost. This is because CPM allows the company to see the trade-off between cost and time. Examples of the use of CPM can be such as:

- The company is approaching a deadline and they want to speed up the work so they crash the project to reduce the time but the cost might be increased.
- The company is running ahead of the schedule so they might want to use the benefit of slack of the activities to reduce cost.

These are just two examples of how scheduling techniques can help control time and cost for the case company.

3.7.2 Better communication via project scheduling

As mentioned earlier, the company is having a problem from lack of communication with the contractor. The real example is when the case company has prepared materials, equipments, and labors to do the work as schedule, but they were not granted access to the work areas. This results in extra cost and delay to the case company. Project management can help solving the problem by linking the contractor's schedule and the case company's schedule together. This means that the contractor will be able to keep track and know the progress of the case company and vice versa. The contractor and the case company can also use project management software and scheduling tools to create a common schedule where both of them can follow so that it will be easier for both the contractor and the case company.

3.7.3 Resource loading and leveling

With project management software and scheduling tools and techniques, the case company can take advantage of resource allocation techniques which can be helpful for the company. There are two main types of resource allocation problem, resource limited and time limited. The company must know which type of the problem they are dealing with so that they know exactly how to tackle the problem. In real life situation, the company has dealt with both resource and time constrained situations. In a resource constrained environment, the company needs to complete the job as soon as possible with limited resources. For the time constrained, the company must finish the job within a given timeframe while using as few resources as possible. Currently, there are many techniques available in dealing with resource allocation problem and a few of the techniques has been discussed above.

3.8 Conclusion

This chapter has discussed the background of the project, current project planning and problems, current project scheduling and problems, and current resource allocation and problems. In the next chapter, a system will be designed based on theories discussed in chapter 2. The system will attempt to solve the problems presented in this chapter.