

Case Study: Integrating SMART Decision Making Attributes to Improve the Selecting Subcontractor Strategy

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Abstract: PT McDermott Indonesia is subsidiary of McDermott International Incorporated. In its working practice, McDermott cooperate with other contractors so called subcontractors to complete specific work on a project. This research was conducted using lessons learned from the non-conformance made by one of the subcontractor on the project of Qatar Gas North Field. The objective of this business research is to ascertain the elements where this problematic subcontractor error occurs. An integrated framework is developed incorporate attributes of : construction value chain, financial ratio, capacity planning and project funding. The study uses analysis methods to identify the potential problem, interviews among related parties and simulation methods to formulate an improvement plan. This research concludes that the analysed attributes have an important role and should be included in the key for subcontractor selection by using the proposed SMART decision making method. This new strategy expected can help PT McDermott Indonesia to improve the assessment of each subcontractor competency prior to contract awards.

1 INTRODUCTION

1.1 Subcontractor

According to Eccles (1981) and Costantino et al., (2001) the contractor will not carry out all the works but sublet specialist works, such as building services works, to subcontractors specialized in the respective work disciplines. Hughes et al. (1997) and Yik et al. (2006) describes specialist work as those that involve the use of special methods, delivery of proprietary products, or works that can only be performed by registered or licensed companies or persons.

PT McDermott Indonesia divides the rules in this subcontracting into four parts, the purpose of this division is to maintain the effectiveness of the process, consisting of Pre-Subcontract Planning, Sourcing, Management and Vessels (see flowchart on Figure 1).

The process of subcontracting itself are divided by (a) Identification of the work scope to be subcontracted (b) Preparation of the relevant package for the identified scope of work to be subcontracted (c) Selection of qualified

subcontractor from whom quotes/bids are to be obtained for the specified work and (d) Evaluation of the respective bids from the Subcontractor(s) and subsequent selection of the Subcontractor based on technical capability, cost, quality and schedule for the execution of the specific scope of work.



Figure 1: Subcontracting.

1.2 Problem Statement

PT McDermott Indonesia was started the fabrication of Qatar Gas North Field project since 2019. One part of the fabrication scope of work for the piping contract of this project is to fabricate clad pipes which is subcontracted.

The subcontractor was considered having a product delivery problem. This case almost causes delays in the delivery of the whole project module plan which can cause a loss of reputation of PT McDermott Indonesia. The management assumed that: (a) This problem was caused by subcontractor's financial problems with the possibility of non-smooth cash flow conditions. (2) On the other hand, there may also be problems related to production aspects, insufficient machinery and equipment as well as the supply of raw materials. (3) Other possibilities also arise such as technical skills, procedures for financing the projects or constraints in the administrative area.

2 LITERATURE REVIEW

2.1 SMART Analysis Method

The Simple Multi Attribute Rating Technique (SMART) decision-making technique has been used to explore how decision analysis can be used to support decision makers who have multiple objectives. According to Paul Goodwin and George Wright (2004) when decision problems involve a number of objectives unaided decision makers tend to avoid making trade-offs between these objectives. This can lead to the selection of options that perform well on only one objective, or the rejection of relatively attractive options because their good performance on several objectives is not allowed to compensate for poor performance elsewhere.

So this is the based to use SMART method on this research, this method also based on a linear additive model. This means that an overall value of a given alternative is calculated as the total sum of the performance score (value) of each criterion (attribute) multiplied with the weight of that criterion.

2.2 Construction Value Chain

According to Porter (1985: 12). The idea of the value chain is based on the process view of organizations, the idea of seeing a manufacturing (or service) organization as a system, made up of subsystems each with inputs, transformation processes and outputs. Inputs, transformation processes, and outputs involve the acquisition and consumption of resources – money, labour, materials, equipment, buildings, land, administration and management. How value chain

activities are carried out determines costs and affects profits. The Inbound Logistics, Operations, Outbound Logistics, Marketing and Sales, and Service are categorized as primary activities, while the other included on secondary activities (see Figure 2).



Figure.2. Construction Value Chain

2.3 Financial Ratio Analysis

According to Gropelli (2000: 433) a financial ratio or accounting ratio is a relative magnitude of two selected numerical values taken from an enterprise's financial statements. Often used in accounting, there are many standard ratios used to try to evaluate the overall financial condition of a corporation or other organization. Financial ratios may be used by managers within a firm, by current and potential shareholders (owners) of a firm, and by a firm's creditors. Financial analysts use financial ratios to compare the strengths and weaknesses in various companies. In this research, the financial ratios of the problematic subcontractor are detailed and checked.

2.4 Capacity Planning

According The North Carolina State University on the book "Terms and Definitions - Supply Chain Management", Capacity planning describes as the process of determining the production capacity needed by an organization to meet changing demands for its products. The strategy which is broadly used worldwide are:

Lead strategy, it is the strategy by adding capacity in anticipation of an increase in demand. Lead strategy is an aggressive strategy with the goal of luring customers away from the company's competitors by improving the service level and reducing lead time. It is also a strategy aimed at reducing stock out costs. A large capacity does not necessarily imply high inventory levels, but it can

imply higher cycle stock costs. Excess capacity can also be rented to other companies.

Lag strategy describe as the strategy by adding capacity only after the organization is running at full capacity or beyond due to increase in demand (North Carolina State University, 2006). This is a more conservative strategy and opposite of a lead capacity strategy. It decreases the risk of waste, but it may result in the loss of possible customers either by stock out or low service levels. Three clear advantages of this strategy are a reduced risk of overbuilding, greater productivity due to higher utilization levels, and the ability to put off large investments as long as possible. Organization that follow this strategy often provide mature, cost-sensitive products or services.

Match strategy, It is by adding capacity in small amounts in response to changing demand in the market. This is a more moderate strategy.

Adjustment strategy, with method of adding or reducing capacity in small or large amounts due to consumer's demand, or, due to major changes to product or system architecture.

2.5 Project Funding

Funding is the act of providing resources to finance a need, program, or project. While this is usually in the form of money, it can also take the form of effort or time from an organization or company.

Generally, this word is used when a firm uses its internal reserves to satisfy its necessity for cash, while the term financing is used when the firm acquires capital from external sources. Sources of funding include credit, venture capital, donations, grants, savings, subsidies, and taxes.

3 METHODOLOGY

3.1 Methodology Flowchart

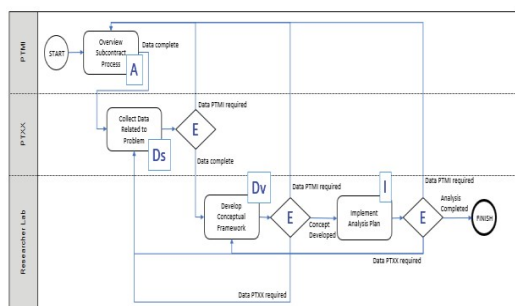


Figure.3: ADDIE Methodology.

This research used ADDIE model which consists of five stages: Analysis, Design, Development, Implementation and Evaluation (see Figure 3). Stage Evaluate in this methodology is iteration process which aims to review again, add improvements if there are still deficiencies, as well as the process of sharpening the process results.

4 ANALYSIS

4.1 Analysis 1, the Construction Value Chain of the Subcontractor

The Porter's Value Chain describe the importance of each activities, both activities are involved and support each other. First step is checking five Primary Activities (see Appendix.1), these are essential in adding value and creating a competitive advantage of the subcontractor.

From the first analysis, it was found that there were no issues related to five primary activities at the subcontractor area, but subcontractor could harness a competitive advantage at any one of activities in the value chain. For example, by creating inbound logistics that are highly efficient or by reducing a company's operation costs, it allows to either realize more profits or pass the savings to the consumer by way of lower prices.

The Support Activities is using to help make primary activities more effective. Increasing any of the four support activities helps at least one primary activity to work more efficiently (see Appendix.2).

From this Value Chain analysis result, found several areas need to have improvement: Operations, Human Resources Management and Technological Development. From those three activities that need improvement, only one is the primary activity, the finding which is also a minor finding in the form of improving dimensional inspection forms, training matrix and one more finding which has not been resolved. In this case it can be concluded that in general the condition of the construction value chain of subcontractor is in good condition.

There are four red dots which are finding in the construction value check above, the finding part is then used as a basic measure of risk checking, which is called the Key Risk Indicator (KRI) and transformed to ranking table (see Appendix.3)

The table shows that technological development shall give first attention, the use of tools and materials without a certificate is very

risky, especially when testing pipes in a shop is in progress. The next critical item is in both the operations and human resources areas, this also shows that the technical work in operations is also influenced by the completeness of tools possessed by the human resources department.

4.2 Analysis 2, the Financial Ratio of the Subcontractor

Financial Ratio will determine the Company performance. Company performance showing the company capability to generate profit. In connection with the selection of a subcontractor, company performance will make it easier for McDermott to choose a subcontractor from one of the important considerations, called Financial Health.

Financial performance is measured from three important aspects: Liquidity Ratio, Solvability Ratio and Profitability ratio from the Statement of Financial Position report from subcontractor for 2018 and 2019 (see Appendix.4).

The table conclude that from the twelve ratios that were checked in relation to the financial performance of subcontractor, eleven are dropping from year 2018 to 2019.

4.3 Analysis 3, Project Funding of the Subcontractor

A company will be said to be an unhealthy company not only from the quality of its human resources or from the value of its sales. However, it can be measured from an internal financial perspective. One way to do this is by measuring the Debt to Equity Ratio (DER).

Debt to Equity Ratio or DER is the ratio of debt to equity or financial ratio that compares the amount of debt to equity. Equity and the amount of debt is used for the operational needs of the company, which must be proportional to the amount. In addition, this Debt to Equity Ratio is also commonly called the leverage ratio, where this ratio is used to measure an investment in the company. The formula for calculating DER is as follows:

$$\text{Debt/Equity} = \frac{\text{Total Liabilities}}{\text{Total Shareholders' Equity}}$$

From the financial report of subcontractor, in 2018 the total long-term liabilities is IDR 36,074,010,000,000 with total owner's equity is IDR 3,975,872,000,000, from the two data obtained DER = 9.07, while in 2019 the total long

term liabilities is IDR 34,478,745,000,000 with total owner's equity is IDR 6,071,641,000,000, DER is obtained from both data is = 5.68 According to Finance Minister Regulation No. PER-25/PJ/2017 (article 2), the reference for DER is that a company can be said to be healthy with a maximum ratio of : 4 liabilities and 1 equity. So the smaller this ratio, the better the company. Subcontractor's DER in 2018 is 9.07 And in the year 2019 is 5.68, This higher DER indicates that more creditor financing is used than equity financing. Movement of DER ratio tends to decrease from 9.07 to 5.68 and it indicates that company moving to better condition.

4.4 Analysis 4, Capacity Planning of the Subcontractor

This research uses project data carried out by subcontractor from January 2019 to March 2021. Data obtained from the Project Reference List consists of two weld overlay (WOL) activities, pipes is measured in length (meters) and fittings is measured by quantity.

From the Project reference list data, it is found that the accumulated changes in load are summarized from the each month load on Appendix.5 (a) and (b).

The existing monthly capacity of Subcontractor is 650 meters for pipe welding overlay (WOL) and 650 ea. for fittings per month. This calculation is an average calculation because the capacity will depend on the diameter and thickness of the pipes and fittings, for example a material with a size of 16 inches and above will require 2 times the processing time than the small material. Besides that, it also depends on the requirements of the client regarding the overlay material and the thickness it requires, each overlay material has its own difficulties in the process.

Capacity utilization rate used to measure of how close the firm is to its best possible operating level, the formula for calculating the Capacity Utilization rate is:

$$\text{Capacity utilization rate} = \frac{\text{Capacity used}}{\text{Best operating level}}$$

From the Subcontractor data, the best operating level is 650 meters and 650 ea. There are several monthly loads that exceed the capacity, it is shown on Appendix.5 (c).

The summary table explained that there are six months overloaded for pipe cladding project and eight months for the fittings. Some of the load gap

even too big, especially on the piping part, while on fitting part, there are extravagant gap found on March 2020, in this condition Subcontractor gets support for the requirement of project fabrication machine from the facility branches in Rio De Janeiro, Brazil and Dammam Saudi Arabia. In this case, actually the capacity of Subcontractor Batam still has limitations which can be increased by adding new machines and experts. However, this will require a fairly long consideration given the continuity of projects and loads that vary widely.

4.5 Proposed Improvement for Subcontractor

From the four analysis that have been carried out, in general we can see better regarding the condition of subcontractor, the results of this research can be used as a basis for proposals to subcontractor and also as input for improvement in the subcontractor selection method at McDermott.

In the Construction Value Chain analysis, from the Deployment Table for Target and Profile Risk, there are twelve key risk indicators which are a combination of the risk of their primary and supporting activities. The unique thing is that the risks between these parts are interconnected, for example: risk in the area of supporting activities, called Technological Development, which is all included in Extreme Risk, if it is not immediately followed up, it will affect risk in the Operations area. Risk in the Technological Development area which includes material, tools and instrument certification is critical, so it must be handled quickly, and after the problem is resolved, monitoring tools must be created immediately to avoid the same case occurring in the future.

In the Financial Ratio analysis, with exception of DER analysis, from the 2018 and 2019 financial reports, there was a declining trend for almost all of the ratios studied, Liquidity Ratio, Solvability Ratio and Profitability ratio. This indicates that the company is in a state of decline or can be said to be unhealthy.

In the Project Funding area, using the same data from Financial Ratio data, DER which is the determinant of project funding for the two (2) years of data studied, 2018 and 2019, got a value of 9.07 for 2018 and 5.68 for 2019. These two conditions are not good enough seen from the minimum standard of DER which should be below the number 4, however there is a tendency that improvements are taking place within the company's financial institutions.

Analysis for the Capacity Planning resulting subcontractor's line of business is classified as a business whose load cannot be planned, in other words, the load varies greatly, for example: there are circumstances where in one month the company only gets orders for only four pcs of fittings to work on, but there are times within one month it get orders of 8635 pcs of fittings, a very unequal number. By looking at this situation, Capacity Planning can only be predicted in general terms, mitigation at the time of overload has also been made, i.e. by borrowing fabrication machines from subcontractor headquarters or branches.

Table on Appendix.6 showing the improvement proposals that can be used by Subcontractor to improve the health of its company.

5 RESULTS AND DISCUSSION

5.1 Integrating SMART Decision Making Attributes to Improve the Selecting Subcontractor Strategy

The default for the subcontractor selection method is from two main parts: Cost and Operations, the cost in this case is represented by fabrication and transport, while in the operation area it only focuses on checking the capacity of the subcontractor, even this checking is not done in detail.

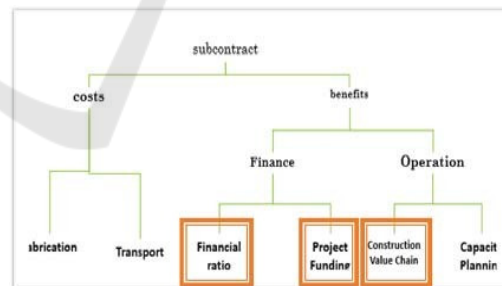


Figure 4: Subcontract Attributes.

From the research that has been done, it was found three items which turned out to be important to check as well and have an overall effect on company performance, they are Financial Ratio and Project Funding plan, as well as checking the Construction value chain. These three items must be registered into attributes which will be used as the basis for the next decision making process (see Figure.4).

To determine the weight of attributes, a

discussion of three parties who is involved with this activity, including: Project Engineer, Subcontracting Coordinator and Completion Coordinator. From the discussion, the results showed that cost still gets the highest ranking, followed by finance and operations (see Figure.5 and Table.1).

This normalized weight then can be used for calculating of aggregate of weighted value for each subcontractor with the purpose to make the calculation more details.

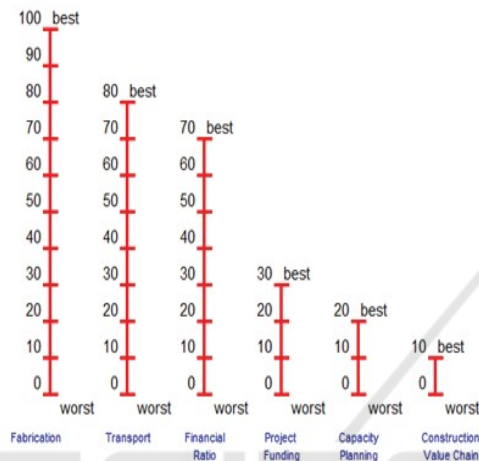


Figure 5: Attributes Weight.

Attributes	Original Weights	Normalized Weight
Fabrication	100	0.32
Transport	80	0.26
Financial Ratio	70	0.23
Project Funding	30	0.10
Capacity Planning	20	0.06
Construction Value Chain	10	0.03
Total	310	1

Figure 6: Original and Normalized Weight.

6 CONCLUSION

As assumed earlier, the problem that occurs is due to the method of selecting subcontractors which seems to ignore several important items. As evidenced by the four analyses: Construction Value Chain, Financial Ratio Analysis, Project Funding and Capacity Planning in subcontractor area, found deficiencies that indicate the company is not healthy.

In Construction Value Chain area, the Technological Development area which includes

material, tools and instrument certification is critical, so it must be handled quickly, and after the problem is resolved, monitoring tools must be created immediately to avoid the same case occurring in the future. In Financial Area, improvement need to be done as the company is in a state of decline or can be said to be unhealthy. In Project Funding plan, even there is a tendency that improvements are taking place within the company's financial institutions, improvement still need to be done. In Capacity Planning area, improvement need to be done to make the load uniform so will be easier to make capacity planning.

Seeing from these results, we can conclude that the attributes studied are items that are important in relation to the decision making in selecting the subcontractor, therefore it needs to be included in the existing attributes.

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