



Applying activity-based costing in managing  
the projects of a construction company: a case  
study of JDG Rakennus Oy in a project with a  
private client Phi&Phi Oy

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While most contractors are more familiar with technical and mechanical work in the field, they are recommended not to underestimate and eliminate management accounting tasks. Otherwise, they may face poor performance in cash flow and lack reliable data to deliver proper decisions. This thesis is created to optimize the costs in a construction project by applying activity-based costing.

The concept of activity-based costing is a key knowledge base of the thesis. From studying how such a concept can resolve problems in traditional costing methods, the author develops a costing implementation plan that adds value to construction projects. The results generated are utilized for project management purposes in the case company.

A qualitative method was chosen as the research method and case study as the research strategy. Data was collected through semi-structured interviews and analyzed using a thematic method. The thesis is project-based, and its result is a user-friendly guideline to build an activity-based costing system in a small construction project. The guideline is illustrated and tested through practical data of the case company JDG Rakennus Oy in a project with a private client Phi&Phi Oy.

The insights received from applying the new costing procedure in the guideline can help the case company to evaluate cost performance in each management area and estimate a better budget for future projects.

Keywords: construction industry, activity-based costing, management accounting, project management.

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## 1 Introduction

Besides construction operations, which are main tasks in a construction company, the business aspect plays an integral role in the success and prosperity of the firm. Such aspect includes managing the information system, controlling financial data, interpreting accounting procedures and evaluating the task accuracy. (Schleifer, Sullivan & Murdough 2014.) Although most contractors, who are often also owners and managers of the firm, have technical background, they are not entitled to be irresponsible for the accounting operation of the company. While they can be more familiar with concrete pouring and structural steel erecting, they should be equipped with decent knowledge and education to select, manage and analyze data system. (Clough, G. Sears, S. Sears, Segner & Rounds 2015.) That does not necessarily mean that the company's construction executives are responsible for generating and completing accounting and financial work. An accountant can be outsourced to follow suit. However, top managers of the firm should acknowledge the basic logic and investigative reasoning to make sensible decisions and evaluate the results performed by accounting personnel. (Schleifer et al. 2014.)

Regardless of the industry type, management accounting and financial functions are indispensable activities in demonstrating and guiding the performance of the company. This thesis focuses on designing a new system for the case company to utilize and improve its management accounting efficiency.

Chapter 1 represents the background, objectives and values that the thesis brings to the case company.

Chapter 2 concentrates on explaining the knowledge base used to develop implementation plan. Key concepts and theoretical background are clarified in this chapter.

Chapter 3 shows the thesis management method, data collection technique and analysis method. A summary of company interview is reported in this chapter to ensure the thesis coherence, enabling better understanding for next chapter.

Chap 4 is the implementation plan shown as a guideline in seven steps to apply activity-based costing model in construction project. Data collected and observed from current project is illustrated as an example to test the plan performance.

Chapter 5 is the space for evaluation and discussion from the author and the case company.

## 1.1 Background

This section is introduced in two parts, the project and author backgrounds.

### 1.1.1 The project backgrounds

JDG Rakennus Oy is a construction company located in Vantaa, Finland. The company specializes in renovation with high quality and safety. Most of its customer are large construction companies. The firm usually works on the contract as a big project which usually lasts more than 6 months. Besides, it also signs several contracts to serve private clients in Metropolitan area. In the beginning of 2020, JDG had an agreement with Phi&Phi Oy, a private customer, to renovate a location in Punavuori area, Helsinki. At that time, a project team is formed to carry out the whole process that satisfies the customers' demand. There are seven people in the core team who implement the project. The roles include project manager, master builder, main builder, helper, designer and architect. Since the schedule is tight and the project manager needs improvement in the project administration, he opened a position called accounting manager for student to join as a thesis worker.

From the middle of January 2020, I participate in the team to manage and develop management accounting for internal use in private client cases. As I am in my final year at school and seeking for a thesis topic. I decide to be a thesis worker in this construction project. The purpose of the research is to create a platform or system to record, analyze and evaluate the project capital budgeting and profitability performance.

### 1.1.2 Author's background

My major at school is accounting and finance. I have completed most of related courses with high grades. Moreover, with the passion in accounting system and business strategy, I also seek for knowledge in advanced finance and business intelligence tools. My previous internship as a management assistant also provides me with decent competences in dealing with Finnish tax and accounting policy system.

This thesis is a great opportunity for me to apply what I have learned to develop an easy-to-adopt costing system that works and brings visible results for the case company. Construction industry is quite fresh for me at first, but I find it interesting and useful to get to know. Especially, I have a chance to work in a construction project. This enables me to get familiar with the industry and people characteristics in the field.

## 1.2 Project scope

The thesis project concentrates on optimizing construction project costs of the case company. As mentioned before in the background, the case company has two types of project. The small project offered to private clients is focused in this thesis.

The project manager would like to gain more insights for decision making on costs and he wants to begin with the internal costing system in small project first. Moreover, the big project usually takes over six months to complete. Such timeline does not fit my learning schedule at school.

The specific part to be addressed is the indirect cost in construction project. The concept of activity-based costing is applied and analyzed to serve managerial purposes.

## 1.3 Project benefits

The thesis is project-based work. The insights generated from thesis implementation plan support the project manager in evaluating current project. Moreover, the key benefit lies on the guideline of specific steps taken to improve costing system and procedure execution of the project team. New concept of activity-based costing is introduced to fix the drawbacks of traditional costing method.

With clear use of costs through the suggested costing system, the company owners and managers can estimate future project better and make more convincing decisions related to cost control. After some discussions on the company situation, the project manager also agrees that the thesis topic can support positively in enhancing the management performance.

Working in this thesis project also enables me to deepen my knowledge in accounting and broaden my horizons in construction industry.

Moreover, the guideline and results generated in this thesis are useful references for other construction project with similar characteristics.

## 1.4 Construction industry in Finland

In 2018, there are 198 thousand people working in construction industry in Finland (Statista 2019). The number has witnessed an increasing trend since 2015. According to YTN 2020, there are more than 3200 people employed as senior positions in the industry. Approximately 1500 senior employees work in the most common sector, which is building construction. The construction product industry and civil engineering have 850 and 340 senior staffs, respectively. (YTN 2020.)

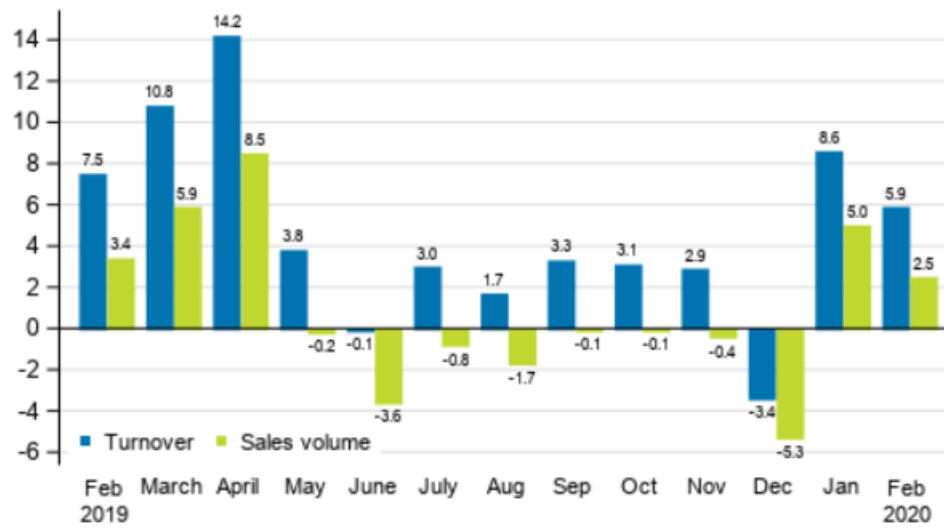


Figure 1: Annual change in working day adjusted turnover and sales volume of construction, February 2020, %  
(Statistics Finland 2020)

Figure 1 illustrates the annual growth in turnover and sales volume of construction industry in Finland from 2019 to 2020. In February 2020, the industry turnover sees a rise of 5.9 percent compared to same amount in February 2019. There is also an increase of 2.5 percent in the sales volume. (Statistic Finland 2020.)

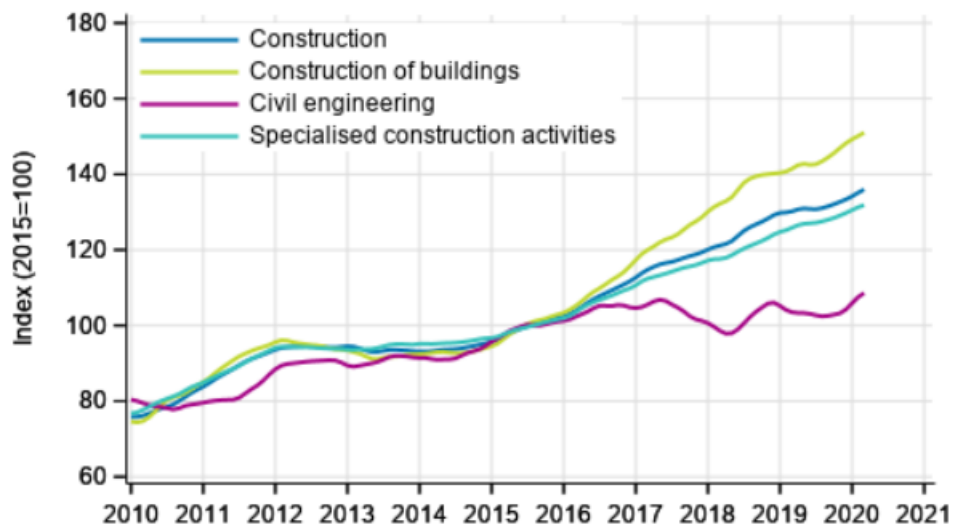


Figure 2: Trends in turnover of construction by industry.  
(Statistics Finland 2020)

Taking 2015 as a base year, as shown in figure 2, the turnover index among different sectors in construction industry generally shares a rising trend. The biggest sector is construction of buildings. Following that are construction, specialized construction activities and civil

engineering. (Statistics Finland 2020.). Although civil engineering constitutes the smallest part in the overall industry, its growth is the highest in 2020 and in the next few years. According to Ministry of Finance 2020, because of a huge investment in transport infrastructure management, the civil engineering sector is predicted to rise by 1 to 2 percent (Ministry of Finance 2020).

#### 1.5 Case company: JDG Rakennus Oy

JDG Rakennus Oy was established in 2013 by John Edward De La Cruz-Grefalda, owner and CEO of the company. Its business ID is 2588895-8. (Finder 2020.) In 2019, two new members join the board to carry out expansion plan of the company. They are Joseph De La Cruz-Grefalda and Le Minh Quang Nguyen. The company focuses on renovation work. Its main customer are larger construction companies. The firm also serves private client on demand.

Phi&Phi Oy own a premise in Punavuori area, which they would like to renovate. JDG has agreed to form a small project team to conduct the work offered. This short-term construction project is treated as a case project in the implementation plan of this thesis.

## 2 Theoretical background to apply activity-based costing in construction company

### 2.1 The importance of having an effective accounting and costing system

According to Clough et al. 2015, there are external and internal reasons on why to have accurate financial records. In terms of external ones, it is required by law to report payrolls, expenses and taxes to the government or tax authorities. Moreover, the company is expected to provide enough financial statements for other stakeholders such as bankers, insurance companies, lenders or other public agencies. (Clough et al. 2015.) In relation to internal factor, the financial record system supports the company on its own management. The accounting system should be designed for the firm to utilize its available capital to the most optimal extent. That is what management accounting mainly focus on. Without purposeful records, and the clear guidelines to maintain and develop these records, the owners and managers are unable to deliver reasonable decision through profound financial base, or to acquire proper equipment amount, or to keep a smooth cash flow for the business. Another essential role of management accounting is to analyze and summarize the information and data recorded. Valuable insights can be generated from data analysis so that the company can not only evaluate current situation but also plan more properly for the company success in the future. (Clough et al. 2015.)

(Clough et al. 2015.) The company is free to choose the accounting and recording system that they find most suitable for their business situation. There is a set of fundamental regulations and procedures on doing accounting for common construction business worldwide. The incomes and expense of construction projects will be recorded separately with the expenses on office operations. In other words, the construction projects are treated as profit centers. According to Clough et al. 2015, profit center includes a combination of activities that can be evaluated separately as either profit or loss. (Clough et al. 2015.)

There are two basic accounting methods: cash method and accrual method. The method chosen in accounting can affect the way of analyzing and managing data received later. While cash method is widely used by small companies, accrual method is more common for most of other companies. The key difference between these two methods lies in timing of when expenses and incomes are realized (Morah 2020). The cash method centers on recognizing immediate transactions and is easier to create. On the other hand, the accrual method is more complicated and focuses on anticipating expenses and revenues. The accrual accounting method is considered as a healthier system for the company because it takes into account the receivable income and payable items.

In a construction firm, the costs estimated in a contracted construction project are treated as initial budget for that project. As the project is carried out, actual costs are incurred and recorded. Within the project life cycle, related reports and summaries are generated to compare

real costs with the project budget. At this post management analysis activities are followed to create proper management actions for the project success.

The accounting procedures and policies within a construction company should be established to prevent the firm from possible failure caused by the lack of accurate, timely and detailed data. A structure for defining and updating the records, an instruction on updating related documents and a proper training must be created, developed and maintained to support the cost control system and to serve managerial purposes.

## 2.2 Types of costs in a construction company

- Business resources

Before categorizing types of costs, a general definition of costs is introduced. Alex 2012 stated that it is not possible for the word 'cost' to be understood when it stands independently. Cost is interpreted along with a specific product, activity or service. Institute of Cost and Work Accounts refers cost as the "measurement in monetary terms of the amount of resources used for the purpose of production of goods or rendering services" (Alex 2012). In general, there are three elements in costs, which are material, labour and other expenses. In construction industry, costs elements can be classified in more details categories. According to Fang and Ng 2011, Kaplan and Cooper 1998 indicated that different resources of cost elements were used during the construction logistics process. Such resources are divided into 5 groups, namely, materials, labour, facilities, equipment, property and capital (Fang & Ng 2011).

- Direct and indirect costs

There are several ways to divide costs into distinctive categories, based on different criteria and usage purposes. One of the most common method is to classify costs into direct and indirect costs. The method is established on the traceability of costs on cost object. The term 'cost object' refers to any item or entity that needs cost measurement. (Griffin 2017.) For example, cost objects can be products, services, activities or projects. Direct costs in its generally accepted definition are the costs that can be traced to a cost object in an economically feasible way (or in a cost-effective manner) (Horngren, Datar & Rajan 2015). Within the construction context, direct costs are understood as being traceable to a specific construction task or to a unit of production in a task (Kim 2017). The costs of labor, materials and equipment are typical examples of direct costs in a construction project. They are directly incorporated into the construction job.

Indirect or overhead costs are relevant to a cost object but cannot be attributed to that object in an economically feasible way (Griffin 2017). The act of using a specific method to

assign overhead costs to the cost object is called ‘cost allocation’. When applying to construction accounting, overhead costs regard to the consumption of logistics resources that support the performance of direct construction activities. (Kim 2017.) To illustrate, the salaries of the project architect and designer are sorted as overhead or indirect costs of the construction project.

<b>Home office overhead (General overhead)</b>		Employees
		Facility and utility
		Others
<b>Construction costs (Project costs)</b>	<b>Project overhead costs</b>	Employees
		Facility and utility
		Others
	<b>Project direct costs</b>	Direct labour
		Direct material
		Subcontractor
		Equipment

Figure 3: Cost structure of a construction company. (Kim 2017)

The figure above illustrates the cost structure of a typical construction company whose revenue equals the total sum of all construction projects revenue. Overall, the firm must cover two main costs, which are the home office overhead costs and construction costs from projects. Each project cost includes project direct costs and project overhead costs. It is noticeable that there are two different types of overhead costs. The first one is general overhead costs of the company, the second one lies in the indirect costs of project activities.

- Duality in overhead costs

The diversity of overhead costs indicates a vague manner in types of cost in construction industry. The same cost can refer to a direct cost of a cost object and an overhead cost of another object. According to Holland and Hobson 1999 in Kim 2017, the cost classification in construction industry is not standardized (Kim 2017). Depending on various perspectives and business situation, each company has its own definition and application on costs term. Moreover, one of the reasons why construction industry does not have a standard cost types is that the cost classification is usually identified by project contracts. For example, if the contract agrees on reimbursement of all direct costs, it is reasonable for the firm to record more items or more percentage of work done as direct costs of the project.

- Roles of overhead costs

Because this thesis project focuses on the proper use of overhead costs in construction project, specific goals of managing overhead costs should be defined in advance to ensure that the used method and results meet initial purposes. In short, overhead costing system play two essential roles in the company cost management. First, the system should equip the company managers with accurate data on cost objects. Second, it should contribute to cost reduction without losing necessary values. (Kim 2017.)

To be specific, accuracy on cost objects depends mostly on overhead costs. The overhead cost accounting system should be established to enhance preciseness in every chosen cost objects of the company. A construction company can define cost objects on their own, basing on different purposes. In general, cost objects may be projects in the firm, to which general overhead costs are allocated. Effective allocation of general overhead costs to each construction project is essential for generating actual profit and loss of the company. Owners and managers are more likely to find where the money is spent. Moreover, precise information on profit also provides contractors valuable insights on marketing strategies. For example, the firm knows which areas are more profitable and more suitable to concentrate on. When negotiating or dealing with customers, such insights can support the company in building and maintaining reliable relationship.

On the project level, cost objects can be work divisions or work tasks so that the owners can evaluate management performance of the project. Accurate calculation on overhead costs of project activities enables managers to deliver better project budgeting. Therefore, the company can be more competitive when bidding in the market. Although most construction firms are applying a certain percentage ratio on different project types, in accurate allocation on overhead costs lead to unreliable or distorted cost structure that may lead to unexpected results and make the company less competitive gradually.

The second function of overhead cost management is that it should contribute to cost reduction without sacrificing the added values the company need. This is an essential role of overhead cost allocation that managers should be aware of to evaluate the company costing performance. The fieldwork on site is supported by overhead cost activities. Overhead costs of a typical construction project include planning and scheduling cost, inspection cost, training costs, to name just a few. According to Kim 2017, there is little space to cut down on direct costs of a construction project, especially when the contract in is fixed-cost type. However, the idea of trying to reduce overhead costs without proper logic is also ineffective. The matter here is to identify each overhead cost activity that consumes overhead resources and to assess whether such activity adds needed values to the project. In other words, managers need to be careful when cutting overhead costs in a manner that will not lose any necessary values of the business.

## 2.3 Comparison between traditional and activity-based costing methods

### 2.3.1 Traditional costing method

A costing method is defined by the process of assigning resources to cost objects. Every construction company is trying to calculate and manage its overhead costs in an effective way. Not only the overhead cost tracking is required for management, but it also provide necessary information to analyze project profitability. The commonly used accounting method in the industry is introduced in this sub-section. Available problems of this traditional method are indicated before the concept of activity-based costing is presented in the next section.

Overall, most companies in construction industry apply traditional costing method in a way that resources are consumed directly by the cost object. According to Miller 1996 in Kim 2017, such method is called one-stage costing allocation (Figure 4). The overhead costs are allocated to products or services directly. (Kim 2017). To illustrate, one construction company runs on 3 projects at a time, each project represents a cost object. Three types of main resources are labor, material and management costs. Resources are attributed to each project as they occur. The result received does not demonstrate process view because the costs are resource-based, not process or activity-based. Some companies also make a further step to allocate overhead cost to each project. This is to have a more precise pricing information. However, allocation is followed by using one single overhead cost rate. For example, many companies assign overhead costs based on direct material cost percentage. Not only does this method provide inaccurate project costs but it also has the potential to distort the cost structure.

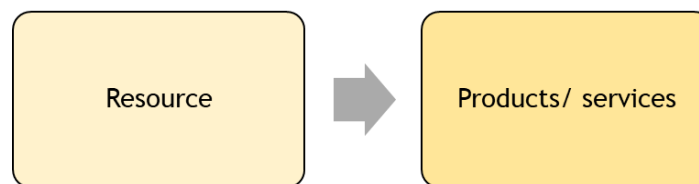


Figure 4: One-stage costing.

(Kim 2017)

To assess the problems of current costing method, a comparison is done to figure out whether the method supports the purpose of managing overhead costs. To remind, overhead costs management should provide accurate costing on cost objects to enable managers on making proper decision. Second, overhead cost management system is expected to contribute in reducing total costs without losing necessary values.

In terms of providing accurate cost picture, according to Cokins 1996, many management accountants acknowledge the irrelevance in the results handed to their clients. The traditional costing system is criticized as being too distorted to be utilized for internal use. Any decision made based on the data generated are not reliable. (Cokins 1996.) Moreover, traditional costing provides insufficient insights for owner to know where to cut or decrease possible costs. Since the method is resource-based, the only available information is the overhead that consumes largest amount of resources. However, managers cannot simply reduce such type of cost immediately. It may be indispensable for the project to generate values. Therefore, cost cutting decision require information on processes and activities that consume the costs. (Kim 2017.)

### 2.3.2 Activity-based costing method

- Definition

In Kim2017, Johnson 1992 states that activity-based costing is an accounting method that defines activities taking place in a production system, a project or a company (Kim 2017). The method is created to fix the problems of traditional costing. Cokins 1996 claims that ABC is not a replacement for general ledger accounting (Cokins 1996). It is a system created to extract and clarify data in a way that generates more accurate and useful insights for managerial purposes.

While traditional costing is resource-based and one-stage method, activity-based costing (ABC) is activity based and two-stage method. Those two stages are (1) allocating resources to activity and (2) allocating activity to cost objects. Cokins 1996 states that activity consume resources and cost object consumes activities (Cokins 1996).

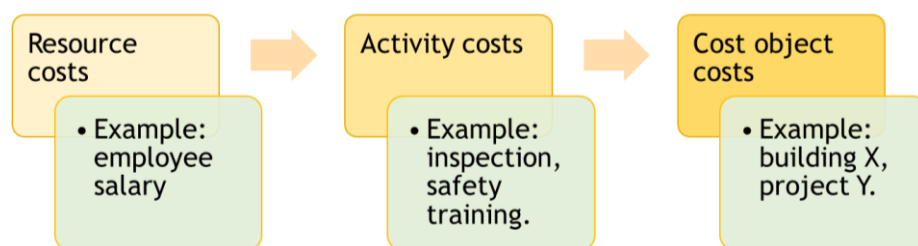


Figure 5: Information flow in activity-based costing.  
(Kim 2017)

Figure 5 illustrates the information flow of ABC. To work through each flow, cost tracking and allocation work is needed. In the first stage, usually resource costs are assigned to activity directly by recording and tracking system. Resource drivers are used to allocate resource costs. In the second stage, activity cost is assigned to cost object based on proper consumed

proportion. This stage requires the manager to define activity cost driver system. Activity cost driver refers to any factor that create changes in cost object consumption (Dierks & Cokins 2000). Kim 2017 presents that activity cost driver have linear relationship with activity costs (Kim 2017). There are three main types of activity cost drivers, which will be addressed later in this thesis.

- Characteristics

Besides the two-stage process, activity-based costing owns another special characteristic. ABC system recognizes different types and levels of activities. A hierarchy of activity enable the costs to be calculated and managed at different levels. There are four common activity levels which are well-known in manufacturing industry. The levels are categorized in a different way when it comes to construction industry context. However, this section will have a brief discuss on activity levels in manufacturing industry before moving on to those in construction industry, to enable possible comparisons and understandings.

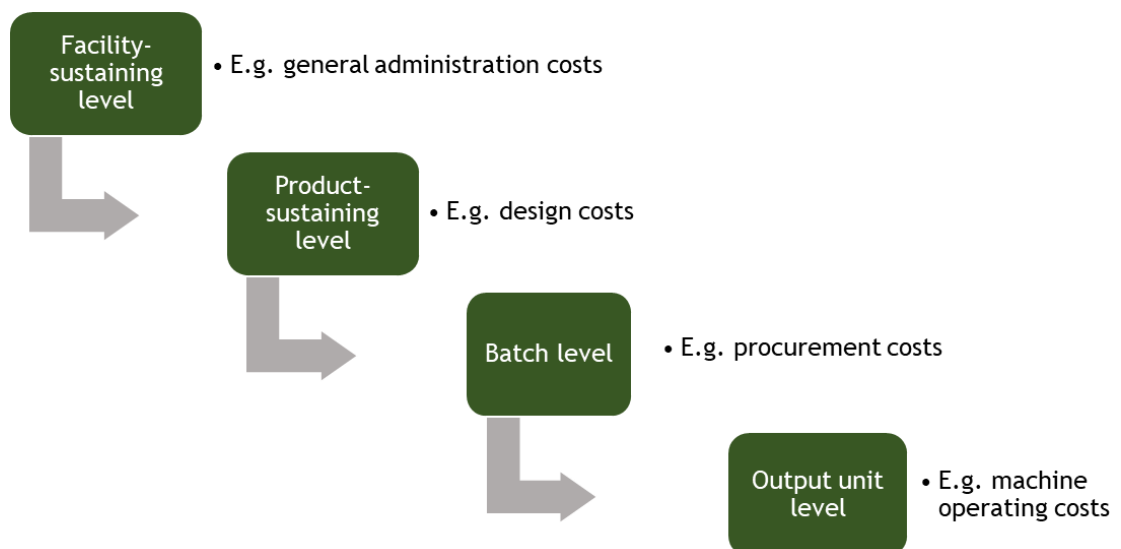


Figure 6: Activity hierarchy in manufacturing industry.  
(Kim 2017)

According to (Cooper and Kaplan 1992; Griffin 2017), four typical activity types in manufacture company are output unit level, batch level, product-sustaining level and facility-sustaining level. In short, output unit level costs are activity costs of each individual unit of a product or service. Output unit costs increase when the number of products or services increase. Batch level costs are activity costs that refers to a group of units rather than the individual unit. (Cooper & Kaplan 1992.) Product-sustaining level costs are activity costs that support individual products or services no matter what number of units produced. Facility-sustaining

level costs are activity costs that cannot be traced back to any individual products or services but contribute to the organization as a whole. (Griffin 2017.) Figure 6 demonstrate these types of activity cost levels in manufacturing industry.

In construction industry, as mentioned before, there are two main types of overhead costs in the company, which are general overhead costs and project overhead costs. According to Kim 2017, each type of overhead cost has different activity level. First, in general overhead costs, there are two level of activities. They are project level and organizational level, as shown in figure 7. Project level costs are the costs of project activities consuming home office resources. (Kim 2017.) For example, inspection costs and training costs related to project work. Organizational level costs are the activity costs that consume home office resources for functioning the company. For instance, recruiting costs, marketing costs are part of organizational level activities.

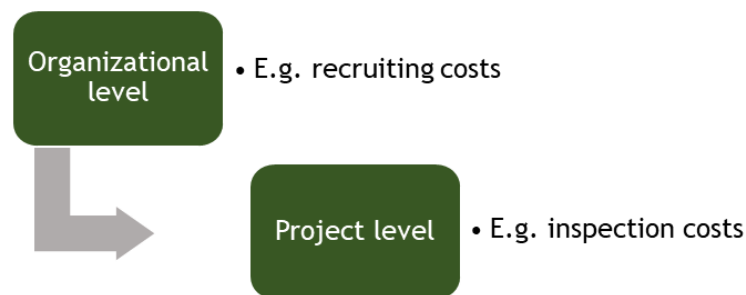


Figure 7: Activity hierarchy in construction general overhead costs.  
(Kim 2017)

In relation to project overhead costs, there are also two activity levels. They are production or work division level and project level costs, as shown in figure 8. The production or work division costs refer to the costs of activity related directly to the project tasks or work division, such as mechanical work or inspection costs of that work. Project level costs are defined by the project overhead costs consumed to support project performance. Reporting costs, scheduling and planning costs are some examples of costs at this level. (Kim 2017.)

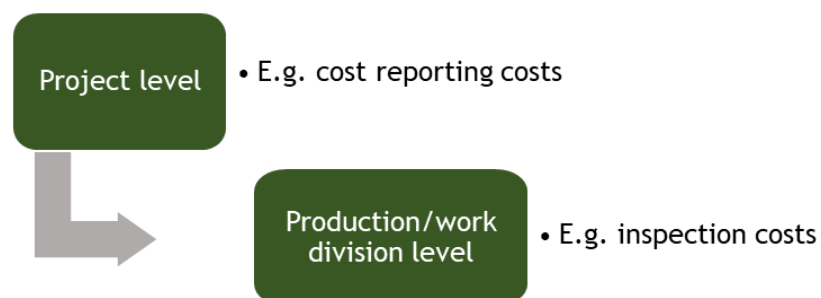


Figure 8: Activity hierarchy in construction project overhead costs.  
(Kim 2017)

- Objectives

With special concept and characteristics, activity-based costing is defined with purposeful objectives in overhead cost management. ABC system can support on removing cost distortion and contribute in eliminating low-value activities in construction company (Onat, O. Anitsal & M. Anitsal 2014). First, ABC can provide accurate information through transparent and effective cost allocation. Cost objects are able to have their precise values. Profitability of the company is analyzed in a more reliable way. Through the process of categorizing activities and processes, managers can examine efficiency of each activity to deliver reasonable decisions. (Kim 2017.) For example, activity can be evaluated as either value adding or non-value adding. With clear structure and sufficient information, ABC system is able to minimize unnecessary processes in construction company and directly help to reduce total costs. Five typical steps to implement activity-based costing in construction company.

The implementation process of ABC can alter as the purposes of the system vary. However, a typical process commonly includes five main steps, ensuring that the system is established logically and effectively. (Kim 2017.)

- Step 1: Build an activity-based costing charter: objectives, scope

The first step plays as a profound base for the whole system. An activity-based costing charter is built to get general guidelines for following tasks. Main purposes of a team charter are to plan, communicate and develop general agreement before the system is applied. A construction company can generate the charter either by organizing a team meeting or by selecting and summarizing employee ideas. The firm can involve any targets it finds necessary. Nevertheless, the ABC charter is expected to define at least the system objectives and scope.

A transparent set of objectives enables related people to acknowledge purposes of ABC system and what they want to achieve through ABC process. With clear objectives, ABC implementation is designed consistently. Data collection method and analysis is chosen thoroughly to accomplish final goals.

In terms of scope, the company should define which department, which type of costs and who are included in the ABC process. Apparent scope assists the firm to utilize its resources consciously. People in charge of recording, reporting or analyzing within the ABC process should be clearly informed about their tasks and roles so that unnecessary efforts will not take place.

- Step 2: Identify cost objects

Cost objects are the final entities being allocated in the ABC system. In other words, they are the end results of the whole process. Usually cost objects are products, services or customers. In construction industry, cost objects vary from projects, buildings to work divisions. Cost

objects are selected based on different purposes of the company managers. According to Kim 2017, there are two main variable that affect cost object selection. They are scope and purposes.

In organizational level, when home office overhead is targeted, costs object can be customers. In this case, the company's purpose is to identify profitable or less-profitable customers, loyal or one-time customer so that the firm can alter its marketing strategies. Besides, it is common that each individual project in the company can be a cost object. This is when the owner wants to evaluate project performance to have certain investing decisions. For example, one possible insight is about which types of project generate more values.

In relation to project level, project overhead is assigned to cost objects chosen by managers and owners of the company. Cost objects this time can be individual facilities such as building 1, building 2 and so on. Moreover, the firm can choose work or task division as cost objects to assess each task efficiency. Information generated through the way cost object are chosen enables managers to address the right area that need improvements.

- Step 3: Define and clarify activities

Activity is defined as a job that consumes the company resources to accomplish a specific goal. After the cost objects are decided, a set of related activities are created to track the ABC system. A proper activity is perceived not as small as a daily task, and not as large as a department or a function. If the chosen activity is too broad, it is difficult to have any space for task improvement. Little insights are extracted from the system. However, if the activity is too narrow, the company may have to face a burden of complex task updating and maintaining.

In reality, usually activity lists are collected through interview sections with department heads or supervisors. After that, related activities in involved process are listed down in a meeting or a workshop to form final activity set for ABC system.

- Step 4: Allocate resource costs to activities

According to Fang and Ng 2011, five categories of resources in construction logistics process are materials, labour, facilities, equipment, property and capital (Fang & Ng 2011). After activity set is established, step four is designed to assign resource costs to chosen activities. The result of this step is the cost of each activity. Although there are five main groups of resources, the company does not have to take them all into ABC system. In a basic and simple process, usually only indirect labor costs are taken into account. (Kim 2017.)

There are two ways to assign resources to activity costs, namely, direct tracking and reasonable allocation (Kim 2017). In the direct tracking method, resources are recorded and reported directly to examine the actual usage in every activity. For example, the person demonstrates the activity fill in a defined sheet to track number of hours they perform specific activity. The direct tracking method often generate precise and reliable insights. However, it maybe costly and time-consuming. Moreover, if the company involve not only indirect labor resource but also other resources such as facilities and equipment, it is difficult and complex to follow the system. Therefore, it is usually not recommended to use the direct tracking method unless special documentation is required.

The more preferred method to allocate resource cost is reasonable allocation method. This method utilizes are ratios or time-effort percentage to track and assign relevant resources. To illustrate, when allocating indirect labor costs to activity, survey is conducted for involved employees to determine their time-effort spent on each activity. This time percentage is then multiplied with the employee salary to define activity costs. Table 1 presents the method in action.

Table 1: Example of time-effort percentage in reasonable allocation method

	Unit rate (per hour)	Activity #1	Activity #2	Activity #3	Activity #4	Total
Employee #1	\$60	20%		30%	50%	100%
Employee #2	\$75		40%		60%	100%
Employee #3	\$80	30%	40%	30%		100%
...	...	...	...	...	...	...
		\$17,760	\$18,784	\$26,720	\$23,296	\$86,560

In the case when the company include facilities and equipment resources in the allocation, different method is applied. First, the related resources are assigned to equivalent department based on the function of that department. After that, indirect labor cost ratio is used to assign department costs to activity costs.

In short, there are two typical method to assign resource cost to activity. Before applying any method, the firm should define which types of resources are involved in the ABC system. Most company prefer reasonable allocation method in practice and indirect labor cost is chosen to be main resources tracked.

- Step 5: Allocate activity costs to cost objects: types of cost driver

After having activity costs, the company can begin to calculate cost objects, which are the final entities needing assessment. To assign activity costs to cost object, a set of cost driver is required. Since direct tracking method in this step is not economically feasible, an mediate concept is needed to connect activity costs and cost objects. That concept is cost driver. According to Kim 2017, cost driver is a factor that change in proportion with activity cost. (Kim 2017.) For example, the number of invoices can be a cost driver of purchasing activity. The costs of cost objects are then calculated by multiply the volume of cost driver to the unit of activity cost.

There is no specific formula to define cost driver for each activity. Owners and managers are expected to know the essence of activities when designing the process to match activity with suitable cost driver (Tsai, Yang, Chang & Lee 2014). In general, a decent cost driver possesses the following features (Kim 2017):

- First, the cost driver has a proportional relationship with the cost objects. When the amount of cost driver increases, the cost of cost object also increases. The connection can be understood as a cause-and-effect relationship.
- Second, it is feasible to measure and track the cost driver volume objectively. For instance, the quality of training can be a cost driver of training activity. However, it is difficult to justify the quality in an effective way. The quality of training is not recommended to be the cost driver of related activity.
- Third, it is economically feasible to examine the cost driver volume on weekly or monthly basis. The recording and measuring process should not consume too much time. Otherwise, the cost of efforts and work required can outweigh the benefits generated.

Three main types of cost drivers are transactional, duration and budget drivers. The most used type is transactional cost driver. This driver is established based on the assumption that the amount of resources consumed each time by an activity is constant or stay stable. Transactional driver demonstrates the number of times that related activity is implemented. (Kim 2017.) For example, the activity of handling delivery from suppliers can have a cost driver as the number of deliveries. If a construction company deal with 9 deliveries every month and unit price of each handling deliveries activity is 650 euros, the cost of that activity in total equals 9 multiply by 650, which is 5850 euros.

Duration cost driver type refers to the time an activity takes to accomplish the relevant task. The activity using this duration cost driver has a fluctuated amount of resources consumed in each time. The nature of overhead costs in construction company also generates several activities that possess high variance in the length of time used. (Kim 2017.) For instance, the amount of time needed to perform the activity of 'monthly reporting' can vary from one to

four hours. When applying duration cost for an activity, the manager assumes that the activity does not consume constant resources in every time.

The third cost driver type is budget driver. This type is also applied for activities having low consistency of resources consumed. Budget driver indicates the budget ratio used to allocate activity cost to cost objects. This is the least preferred drive type. If the activity cannot be counted in number or cannot be tracked by time, it will be assigned budget cost driver. (Kim 2017.)

Regardless of what type of cost drivers are chosen, the number of cost drivers should be limited to reduce the burden of management. Several related activities can share the same cost drivers. By building an efficient set of cost drivers, the company is able to track and follow ABC system effectively.

### 3 Project management method

#### 3.1 Research method and strategy

The research method chosen for this thesis project is mono qualitative study. According to Saunders, Lewis & Thornhill 2016, qualitative research refers to the study of meanings and relationships between involved participants. The method enables the research to generate deep insights and root causes of relevant issues. (Saunders, Lewis & Thornhill 2016.) As the project mainly targets the correlation of costing system and managerial activities, qualitative method can contribute to develop a practical framework. Moreover, the author has built a good rapport with the company owners and the case project managers. Such connection is a huge advantage to set up natural and interactive context for data collection process. Since according to Saunders et al. 2016, a successful qualitative study depends not only on physical access to proper parties but also on the ability of the author to gather reliable and insightful data (Saunders et al. 2016). Because the project concentrates on a specific venture of the case company, it utilizes one single data collection technique and one relating qualitative analytical process.

The project research design follows the purpose of an evaluative study. The project aims at answering the questions: 'How can a construction company apply activity-based costing in management performance?', 'What is the difference between current costing system and activity-based costing system?', 'To what extent can activity-based costing method benefit performance of a construction company?'. Evaluative study concentrates on comparison and evaluation of certain strategy, system or campaign in business management field (Saunders et al. 2016). Evaluative research enables the author to assess project efficiency, the reason behind its operation and the relation with existing theory.

A case study is selected to help answering research questions. The author has an opportunity to work in the case company as a thesis worker. She can assess to related data and necessary information to examine current business performance. According to Saunders et al. 2016, a case study strategy can produce valuable insights from in-depth research in real-life context. Moreover, the relationship between a system and its context is best illustrated through a proper case study. (Saunders et al. 2016.) The research strategy is therefore chosen as a case study.

#### 3.2 Data collection and analyzing technique

Data collection technique utilized in this project is semi-structured interview. The technique gathers non-standardized information through interactive conversation with related people, usually experts or decision makers. In a semi-structured interview section, a list of question that cover certain themes can be prepared in advance by the interviewer (Fang & Ng 2011).

The conversation in practice is organized in a natural way to generate in-depth information. Space for open and additional questions are available depending on the flow of communication (Saunders et al. 2016).

Since the objective of this project is to support the construction project manager and the master builder on managing costing system of construction project, two semi-structured interviews are established to collect related data from the company project manager and project master builder. They are also owners of the case company. The interviews mainly focus on getting to know logistics process and costing situation of the company, identifying lying problems of current management and suggesting possible improvements.

To analyze the qualitative data received, there are several analytical methods such as thematic analysis, explanation building and testing, data display and analysis and so on. In this project, thematic analysis is chosen because Saunders et al. states in 2016 that the analysis can help researcher to interpret disparate amounts of data and define key patterns of a data set (Saunders et al. 2016). The actual qualitative data received from this project is not remarkable. However, it is essential to generate precise insights to build an effective end result of the project, which is a guideline to apply a new costing system.

### 3.3 Company interview

The answers are reported and summarized with agreement from both sides.

Interview objectives:

- To collect project costing data
- To gain perspectives of project manager and project master builder on three main areas: costing system management, purchasing and equipment management, and project management.
- To address available problems so that space for improvement can be identified.

#### 3.3.1 Interview construction project manager

Participants: Quang Nguyen (project manager), Linh Nguyen (representative from private client - Phi&Phi Oy), Uyen Tran (thesis worker).

Duration: 1,5 hours.

Date: 18<sup>th</sup> February 2020.

Method of interview: face-to-face

- Costing system management:

- What is the current cost structure of the project?

The project of constructing private premise for Phi&Phi Oy lasts for six weeks. The actual construction part is three weeks in soft deadline and four weeks in hard deadline. There are two main types of costs, namely equipment costs and labour costs. Labour costs include the cost of direct labour doing construction work and the costs of human resource on administration activities.

- How are the equipment costs recorded and calculated?

Before every purchase, a list of equipment is written to define what need to be bought. After that, all related invoices and bills are collected and sorted. Those receipts are then handed to an outsourced accountant to update the company financial situation. However, the company and the project manager cannot depend totally on the accountant to take care of everything because she is just responsible for the paperwork. The company itself need to have an accounting management activity. There are several management decisions that require enough data and in-time catch up of costs. Hence, there is an excel file to record and update equipment costs so that project manager can estimate the work done and accurately price the task. By then he can acknowledge whether the ongoing job is profitable.

Equipment and construction costs are attributed and calculated to the project based on percentage used and time used. Actual costs are updated in the system as they incurred to compare with the estimated costs. Project manager strives to keep the costs in budget and makes possible changes to deliver a quality performance.

- How are the payments processed?

Usually payment process depends on mutual agreement and the contract with clients. Private project is small and short. So, there are mainly three payment requests. The project manager conducts each periodic payment request based on the work that has been planned and accomplished. The client is expected to pay each request on equipment costs through the life of the project. Labour costs are calculated and paid out when the project is finished.

- What do you want to be improved in the project costing management?

The project manager wants to gain more insights from costing system through more proper process of collecting and recording data. The current operation is decent, but he needs to know the exact area to improve so that experiences and lessons are earned for the next project. For example, he would like to address where costs can be cut, what the most profitable work is, where more investment should be made, what the project competitive advantage is.

- Purchasing and equipment management:

- Are there any rules or strategies in equipment purchasing and management?

There are two main reasons to buy more equipment in a construction company. First, it is when a new contract is made but there is no available equipment to accomplish the work. Second, the company wants to acquire more equipment to serve its near future expansion plan. The project manager and master builder should examine current situation to identify whether new equipment is required, or the company can utilize on hand stocks.

For the current project, purchases are made based on the order of constructing. For example, items and materials needed for building the ceiling and the wall are prioritized first. After that, materials and equipment of kitchen, toilet and electricity system are delivered. The last shopping list usually relates to decoration and furniture items. Shopping lists in details are discussed and created by master builder, architect, designer and project manager.

- Project management:

- How can you demonstrate the quality control of the project?

Quality management is ensured by inspection work. When items and materials are delivered, they need to be inspected properly. The person in charge is responsible for checking the purchase quantity, quality to notice whether there is loss or damage during shipping activity. Moreover, project manager and master builder are mainly responsible for inspecting the construction work of other builders, assuring that all tasks are done with right standard.

- Are there any sources that you utilize to finance a construction project?

This is an additional question. In practice, payments are often made by client periodically. However, when constructing project, there can be time when the contractor needs to spend in advance for purchasing materials. The company has options to borrow from financial company. The project manager suggests a potential firm such as Saldo.com, which belongs to Finnish Saldo Finance Plc. (Saldo 2020).

- What are the difficulties in managing construction projects?

Main problems are human resource management and work-site accident control. As there are big and small projects in a construction firm. Every time the company takes in a new customer, it must ensure that there is enough human resource available to handle the project on time. There have been several cases when the team lack human resources that make it be at risk of losing loyal customers. Moreover, construction works usually face unexpected accidents. Time and effort are required to fix related accidents, which may hurt the project timeline and budget.

JDG Oy is planning to build a meeting place targeting the engineers, electrician, plumber, architect, interior designers so that a network of human resource can have a place to gather and connect. The place is constructed as a coffee shop that also serves buffet and snacks besides traditional drinks (JDG Cafe 2020). It is expected to attract local customers and is advertised as a hub for contractors.

### 3.3.2 Interview construction master builder

Participants: John Edward De La Cruz-Grefalda (project master builder), Quang Nguyen (project manager), Linh Nguyen (representative from private client - Phi&Phi Oy), Uyen Tran (thesis worker).

Duration: 45 minutes

Date: 20<sup>th</sup> February 2020.

Method of interview: face-to-face

- Costing system management:

- How do you evaluate the current cost structure of the project? What do you want to improve? (invent)

The cost structure is simple and easy to understand. In some ways, such structure suits small projects since it does not require too much effort on project management. However, little insights can be generated so that the company can do better budget in next projects. The structure can be defined in a clearer way to support related decision making.

- Purchasing and equipment management:

- What are the criteria of equipment acquisitions?

Equipment cost accounts for one of the biggest costs in construction company. It is important to select what to buy carefully. When searching and choosing the equipment to acquire, the person in charge should evaluate the sources or the reliability of suppliers. For common project, there are well-known parties such as Bauhaus, Stark, K-rauta. Price and description of each item should be checked thoroughly to compare among available suppliers to guarantee that the investment is maximized in profit.

- Can you share more about equipment management process?

It is essential to manage equipment properly so that it can generate expected income for the project. Equipment lists should be recorded, updated and analysed in accordance with its

expense, usage and maintenance costs. After that, if there are any items to be disposed, the residual values should be recorded. Each company can have its own policies to calculate equipment cost through its life cycle. For small projects, such activities are undermined. Most of the time only the total costs are updated in management system. And the accountant will take care of other factors such as depreciation, usage or maintenance values.

- Project management:

- What are the difficulties that you often face when conducting a construction project?

Risk management is one of the most important things to take care of. Without the act of predicting and managing possible risks, the project is very easy to go over budget or delayed. Moreover, accountability can be clarified more and the role of each person in team should be assigned clearly so that all tasks are covered with high awareness.

#### 4 Implementation plan

From the theoretical background in chapter 3, findings and recommendations received from chapter 4, this chapter represents an implementation plan for the case company to adopt activity-based costing into construction project.

A guideline of seven steps are illustrated through a chosen project of the company with private customer Phi&Phi Oy.

Before those steps are specified, an overview of cash flow operation in the case company is explained and shown in figure 10.

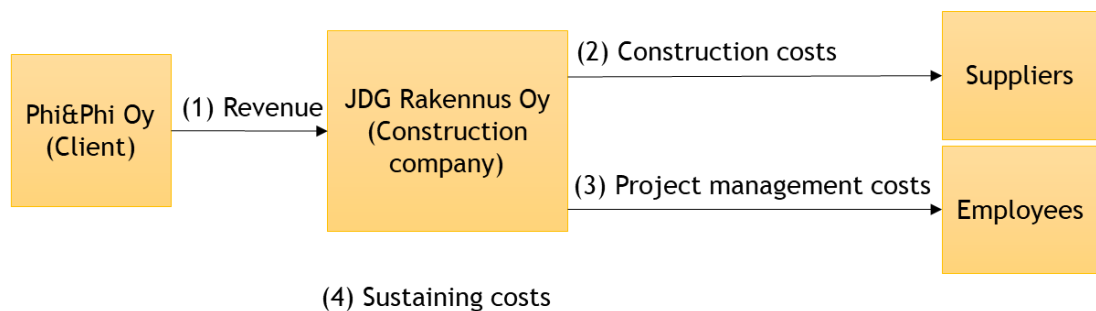


Figure 9: Cash flow operation in project of JDG Rakennus Oy with Phi&Phi Oy

Initially, the client makes payments to general contractor in an agreed date and time. In this case, Phi&Phi Oy sends the first cash flow to JDG Oy. That is how revenue of the project occurs. There are three types of costs among the projects. The first type is the construction costs, which are direct materials and direct labor costs. Second, project management costs play as key overhead costs of this project. These two types of costs are paid to workers or employees involved in the project. The third type of cost is sustaining cost, which is the cost that supports the performance of the project, such as the rent or office electricity expense.

When designing a guideline to apply ABC, I aim at helping the case company to manage its overheads more efficiently. The guideline has two key objectives. First, it supports the project manager in defining the usage and efficiency of overhead costs. For example, how the costs are reflected through each work division or through each management activity. The project manager, therefore, can have a better source to estimate costs for next project in the future. Second, the guideline provides a useful tool for the company owners to evaluate their employee performance in the project. This benefit can reduce the risk of using unqualified workers. In reality, it is easy for the company to select low-price workers and end up raising the project costs to deal with unexpected issues.

Seven main steps to apply ABC in managing construction project costs are clarified and explained below:

- Step 1: Defining scope and objectives of activity-based costing system.

ABC system applied in this project aims at the project management costs that are paid to employees. Therefore, the system scope covers all human resource involved in the project.

As mentioned above, two main objectives of the system are to assess management areas and activities for improvement and to evaluate worker performance. Smaller objectives that support the main ones are to identify major activities in the project, to define activity cost and to define cost drivers.

There are two weeks reserved for project planning. The soft deadline to complete construction work is three weeks' time and the hard deadline is four weeks' time. All project members are involved in the system.

- Step 2: Scheduling a workshop or a team meeting.

The purpose of having a team meeting is for all members to acknowledge the project goals and procedure. It is important to include at least the project manager, master builder, designer and architect in the meeting. A wide range of insights and viewpoints are needed to form a consistent and useful system. At the end of the workshop, everyone is expected to know how the data collection process works and recognize their role in the process.

- Step 3: Defining and choosing cost objects.

Cost objects are chosen based on the objectives of ABC system. Because I want to measure overhead costs by each construction task, it is reasonable to choose work divisions as cost objects. Employee performance can also be reflected through work division costs.

Moreover, the company already categorize its direct construction costs by work division. If overhead costs are integrated and calculated in the same way, the project manager can have a more holistic view on the cost structure of the project.

The project manager has his own lists of work division in use. As he sent me the current cost information of the project, there are twelve main tasks, which are emptying, making frame, electrician, making gyprock, painting, coating, installing the cabinet, installing the machines, tiles, plumber, flooring, decoration and furniture. I modify these internal-use divisions based on the Construction Specification Institute (CSI) code lists 50 work divisions in MasterFormat (50 divisions 2006). The new work divisions chosen are illustrated in table 3 below

Table 2: Work divisions as cost objects in project of JDG Rakennus Oy with Phi&amp;Phi Oy

Currently used phrases	CSI work divisions - the chosen phrases
Emptying	Openings
Making frame	Structure
Electrician	Electrical
Making gyprock/ drywall	Gyprocking
Painting	Painting
Coating	Cladding
Installing the cabinet	Utilities
Installing the machine	Utilities
Tiles	Tiling
Plumber	Plumbing
Flooring	Flooring
Decoration and furniture	Furnishing

- Step 4: Identifying a list of involved activities.

In this step, it is easier to start with building activity centers, which are main groups of activities. Because the ABC system aims at creating managerial insights for the company, management functions or areas can be activity centers. After defining activity centers, I generate activities that include or occur in each center. As mentioned in chapter 2, a decent activity should be neither too detailed nor too general. From the information received in the meetings with project manager and master builder, I choose the following activities shown in table 4.

Table 3: Identifying activity list for the case project.

Activity center	No.	Activity
Cost management	1	Cost reporting (head office)
	2	Requesting payments
Quality management	3	Supervising field activities
Time management	4	Developing/updating project scheduling
	5	Monthly/weekly production scheduling
Safety management	6	Safety training
	7	Safety report
Procurement management	8	Requesting material purchase
	9	Coordinating delivery schedule with supplies
	10	Handling deliveries
General management	11	General correspondence
	12	Manpower hiring/management
Design management (or scope management)	13	Reviewing drawings
	14	Change order issue



Table 5: Assigning resource costs to activity costs

Employee	Cost reporting (head office)	Requesting payments	Supervising field activities	Developing /updating project scheduling	Monthly/wkly production scheduling	Safety training	Safety report	Requesting material purchase	Coordinating delivery schedule with supplies	Handling deliveries	General correspondence	Manpower hiring/management	Reviewing drawings	Change order issue	Percentage
Quang	5% € 100.00	5% € 100.00	15% € 300.00	15% € 300.00	5% € 100.00	0% € -	0% € -	0% € -	17% € 340.00	0% € -	25% € 500.00	8% € 160.00	0% € -	5% € 100.00	100% € 2,000.00
John	0% € -	0% € -	25% € 500.00	10% € 200.00	10% € 200.00	15% € 300.00	0% € -	20% € 400.00	0% € -	0% € -	5% € 100.00	0% € -	0% € -	15% € 300.00	100% € 2,000.00
Jolly	0% € -	10% € 200.00	20% € 400.00	0% € -	0% € -	10% € 200.00	5% € 100.00	5% € 100.00	25% € 500.00	25% € 500.00	0% € -	0% € -	0% € -	0% € -	100% € 2,000.00
Rene	0% € -	10% € 200.00	20% € 400.00	0% € -	0% € -	10% € 200.00	5% € 100.00	5% € 100.00	25% € 500.00	25% € 500.00	0% € -	0% € -	0% € -	0% € -	100% € 2,000.00
Regie	0% € -	5% € 100.00	10% € 200.00	0% € -	0% € -	10% € 200.00	10% € 200.00	5% € 100.00	0% € -	60% € 1,200.00	0% € -	0% € -	0% € -	0% € -	100% € 2,000.00
Halbo	0% € -	0% € -	0% € -	25% € 500.00	0% € -	0% € -	0% € -	25% € 500.00	0% € -	0% € -	0% € -	0% € -	50% € 1,000.00	0% € -	100% € 2,000.00
Ari	0% € -	0% € -	0% € -	0% € -	30% € 600.00	0% € -	0% € -	40% € 800.00	0% € -	0% € -	0% € -	0% € -	30% € 600.00	0% € -	100% € 2,000.00
Dung	40% € 800.00	0% € -	0% € -	10% € 200.00	10% € 200.00	10% € 200.00	15% € 300.00	0% € -	0% € -	0% € -	15% € 300.00	0% € -	0% € -	0% € -	100% € 2,000.00
Uyen	70% € 1,400.00	0% € -	0% € -	15% € 300.00	0% € -	0% € -	0% € -	0% € -	0% € -	0% € -	15% € 300.00	0% € -	0% € -	0% € -	100% € 2,000.00
Activity costs	€ 260.00	€ 1,045.00	€ 3,315.00	€ 1,390.00	€ 1,730.00	€ 1,795.00	€ 735.00	€ 3,560.00	€ 2,365.00	€ 3,645.00	€ 785.00	€ 160.00	€ 2,340.00	€ 775.00	€ 23,900.00
Activity cost percentage %	1.09%	4.37%	13.87%	5.82%	7.24%	7.51%	3.08%	14.90%	9.90%	15.25%	3.28%	0.67%	9.79%	3.24%	100.00%

Combining the time-effort percentage with the project salary of employees, the project manager can calculate each activity cost. Table 6 shows the data generated in the case company. At the end of this step, activity costs are defined. For example, the cost of cost reporting activity is 260 euros, while the cost of handline deliveries activity is 3645 euros.

- Step 6: Calculating the costs of cost objects through activity cost allocation.

To allocate activity costs to cost objects, the company need to define the cost driver and cost driver rate. I address the term cost driver already in chapter 2. Cost driver type for each activity in the case project are chosen based on the characteristic of the activity. After having a meeting with the project manager, I combine his idea with my own observation to from a list of cost driver for current project.

Table 6: The list of cost drivers chosen for each activity

Activity center	Activity	Cost driver	Cost driver type
Cost management	Cost reporting (head office)	Budget (costs ratio)	Budgetary
	Requesting payments	Budget (costs ratio)	Budgetary
Quality management	Supervising field activities	Budget (costs ratio)	Budgetary
Time management	Developing/updating project scheduling	The number of milestones	Transactional
	Monthly/weekly production scheduling	The number of milestones	Transactional
Safety management	Safety training	Budget (costs ratio)	Budgetary
	Safety report	The number of violations	Transactional
Procurement management	Requesting material purchase	The number of requests	Transactional
	Cooordinating delivery schedule with supplies	The number of deliveries	Transactional
	Handling deliveries	The number of deliveries	Transactional
General management	General correspondence	Budget (costs ratio)	Budgetary
	Manpower hiring/management	Budget (costs ratio)	Budgetary
Design management (or scope management)	Reviewing drawings	The number of drawing sheets	Transactional
	Change order issue	The number of change orders	Transactional

The unit rate of activity costs is calculated by dividing the total activity costs generated in step 5 to the volume of cost drivers. The results are represented in table 8.

Table 7: Activity unit cost table

Activity ID	Activity	Cost driver	Total activity cost	Vol. of cost drivers	Unit activity cost
1	Cost reporting (head office)	Budget (costs ratio)	€ 260.00	15	€ 17.33
2	Requesting payments	Budget (costs ratio)	€ 1,045.00	15	€ 69.67
3	Supervising field activities	Budget (costs ratio)	€ 3,315.00	15	€ 221.00
4	Developing/updating project scheduling	The number of milestones	€ 1,390.00	11	€ 126.36
5	Monthly/weekly production scheduling	The number of milestones	€ 1,730.00	11	€ 157.27
6	Safety training	Budget (costs ratio)	€ 1,795.00	15	€ 119.67
7	Safety report	The number of violations	€ 735.00	3	€ 245.00
8	Requesting material purchase	The number of requests	€ 3,560.00	3	€ 1,186.67
9	Coordinating delivery schedule with supplies	The number of deliveries	€ 2,365.00	6	€ 394.17
10	Handling deliveries	The number of deliveries	€ 3,645.00	6	€ 607.50
11	General correspondence	Budget (costs ratio)	€ 785.00	15	€ 52.33
12	Manpower hiring/management	Budget (costs ratio)	€ 160.00	15	€ 10.67
13	Reviewing drawings	The number of drawing sheets	€ 2,340.00	4	€ 585.00
14	Change order issue	The number of change orders	€ 775.00	3	€ 258.33
	<b>Total</b>		<b>€ 23,900.00</b>		

The volume of cost drivers is then assigned to each cost object, which is the work division. After having the share of each activity on each work division, activity cost is multiplied by equivalent proportion to calculate the cost of cost object related to the activity. Final results are demonstrated in the table 9 below.

Table 8: Overhead costs of cost objects in the case project

Activity	Openings	Structure	Electrical	Gyprocking	Painting	Cladding	Utilities	Tiling	Plumbing	Flooring	Furnishing	Total
Cost reporting (head office)	€ 7.80	€ 7.80	€ 44.20	€ 49.40	€ 13.00	€ 41.60	€ 26.00	€ 23.40	€ 13.00	€ 13.00	€ 20.80	€ 260.00
Requesting payments	€ -	€ 31.35	€ 177.65	€ 229.90	€ 31.35	€ 250.80	€ 73.15	€ 31.35	€ 31.35	€ 31.35	€ 156.75	€ 1,045.00
Supervising field activities	€ 66.30	€ 165.75	€ 663.00	€ 663.00	€ 165.75	€ 663.00	€ -	€ -	€ 331.50	€ 331.50	€ 265.20	€ 3,315.00
Developing/updating project scheduling	€ 126.36	€ 126.36	€ 126.36	€ 126.36	€ 126.36	€ 126.36	€ 126.36	€ 126.36	€ 126.36	€ 126.36	€ 126.36	€ 1,390.00
Monthly/weekly production scheduling	€ 157.27	€ 157.27	€ 157.27	€ 157.27	€ 157.27	€ 157.27	€ 157.27	€ 157.27	€ 157.27	€ 157.27	€ 157.27	€ 1,730.00
Safety training	€ -	€ 89.75	€ 323.10	€ 215.40	€ -	€ 359.00	€ -	€ 269.25	€ 269.25	€ 269.25	€ -	€ 1,795.00
Safety report	€ -	€ -	€ 245.00	€ -	€ -	€ 245.00	€ -	€ -	€ 245.00	€ -	€ -	€ 735.00
Requesting material purchase	€ 1,186.67	€ -	€ -	€ -	€ -	€ -	€ 1,186.67	€ -	€ -	€ -	€ 1,186.67	€ 3,560.00
Coordinating delivery schedule with supplies	€ 394.17	€ 118.25	€ 315.33	€ 315.33	€ 78.83	€ 197.08	€ 236.50	€ 118.25	€ 197.08	€ 118.25	€ 275.92	€ 2,365.00
Handling deliveries	€ 607.50	€ 182.25	€ 486.00	€ 486.00	€ 121.50	€ 303.75	€ 364.50	€ 182.25	€ 303.75	€ 182.25	€ 425.25	€ 3,645.00
General correspondence	€ 78.50	€ 62.80	€ 141.30	€ 133.45	€ 39.25	€ 39.25	€ 39.25	€ 39.25	€ 78.50	€ 78.50	€ 54.95	€ 785.00
Manpower hiring/management	€ 24.00	€ 24.00	€ 24.00	€ 24.00	€ -	€ 24.00	€ 16.00	€ -	€ 24.00	€ -	€ -	€ 160.00
Reviewing drawings	€ -	€ 585.00	€ -	€ -	€ 585.00	€ -	€ -	€ 585.00	€ -	€ -	€ 585.00	€ 2,340.00
Change order issue	€ -	€ -	€ -	€ 258.33	€ -	€ -	€ 258.33	€ -	€ -	€ -	€ 258.33	€ 775.00
<b>TOTAL</b>	<b>€ 2,648.57</b>	<b>€ 1,550.59</b>	<b>€ 2,703.22</b>	<b>€ 2,658.45</b>	<b>€ 1,318.32</b>	<b>€ 2,407.12</b>	<b>€ 2,484.04</b>	<b>€ 1,532.39</b>	<b>€ 1,777.07</b>	<b>€ 1,307.74</b>	<b>€ 3,512.50</b>	<b>€ 23,900.00</b>

- Step 7: Analyzing data for managerial purposes.

There are several ways to utilize data generated from ABC system. Before making any further analysis, the project manager can firstly assess how the system serves the initial objectives set in step 1. Figure 10 shows the proportion of management area in the project. Procurement management constitutes the biggest share of 40 percent, while the smallest share belongs to general management, accounting for only 4 percent. Management areas are treated as activity centers in the ABC system. Activities included in procurement management are requesting material purchase, coordinating delivery schedule with supplies and handling deliveries. A clear picture of how each area performs enables the project manager to make possible improvements in the future. In the current project, it is reasonable to invest more in cost management and general management. A more efficient process should be established to reduce the cost spent in procurement management. However, the manager should take into account the impact of each decision in other aspect besides costs such as project quality and profitability.

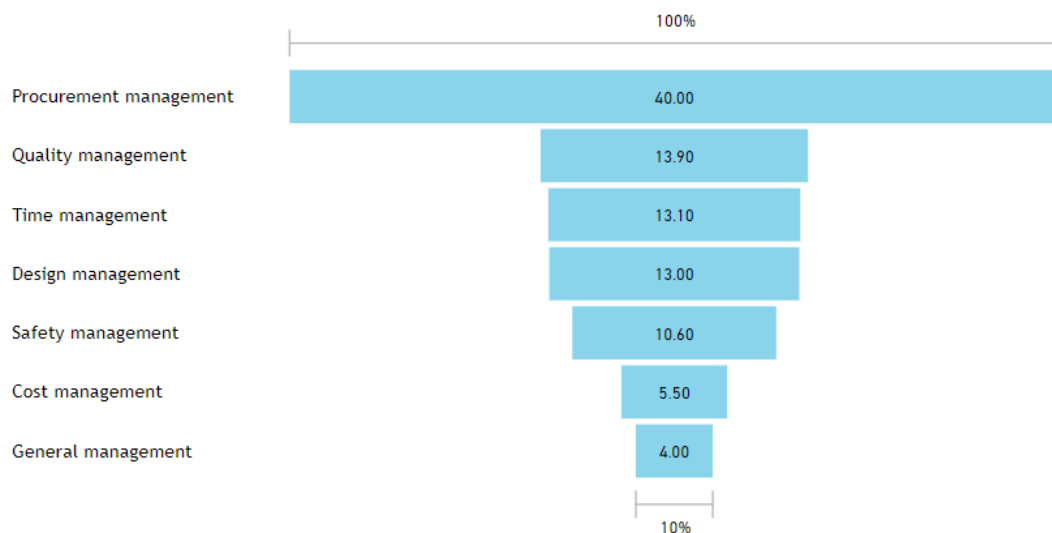


Figure 10: Management area analysis.

The second initial objective of project ABC system is to evaluate employee performance. The work division analysis can play an integral part in assessing how human resource costs are used and allocated. Figure 11 and Figure 12 are different charts of work division percentage. The column chart demonstrates descending order of all construction jobs involved, while the tree map presents well the relationship in volume between related work divisions.

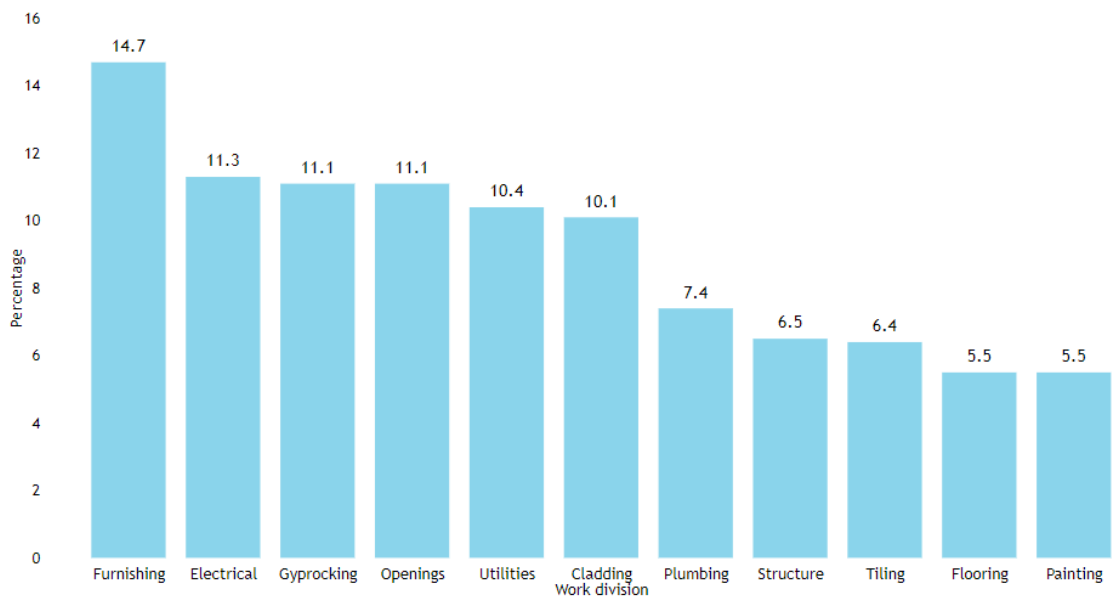


Figure 11: Column chart of work division costs.

The overhead cost consumed for furnishing work is the greatest. Following that are the costs for electrical and gyprocking. There are several reasons why it is costly to manage the decoration and furniture part in this project. First, research and efforts are required to request payments from different parties, including the foreign ones. Second, collaborate works between architect, designer, master builder and project manager are needed to review drawings, make purchases, coordinate with suppliers and handle deliveries.

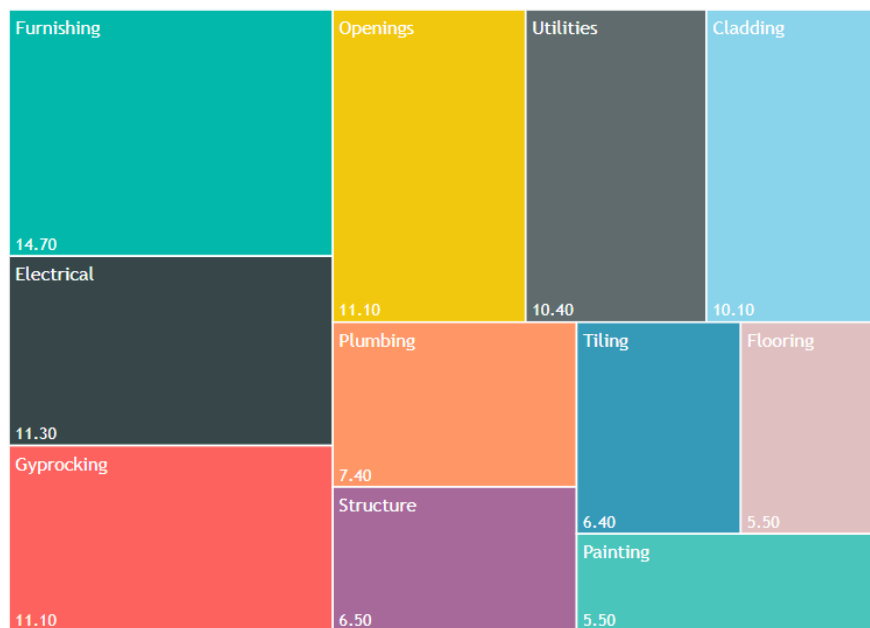


Figure 12: Tree map of work division costs.

Painting takes the lowest proportion because the colour palette is agreed in advance between client and project manager. Moreover, master builder and main builders of the project have already been familiar with painting items included in purchasing process.

In the seventh step, the managers can choose their own way to analyse data of ABC system. The way data is visualized can play an essential role in analysing data and gaining valuable insights. I suggest that the project team should carry this seventh step thoroughly to make full use of the costing management system. The charts in this thesis are created by Power BI. There are other familiar tools to be used such as Excel or PowerPoint.

To conclude, the guideline of 7 steps is illustrated in figure 13 as a handy version for the company to follow.

# A 7-step guideline

## to applying ABC in construction projects

The guideline illustrates key steps to use activity-based costing in improving the cost management of JDG Rakennus Oy projects



Figure 13: A 7-step guideline to apply ABC in construction project of JDG Rakennus Oy

## 5 Discussion and evaluation

### 5.1 Product assessment

The project has been successful in providing a clear implementation plan for the case company to apply ABC in current project. The insights generated help owners and managers have a holistic view of how overhead costs of the project are spent. Such insights are beneficial source for the managers to decide which cost to cut or which area needs more investment. The plan has met initial objectives of evaluating management areas in the case project and assessing employee performance.

The seven-step guideline can be utilized for future project of JDG with private clients. The guideline is designed according to business characteristic of the case company so that it is easy to apply and modify. The new concept of ABC can take efforts and time for all involved employees to cooperate at first. Some may argue that it is unnecessary to bear a new costing system while the traditional one still works. Nevertheless, the work spent on promoting ABC method provides long-term benefits not only for small projects but also for the projects with larger clients. The results received from the system are valuable data for the company to improve its internal management, to negotiate contract better and to build trust in future clients.

### 5.2 Validity and reliability

The research quality is assured in several ways in this thesis project. In terms of reliability, I keep writing memos as the project proceeds. Communication between researcher, supervisor and case company is kept regularly and clearly. Other relevant findings in the field witness no disagreement. The results generated from implementation plan is consistent with related work done by other researchers.

In relation to validity, all information received from interview is allowed to be recorded by taking notes. The author types all key points from the conversation and category into various sections. The reported and summarized version of the interview is then checked and agreed again by interviewees. Each interview includes both the case company and the client representative to ensure the transparency and consistency of information flow. The guideline created in the research can be utilized to improve costing system for future private project of the case company. Moreover, similar companies that have project with the same size and characteristics can benefit from the guideline to manage their overhead costs.

### 5.3 Thesis process and own learning assessment

This thesis project is a great space for me to apply and deepen my knowledge in management accounting. I have learned at school the concept of activity-based costing method but to use

it in construction industry requires decent awareness of the industry. As I have a chance to observe and work in a construction project, I am able to learn from direct people in the field. The experiences they share have created a strong base for me to develop my thesis plan.

It is challenging at first to look for related materials, which are about management aspect of construction industry. The case company is a small-size company that focuses mainly on renovation work. The firm usually plays as a subcontractor for bigger construction company, while most references are written about construction company in general. For that reason, the literature review process requires more effort to navigate and summarize relevant key points.

Besides the know-how and insights received from thesis work, soft-skill competences are essential to keep the project on track and deliver useful results. Time and task management is one of those soft skills. I have gained the ability to set, work towards and modify the deadlines. Because the project process has several parts depended on other parties' responses, clear and proactive communication is required to accomplish each task. It is also important to clarify the project objectives and standard to complete the work and reduce needless stress or doubts along the way.

#### 5.4 Future development

The guideline generated in the implementation plan of this thesis is applicable for other construction companies that want to improve indirect cost management of small project. The application of that guideline into the case project play a great example for JDG to develop and improve its costing management.

One limitation of the research is a narrow range of references available for the thesis topic. There are remarkable resources on either construction project or activity-based costing. However, cost management and ABC system in construction company has not received the same attention.

Moreover, the way ABC is applied into the case project only considers human resource costs in overhead costs. It is reasonable for the case project to do so because the project is small, and most of its activities consume human resources. However, for more complicated or bigger projects, other resources may be considered such as equipment or property overhead costs. That is also the pool for further research or application.

#### 5.5 Feedback from the case company

The project manager agrees on the preciseness and efficiency of all data and information presented. He perceives that the research solution is interesting and generates more insights for the project. The solution meets 85 percent of his expectation. The knowledge base utilized is excellent. However, the solution may not be carried out in near future because training effort

needed is a limitation of the suggested guideline. He calculates that to totally make a new system works, the time spent for training can exceed the benefit it brings. Moreover, most construction workers are still use paper management these days, which causes difficulties in execution. He claims that it requires a person who know well in both accounting and construction industry to conduct the system effectively.

Despite certain limitation, the project manager and owner state that one advantage of the guideline is to help control cash flow in project better. They will consider applying it in bigger project teams.

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