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Comparison of Data Inquiry and Cost Structure Methods to Arrange Owner Estimate (Case Study of Carbon Steel Pipe Procurement at PT XYZ)

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ABSTRACT

In material sourcing, one of the procurement processes that should be completed before evaluating and selecting the vendor is making an Owner Estimate (OE). The most common way to arrange an OE is by making Data Inquiry, where the arranger asks for a certain product's price from a list of providers or vendors. However, this method does not describe in detail how the price of the product is constructed, so the company, which is doing the procurement process, tends to set a higher OE. To reduce this risk, another method to determine OE is introduced. This method applies a Cost Structure method to calculate production and transportation costs, the expenses a vendor should cover when manufacturing the products. Using a total of 20 scenarios that varied the percentage of profits, the increase in carbon steel plate costs, and the overhead costs, using Cost Structure Method can lower the Owner Estimate between 0.51% to 24.46%. The last scenario with 20% increase in profit, 20% increase in carbon steel plate cost and 20% increase in the overhead cost resulted to -2.55% reduce of Owner Estimate. This new method is proven effective as an alternative way to arrange OE for similar material.

1. Introduction

Because of the high amount of money involved in sourcing activities, it is commonly stated that the procurement process had elevated supply management from an operational function to an integral part of company strategy. This statement aligns with 90% of 156 procurement executives in Germany who took part in a survey conducted by Niezen, Weller and Deringer to 156 procurement executives in 2006. The responsibilities of procurement executives had expanded to enhancing the quality of products or the outcomes of the business [1]. While the nature of value is also changing over time since the focus has shifted from obtaining the lowest unit price – through negotiation approaches – toward a more holistic value approach, finding the highest value. The traditional method focused on the lowest price created sub-optimal decisions when the lowest price supplier eventually produced poor-quality products, or the transportation and additional inventory costs outweighed the unit price saving [2].

Considering the great value of product and the high risk involved, sourcing activities in the petroleum industry can spend up to 81% of its Sales Dollar for materials procurement, including the cost of crude oil, spare parts and materials for the production processes as office supplies. The following table describes the cost of purchased materials as a percentage of sales revenue in several industries in the US [3].

Table 1. The Importance of Purchasing in U.S. Manufacturing Industry

Industry	Percent of Sales Dollar
Food and Kindred Products	56.4
Textile	59.0
Wood Product	58.3
Petroleum	81.0
Machinery	50.7
Transportation equipment	64.1
Beverage and Tobacco	36.2
Average U.S. Manufacturing Firm	52.7

One of the most essential materials in Petroleum industry is Carbon Steel Pipe, the most commonly used material type of pipe [4]. It has the advantage of wide availability, high strength, and a large array of connection possibilities, such as through screwed, socket-welded, or butt-welded [5]. In the upstream, the pipe is used for exploitation processes, while in the midstream for transporting the crude oil to refinery unit, and also for distributing refined products to fuel terminals in the downstream. Since PT XYZ is an oil and gas company, there are several steel manufacturing companies that can provide the pipes PT XYZ needs, namely PT Bumi Karya Steel Industries, PT Bakrie Pipe Industries, PT KHI Pipe Industries, PT Indo Karya Energi, PT Indal Steel Pipe and PT Steel Pipe Industry of Indonesia.

In general, the manufacturing process of these carbon steel pipes can be done through three methods. The first one is the seamless method, where the forming activities are done through piercing a solid, near-molten steel rod with a mandrel to produce a pipe without joints. The second method is called butt-welding, where a tube is formed by rolling a hot steel plate into a hollow circular shape, and then the two ends of the plate are welded. The last method is the spiral-welded pipe, where the pipe is formed by twisting strips of metal into a spiral shape and welded where the edges join one another to form a seam [5]. In terms of production cost, the butt-welded is the lowest one while seamless is the most expensive. The following picture is the final forms of the three Carbon Steel pipe types [4].

Figure 1. Seamless, Butt-welded and Spiral-welded Carbon Steel Pipes

The generic procurement process is initiated by the assessment of demand, where statistical or other demand planning methods are used to predict the demand of specific materials as accurately as possible. The second process is data inquiry, where instant market research is conducted to identify potential suppliers. The third step is evaluating tenders, which is done to confirm the quality, quantity, dates, and delivery conditions. The sourcing decision is based on evaluation indicators that include purchase price, time of delivery, level of quality, capacity, service, location, reliability and supply risk [6]. The Owner's Estimate (OE) is basically a part of the second process when the procurement committee of the company performs market research to determine the highest amount of money the company is willing to pay for a particular material or service it needs [7]. PT XYZ always arranges the OE of its Carbon Steel Sourcing through the data inquiry method, and the OE is always a lot more expensive than the price vendors offer. That is why a cost structure method to determine the OE of Carbon Steel Pipes is studied.

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2. Research Method

This research was started by doing a problem identification and continued with data collection and calculation. The software involved is Microsoft Excel.

2.1. Research Steps

The steps involved are as follows:

1. Identification of problems related to pipe specification

   In general, the procurement process in PT XYZ is divided into two: hydrocarbon material sourcing and non-hydrocarbon one. The problem identification is done through interviews and discussions with the procurement staff as well as several vendors that could be contacted through emails and calls.
2. Data Collection

   For the case study, the team decided to use one type of spiral-welded Carbon Steel pipe needed in the upstream processes, following ASTM A252 standard, grade 2 with bevel end, and varnish coating. The outside diameter is 30 inches and 12 mm thickness. The historical OE data were collected by checking the contracts as well as interviewing the related procurement staff [15].
3. Owner Estimate (OE) Calculation using Data Inquiry Method

   The data inquiry method involved carbon steel pipe price list from four vendors, and the lowest price was chosen as the OE for data inquiry method.
4. OE Calculation suing Cost Structure Method

   The calculation of OE with cost structure method is started by breaking down all costs the manufacturer spent on Carbon Steel pipe production, including the cost of raw material, cost of labor, manufacturing overhead. The number of scenarios prepared for comparison is 20, comprising the percentage of plate price as well as the percentage of manufacturing overhead. We also computed the total transportation cost from Jakarta to the drilling locations to compare the OE between Data Inquiry and Cost Structure methods.
5. Analysis

   Analysis is done based on the OE using Data Inquiry and Cost Structure methods.

2.2. Supporting Theory

The following are theories used to support the research.

2.2.1 Procurement

Procurement plays a critical role in creating and sustaining the competitive advantage of an organization. Not only does the cost of purchased materials and supplies play a significant part in the total cost, but there is also a significant opportunity for leveraging the capabilities and competencies of suppliers through closer integration of the buyers' and suppliers' logistics processes [8]. In the oil and gas upstream industry in Indonesia, procurement is done under the supervision of the Supply Chain Management Function [9], as one of the vital contributor to the organizations' strategic success [1]. In general, the steps of a procurement process are as follow:

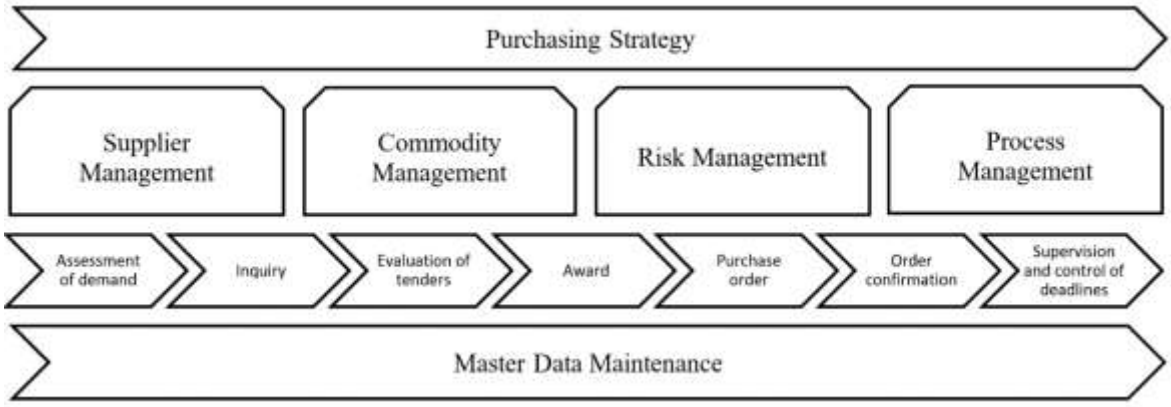

Figure 2. Steps of the Procurement Process

Based on the picture, the activity of estimating Owner Estimate (OE) starts after the assessment of demand is done, or during the inquiry step, where an intense procurement market research is undertaken to identify potential suppliers. The whole process is completed when the contract is signed, and the products are delivered [10].

2.2.2 Market Research Method for Owner Estimate

Doing market research is the most common and easiest way to find the price of a particular product or service [16]. This market research method is divided into Primary and Secondary Market Research. Primary market research directly gathers data relevant from the suppliers or vendors, while secondary market research is done through the leaflet or company reports [10]. Based on Pedoman Tata Kerja (PTK) 007, a standard operating procedure for supply chain management in an upstream oil and gas organization, the local components, taxes, and other fees should be considered when arranging an Owner's Estimate (OE). Besides market research, the OE can also be computed through the historical data from similar products, the price stated on previous contracts with consideration for inflation, and the cost structure method [9].

2.2.3 Cost Structure Method for Owner Estimate

Supplier price and cost analysis have received considerable attention as organizations strive for cost savings, the central value of supply chain management activities in many organizations. Since price represents what we pay or what we expect to pay in the process of creating a particular product or service [11]. The price of a product or service is closely related to all the expenses, such as rents, salaries, utilities, and other things an organization should be willing to pay to ensure the product can be produced. A cost/price structure refers to the relative proportion of fixed versus variable cost [12].

Price analysis is a comparative process that seeks to establish reasonable purchase price thresholds relative to the market conditions. Such analysis does not necessarily require knowledge of the supplier's cost structure. Instead, it evaluates the extent to which the sum of the cost elements is justified given prevailing prices for the item or similar items [11].

Cost analysis requires the cost information obtained from the suppliers. Including the production cost of each product compromises the direct expenses, including the materials and labor attributable to the production of the product, and indirect costs [11], such as the administration and sales costs. The following picture visualizes the general components of full production cost [10].

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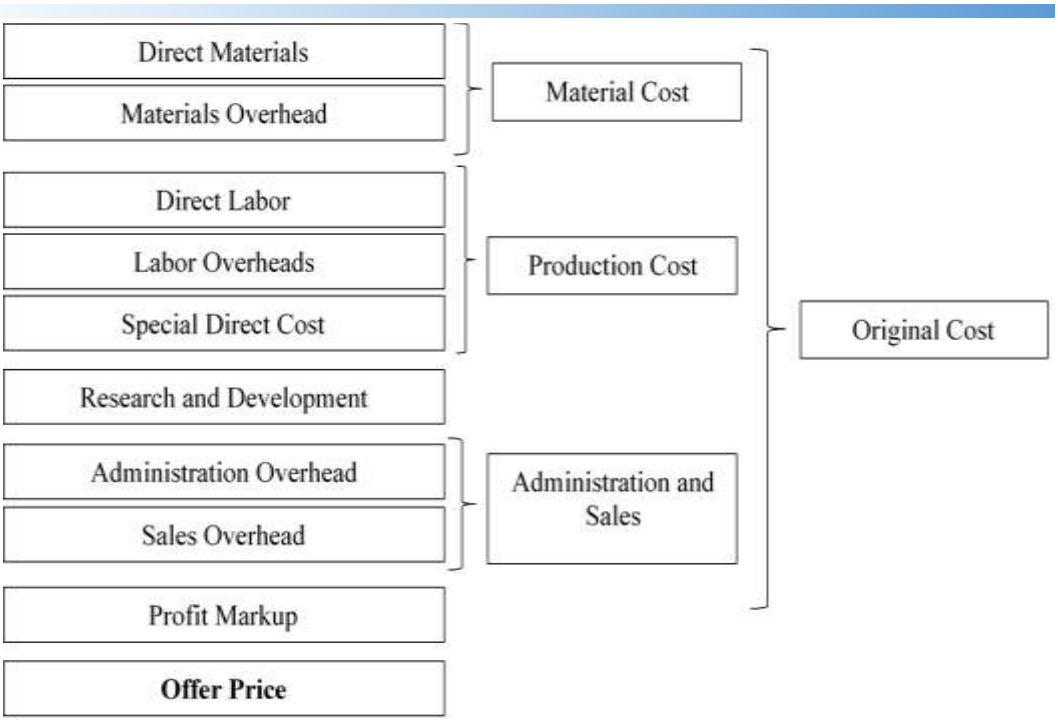

Figure 3. Components of Full Costing

3. Results and Discussion

3.1 Results

3.1.1 OE of Carbon Steel Pipe for several drilling locations across Indonesia

For this research, we used five drilling locations on three main islands of Indonesia. The transportation costs from Jakarta to the five location is included in the Carbon Steel pipe (the transportation is also included as supplier's responsibility). Thus, the OE for one unit of Carbon Steel Pipe using Data Inquiry Method can be seen in the following table:

Table 2. Owner Estimate of Carbon Steel Pipe using Data Inquiry Method

Locations	Unit Price (IDR)
A in Sumatera	31,513,877
B in Sumatera	30,138,000
C in Java	27,636,000
D in Java	27,636,000
E in Kalimantan	32,376,779

3.1.2 Total Manufacturing Cost Data

To simplify, we assumed that the total manufacturing cost consists of only three components: material cost, labor cost and manufacturing overhead cost. Since the real data of these three components are not the inquiries that would be answered by any carbon steel pipe manufacturers, we did a different approach: checking the annual report of one public manufacturer: PT Steel Pipe Industry of Indonesia (SPINDO). The annual report that was used was the year of 2018. We also overlooked the inflation rate. Based on the annual report, the cost structure of the cost components are as follows:

Table 3. Percentage of Cost Components to Material Cost (SPINDO)

Cost Components	Price (IDR)	Percentage to Material Cost
Raw material	3,629,561,000,000	100%
Direct labor	81,361,000,000	2.24%
Manufacturing overhead	371,790,000,000	10.24%
Total Manufacturing Costs	4,082,712,000,000	

After acquiring the cost components data, the next step to compute the total cost of producing one unit of Carbon Steel spiral-welded pipe is checking the amount of material needed as well as the price the manufacturer should pay for it. Since an interview session with SPINDO could not be completed, an interview with one of the workers at PT KHI Pipe Industry was conducted to check the needs of material to produce one unit of Carbon Steel Pipe. To create a piece of carbon steel spiral-welded pipe, three components are needed: the hot rolled coil (HRC), the wire rod for welding (both Internal Welding/IW and Outside Welding/OW), and the flux to protect the material during welding. The total material that is needed and the costs are described in the following table.

Table 4. Raw Material and material Cost for Spiral-Welded Carbon Steel Pipe

Material	Size	Needs per pipe (kg)	Unit Cost	Total Cost (IDR)
HRC	1,500 x 10,000 mm	1,413	Rp 8,875 per kg	12,540,375
Flux	IW = 2.1 kg/ton HRC	5.9346	Rp 8,665,156 per ton	51,424
	OW = 2.1 kg/ton HRC			
Wire Rod	IW = 2.1 kg/ton HRC	5.9346	Rp 20,867,111 per ton	123,838
	OW = 2.1 kg/ton HRC			
			Total Raw Material Cost	**12,715,637**

Following the percentage of total production cost to total material cost, we can compute the total cost for direct labor and manufacturing overhead based on table 1 to complete the following table:

Table 5. Percentage of Each Component Cost to Material Cost

Cost Components	Percentage to Direct Material Cost	Total Cost (IDR)
Raw material	100%	12,715,637
Direct labor	2.24%	285,036
Manufacturing overhead	10.24%	1,302,512
	Total Manufacturing Costs	14,303,286

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Besides the manufacturing cost, the OE for cost structure approach will also consider the transportation cost of the Carbon Steel spiral-welded pipes from Jakarta to the five drilling location across Indonesia. We computed the transportation cost based on the transportation tariff to each field as well as the mass of each pipe. Thus, the total transportation cost for one Carbon Steel spiral-welded pipe from Jakarta to the fields are as follows:

Table 6. Transportation Cost of Carbon Steel Pipe from Jakarta to fields

Fields	Transportation Cost per Pipe (IDR)
A	14,379,939
B	8,361,274
C	1,741,932
D	5,225,796
E	11,496,751

3.2. Discussion

To compare the Owner Estimate (OE) using the two methods, we prepared twenty scenarios, ranging from the considerations of profit the pipe manufacturer expects, various manufacturing overhead rate, as well as the possibilities of the increase in carbon steel plate (HRC) price.

The following table is the result of OE of Carbon Steel pipe price under the consideration of 5% expected profit as a calculation sample for cost structure method.

Table 7. Comparison between OE under Data Inquiry Method and OE for 5% Profit (Cost Structure)

Field	Carbon Steel Pipe Manufacturing Cost	5% Profit	Transportation Cost	OE Cost Structure	OE Data Inquiry	% Difference of OEs to Data Inquiry (no profit)
	(A)	(B)	(C)	(D) = (A)+(B)+(C)	(E)	(F) = ((D)–(E))/(E)
A	Rp 14,303,186	Rp 715,159	Rp 14,370,939	Rp 29,389,284	Rp 31,513,877	-6.74%
B	Rp 14,303,186	Rp 715,159	Rp 8,361,274	Rp 23,379,618	Rp 30,138,000	-22.42%
C	Rp 14,303,186	Rp 715,159	Rp 1,741,932	Rp 16,760,277	Rp 27,636,000	-39.35%
D	Rp 14,303,186	Rp 715,159	Rp 5,225,796	Rp 20,244,141	Rp 27,636,000	-26.74%
E	Rp 14,303,186	Rp 715,159	Rp 11,496,751	Rp 26,515,096	Rp 30,376,779	-12.71%
			TOTAL	**Rp 116,288,416**	**Rp 147,300,656**	**-21.05%**

Based on table 7, we can simply check that the Owner Estimate of Carbon Steel Pipe for each location is lower compared to the OE for each field using Data Inquiry Method.

The following table is a comparison between the two OE approaches under various scenarios:

Table 8. Comparison between OE under Data Inquiry Method and OE of Cost Structure with Various Percentage of Profit

No	Scenarios	Cost Structure Profit			
		5%	10%	15%	20%
1	Normal cost of HRC	-21.05%	-19.72%	-17.32%	-14.93%
2	5% increase of HRC cost	-19.60%	-17.08%	14.57%	-12.05%
3	10% increase of HRC cost	-19.56%	-17.05%	14.53%	-12.01%
4	15% increase of HRC cost	-14.57%	-11.81%	9.06%	-6.30%
5	20% increase of HRC cost	-12.05%	-9.18%	6.30%	-3.43%
6	5% Manufacturing Overhead (OH) Rate	-24.46%	-22.17%	-19.89%	-17.61%
7	15% Manufacturing Overhead (OH) Rate	-19.98%	-17.49%	-12.54%	-12.5%
8	20% Manufacturing Overhead (OH) Rate	-17.75%	-15.15%	-17.26%	-9.94%
9	5% increase in HRC cost and 5% increase in OH	-14.87%	-19.66%	-17.26%	-14.87%
10	5% increase in HRC cost and 15% increase in OH	-17.36%	-14.74%	-12.12%	-9.50%
11	5% increase in HRC cost and 20% increase in OH	-15.02%	-12.28%	-9.55%	-6.82%
12	10% increase in HRC cost and 5% increase in OH	-22.03%	-19.63%	-17.23%	-14.83%
13	10% increase in HRC cost and 10% increase in OH	-17.33%	-14.70%	-12.08%	-9.46%
14	10% increase in HRC cost and 15% increase in OH	-14.98%	-12.24%	-9.51%	-6.77%
15	15% increase in HRC cost and 5% increase in OH	-17.26%	-14.64%	-12.01%	-9.39%
16	15% increase in HRC cost and 15% increase in OH	-12.12%	-9.25%	-6.38%	-3.51%
17	15% increase in HRC cost and 20% increase in OH	-9.55%	-6.56%	-3.56%	-0.57%
18	20% increase in HRC cost and 5% increase in OH	-14.87%	-12.13%	-9.39%	-6.65%
19	20% increase in HRC cost and 15% increase in OH	-9.50%	-6.50%	-3.51%	-0.51%
20	20% increase in HRC cost and 20% increase in OH	-6.82%	-3.69%	-0.57%	-2.55%

The comparison between Owner Estimate for the Procurement Process of a Carbon Steel Spiral-Welded pipe is done using two methods: Data Inquiry and Cost Structure with twenty scenarios. The scenarios we used to check the effectiveness of this method involved three factors. The first is the increasing price of carbon steel plates, the second is the growing manufacturing overhead cost, and the last is the expected profit.

Even when we compared the standard raw material (HRC plate) price, with standard manufacturing overhead and 5% expected profit, the OE with cost structure is proven lower compared to data inquiry (the difference reached Rp 31,012,240 for five pipes that would be transported to five locations). By checking table 7, we can see that all scenarios resulted in the lower

OE in Cost Structure Method. This cost structure method is rarely used in estimating the price of a product, especially when we are discussing the procurement process of a particular material. This cost structure method is mainly used to estimate a project cost, such as a software development project since it is simpler, and no material cost is involved. Cost structure approach in software development projects emphasizes the personnel cost per activity. A research to model the determination of OE for software project was completed in 2018, incorporating only three aspects: Personnel Direct Cost, Nonpersonnel Direct Cost and Taxes. The approach is proven to be effective with an error rate of 6.89% [13].

Looking back to PT XYZ that needs high number of Carbon Steel Pipes every year, this Cost Structure approach is practical. Considering the similar products needed by PT XYZ to support its business across Indonesia, this method can be improved to assist the Supply Chain Management function as a comparative process to establish reasonable purchase price thresholds relative to market conditions. The number of Carbon Steel pipes needed every year is more than 200 units and the unit cost is between 27 to 32 million Rupiah per unit, a better approach in arranging the OE will provide better insight and give benchmark of prices [11].

This method is very applicable to PT XYZ since the type of products it buys in large number every year are similar in characteristics and manufacturing processes. They only differ in terms of diameters, thickness, or length. If another organization with different product types plans to apply this method, it should check the types of product and the manufacturing processes.

4. Conclusion

Based on the results, the calculation of OE using the cost structure method still resulted in a lower cost compared to the data inquiry method. Even when the manufacturing overhead rate reached 15%, the price of carbon steel plate increased by 20%, and the profit set by the manufacturer was 20%, the Owner Estimate is still 0.51% lower compared to data inquiry. This cost structure method is an alternative that can be applied by organizations that need the same product for a large number every year. The people involved in the procurement processes can check the general cost of the HRC plate for each period as the basis of calculation. Besides, this method is also applicable to a slightly different product specification as long as it has a similar manufacturing process.

It would be better to use more than one reference as the baseline for the following research to compute the manufacturing cost since we simplified the cost components for this initial study.

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