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Business Process Re-Engineering of Engineering Procurement Construction (EPC) Project in Oil and Gas Industry in Indonesia

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Abstract

Objectives: To reduce time delays of Engineering Procurement Construction(EPC) projects in the oil and gas industry. Methods: This study used Business Process Re-engineering (BPR) methodology applied in project management. The methodology used starting Prepare for Engineering, Map and Analyze As-Is Process, Design To-Be Process, Re-engineered Process and Improve Continously. Findings:This study resulted an improved project planning using business process re-engineering method with time on engineering phase is reduced up to 55% and the procurement phase with an efficiency up to 35%. Application/Improvements:BPR method should be used in evaluating the delay in project work.

Keywords: Business Process Re-engineering, Information System, Oil and Gas, Operation Management, Project Management

1. Introduction

The project management can be defined as the attainment of the objectives of the project is completed by the time the project was planned, according to budget costs, the desired results, the use resources effectively and efficiently, and accepted by consumers[1]. Generally, only 33% of all construction projects completed on time, 36% of the projects completed within three months from the date of completion, 13% completed between three to six months after the deadline for completion, and 18% completed more than three months late[2].Based on the categories of industries surveyed by Chartered Institute of Building (CIOB), the category of projects in the oil and gas industry is the worst in the completion of the project, which only 19% was completed on or before the settlement dates, and 74% of jobs completed in a span of one to three months from the deadline for completion project.

Based on the distribution of integrated construction projects, many construction projects in Indonesia has valued over Rp 50 billion and has been completed by the contractor over the past 10 years, grouped according to the classification of the field of integrated construction services, projects in the oil and gas industry is a project that has the highest value compared with other projects. The difference with other projects is practically very high[3].

If a project is delayed then stakeholders will prolong or even speed up the project, but this causes additional costs[4]. In the oil and gas industry, the intensity may vary from time to time, and this variation underscores the dynamic aspect of the complexity of the project[5].In order to face the global economic developments, the company must have a business process that is fast, high quality, consistent, flexible, and low cost[6]. According to its characteristics is a cross functional process, one approach that can be used to solve these problems are the redesign of business processes using Business Process Re-engineering (BPR). BPR can help companies find the root causes and achieving improvements in terms of quality, speed, and cost reduction process[7]. The failure to achieve targeted

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time, budgeted cost, and specified quality result in various unexpected negative effects on the projects.

The objective of this study is to reduce delays of EPC projects in the oil and gas with business process re-engineering approach. By using the appropriate methods to improve business processes, the cause of delays in EPC projects in the oil and gas industry can be minimized so that the project can be running successfully.

Project is an activity that has a goal to create a product, service or result that is unique[8]. Project management is the application of knowledge, skills, tools, and techniques to project activities to meet the needs or requirements of the project.Project management is a universally accepted standard for the handling of business are temporary, unique, and made for a specific purpose[9,10].

First phase of the EPC project is engineering, where engineering is process of realizing the idea became a reality with insight into the totality of the system is to focus on the effectiveness of the operational and maintenance are carried out from the conceptual stage, basic engineering and detail engineering. Procurement phase is the phase which includes the activities of procurement of goods and services for the purposes of the project and its supporting. It includes the planning process in purchasing, contract planning, the planning contract, acceptance of the offer from the vendor, the bid evaluation and determination of the winner, contract management and contract closure[8]. Construction phase is the activity of establishing or building installations as efficiently as possible based on everything that was decided in the engineering phase. Generally existing activities in construction such as building temporary facilities, preparing the land, setting up the infrastructure, set up a fabrication facility, building, install various equipment, piping, install the electrical installation, and testing. Categories of the construction phase itself consists of a variety of disciplines and made to follow a system to facilitate the planning, implementation, monitoring, and controlling during the construction period.

Process is several interrelated transactions that transform inputs into results or outputs. The term business process is used to distinguish the processes occurring in the world of business with another process. Business process is the activities undertaken by the network of resources and transform inputs into outputs[11]. Business process itself can be interpreted as a set of activities that transform inputs into one or several outputs that provide value to the consumer[12].

Business process need to be a performance measurement to determine how well the process works. Business process performance measurement can be done in various ways, factors that affect the performance of business processes among others financial factors, internal factors and external factors[13].

Business process re-engineering is popular since 1990 in which BPR is the thought and redesign fundamentally and radically in order to achieve significant improvements in the process dramatically in certain sizes such as cost, quality, service, and speed[12]. BPR is an attempt to achieve improvements in business performance significantly by making radical changes to the process[14]. On a BPR research in Indonesian milk industry, by visualize predicted implementation using simulation model showed that proposed solution could effectively reduce process lead time and increase quality releases[15].

There are several characteristics possessed by BPR, which are hallmark characteristics of BPR is applied in various industries. Some characteristics of the BPR among others fundamental, radical, dramatic, and process[12].(1) fundamental, analyzing based on "what" process that the company does and "how" the process is done; (2) radical, solving the root causes and designing solution by ignoring current procedure and structure; (3) dramatic, the change effort gives significant and great impact, not an incremental impact; (4) process, investigating based on process.

Integrated Definition for Function Modeling (IDEF) is a part of information system, method of graphical modeling languages that are useful in modeling information flow on Software Engineering (SE), business process, and business process improvement.[16]. IDEF0 modeling can be used to model and map existing processes in project management[17].

2. Methodology

This research was developed with business process re-engineering methodology applied in project management. The methodology used as starting Prepare for Engineering, Map and Analyze As-Is Process, Design To-Be Process, Re-engineered Process and Improve Continously.

First stage begin with Prepare for Engineering, conducted understanding of the business processes in Engineering Procurement Construction (EPC) project on the oil and gas industry. Then performed a prelimi-

nary analysis of the problems that occur from interviews and document data project with the project team. After that, define business processes engineering purposes in accordance with the needs of project management in EPC company.

Second stage was Map and Analyze As-Is Process, starting with data collection using EPC project reports, interviews with expert like General Manager, Project Manager, Project Control & Planning Manager, Engineering Manager and Procurement Manager. Then identify the actors involved in EPC project business processes. Mapping is done by using the software Microsoft Project. Furthermore, the business process modeling using IDEF0 technique to determine the input, control, mechanism, and the output of each phase. After that, the simulation of sub-processes that exist in each phase which will then be analyzed to determine problems that occur as a basis for the next stage.

Third stage was Design To-Be Process, at this stage performed by determining remediation strategies gained through focus group disscussion with the company and literature studies. Then to design several draft scenarios were discussed with the EPC project team.

At the stage of Re-engineered Process, the implementation of the proposed to-be simulated using Igrafx. From the simulation results, then analyzed to choose the best scenario. The best scenario mapped and simulated with software Microsoft Project. From the best-case scenario of each phase will be proposed to the project management in the EPC company.

At this stage to Improve the process Continously, is done by making the strategy to be able to control the quality and systems as well as continual improvement, monitoring, and control the performance of the new system. This can be done by creating and using the Key Performance Indicator (KPI), so that the performance of the proposed business processes in EPC project management can be monitored optimally.

3. Discussion and Data Analysis

Phase 1: Prepare for Engineering

Fist stage begin with Prepare for Engineering, conducted understanding of the business processes in Engineering Procurement Construction (EPC) project on the oil and gas industry. Then performed a preliminary analysis of the problems that occur from interviews and document data project with the project team. After that, business processes engineering purposes was defined in accordance with the needs of project management in EPC company.The objective of this study is to reduce delays of EPC projects in the oil and gas with business process re-engineering approach.

In this study did not discuss the existing business processes in the construction phase due to limitation of the study and the results of interviews and the data obtained from the company showed that 80% phase of construction has been delayed because there is a delay in the two previous phases.

Phase 2: Map and Analyze As-Is Process

Map As-Is Process with Microsoft Project

Project management process undertaken by the company consists of three phases, namely Engineering, Procurement, and Construction. Microsoft Project will map out the process in terms of activity, duration, resources used in the form of actors, predecessor, and can display the Gantt chart of the project. In time mapped, used the average time standard corporate projects, for project Jacket & Platform takes total 168.5 days with details of the phases of engineering is 50.5 days and procurement phase is 118 days.Business process flow of EPC project can be described using IDEF0 technique. IDEF0 consists of input, control, mechanism, and output. Business process mapping with IDEF0 Technique is shown in Figure 1

There are several components in the A0 level IDEF0 activity in EPC projects, namely the input, control, mechanism, and output.

- Component input in the activity level A0: Client Order
- Component control in the activity level A0:(1) Contract Handover & Package; (2) Project Executive Summary; (3) Project Execution Plan; (4) Data Analysis; (5) Corrective & Preventive Action; (6) Quality System & Management; (7) Control of Quality Records; (8) Internal Quality Audits; (9) Management Review; and (10) Customer Complain.
- Component mechanism in the activity level A0:(1) CEO; (2) COO; (3) CTO; (4) GM Project; (5) GM CADA; (6) Manajer Proyek; (7) Project Plan & Control; (8) Project Interface & Services; (9) Engineering; (10) Procurement; (11) Construction;

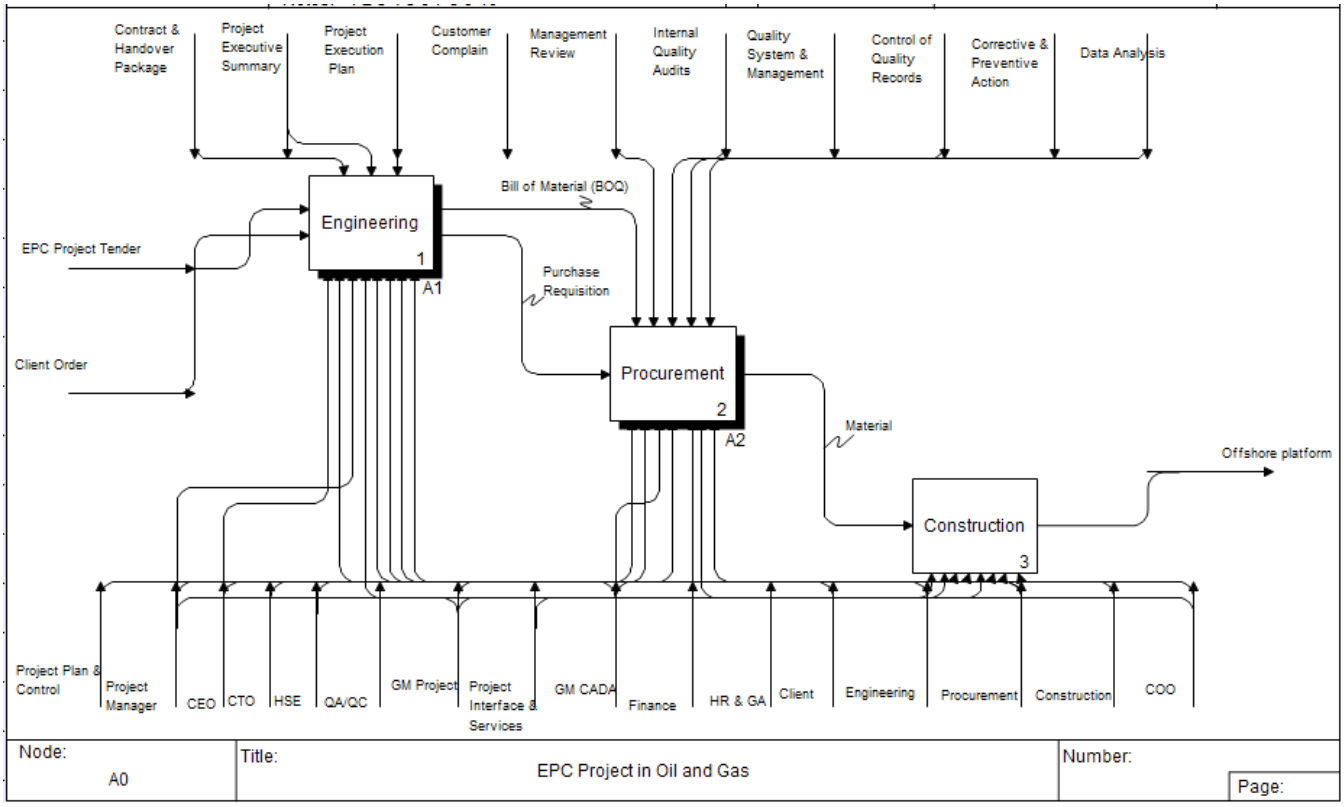

Figure 1. Map As-Is Process in EPC Project with IDEF0 Technique.

(12) Finance; (13) HR & GA; (14) QA/QC; and (15) Client.

- Component output in the activity level A0: Results of the project is the output of EPC project. In this case the results of the project is building oil and gas EPC projects namely offshore platforms.

Mapping Engineering Phase

The first phase of the EPC project is engineering, where engineering is the process of realizing the idea became a reality with insight into the totality of the system is to focus on the effectiveness of the operational and maintenance are carried out from the conceptual stage in basic engineering and detail engineering.In the EPC company the oil and gas industry, existing business processes are mapped on a diagram level A1 which is in phase engineering starts from receiving the design specifications from the customer, and then makes the Material Take Off (MTO), and followed by making the Bill of Quantity (BOQ), Business process in EPC project in detail can be seen in Figure 2.

Mapping Procurement Phase

Procurement phase is the phase which includes the activities of procurement of goods and services for the purposes of the project and its supporting. It includes the planning process in purchasing, contract planning, the planning contract, acceptance of the offer from the vendor, the bid evaluation and determination of the winner, contract management and contract closure. In the EPC company the oil and gas industry, existing business processes are mapped on a diagram A2 level that existed at the procurement phase starts of making purchase requisition, held a beauty contest, receiving goods from vendors, and payment. For more details, mapping can be seen in Figure 3.

Analyze As-Is Process

a. Current Condition

In the historical data the final report of the project and data processing in EPC projects undertaken during the last 10 years, four of the five projects late in completion. The delay is ranging from 10-50 days of the deadline. In

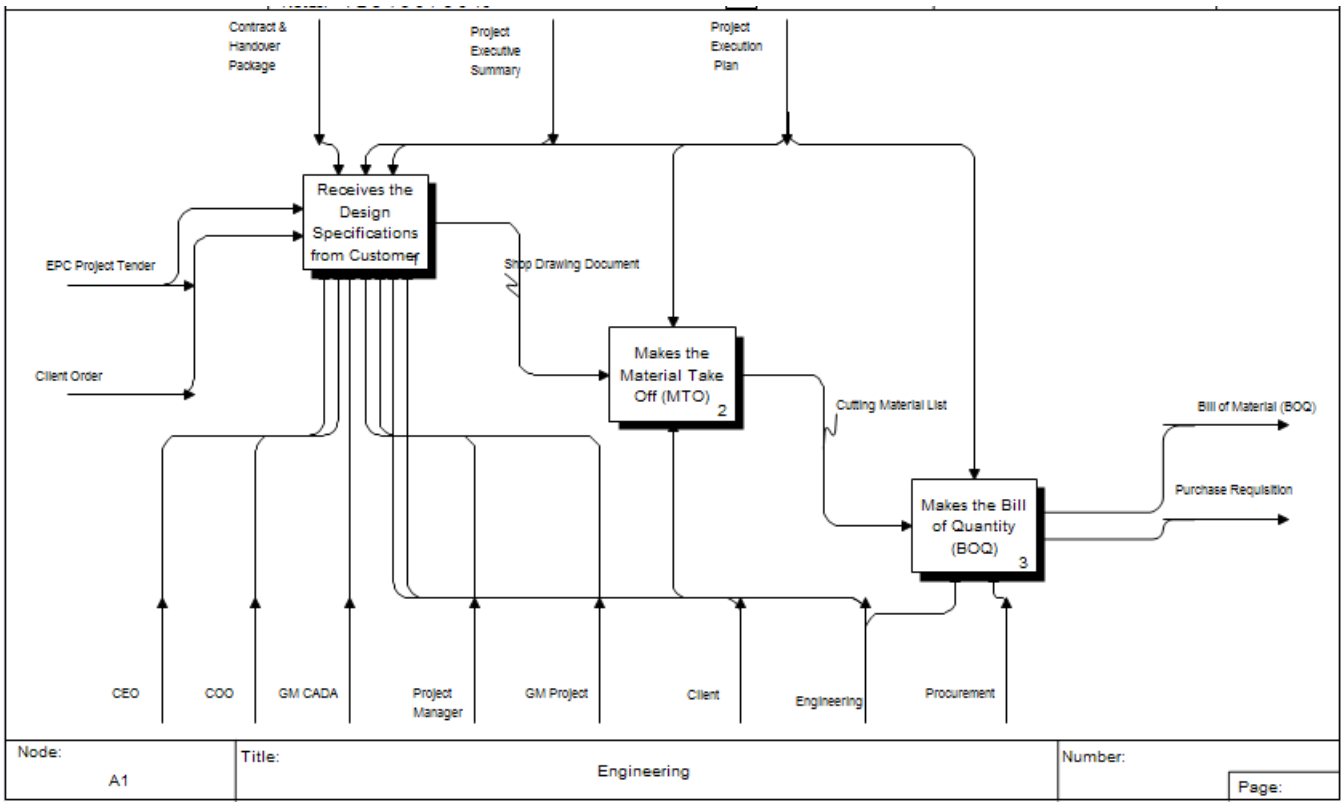

Figure 2. Mapping IDEF0 Level A1 in Engineering Phase.

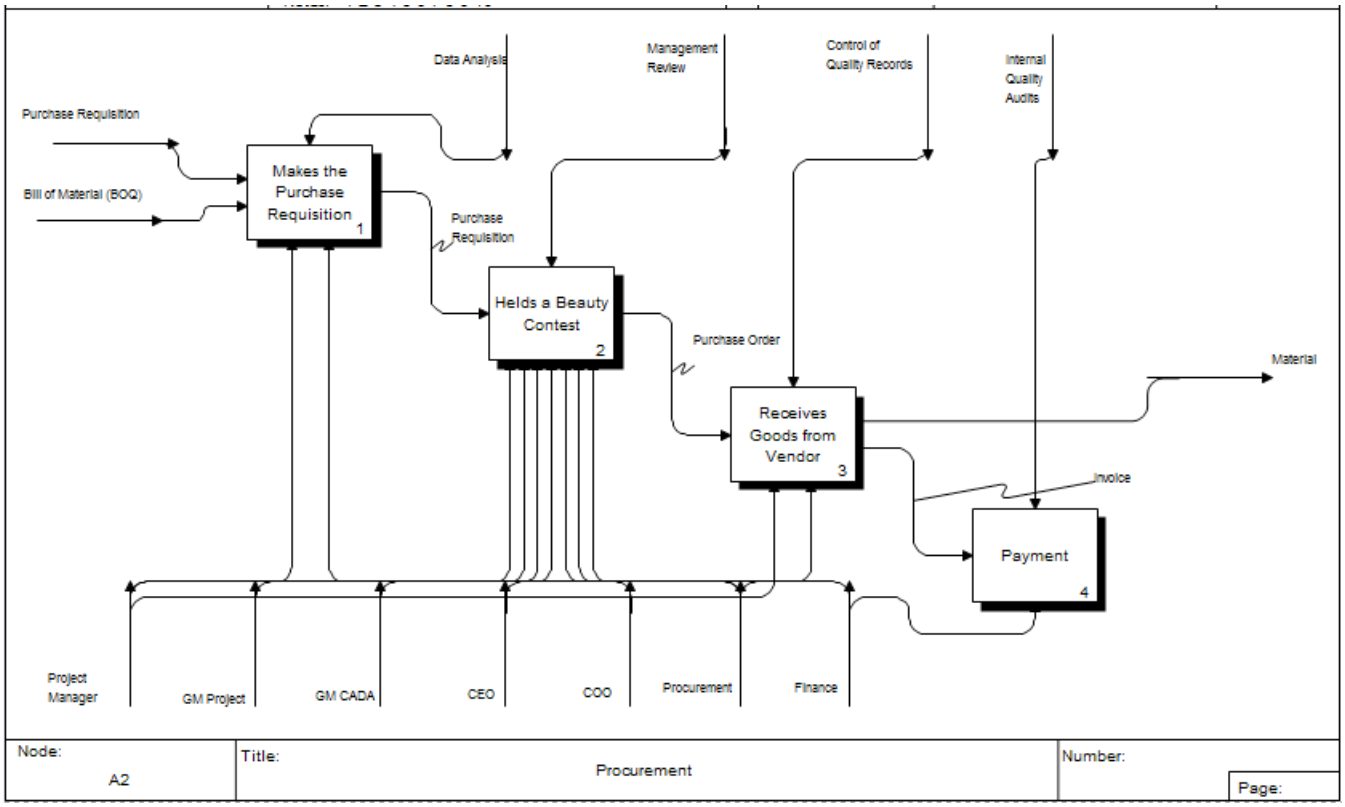

Figure 3. Mapping IDEF0 Level A2 in Procurement P.

addition due to project delays resulting in cost for the project was swollen, the swelling is between USD1-6 million.

b. Problem Identification

In the interview with four experts which are GM Project, Project Planner & Control Manager, Engineering Manager, and the project team, the complaints in the planning and implementation of existing projects in the engineering phase, among others:

- Index drawing does not fit
- The blueprint does not Approved for Construction, with precentage 20%.
- The blueprint does not match with the field, with precentage 20%.
- The design specifications are not in accordance with engineering
- The process of approval of the client is too long (5-10 days).
- Frequent revisions of documents thus slowing down the processing of the document.

The interview with four experts which are GM Project, Project Planner & Control Manager, Procurement Manager, and the project team, the complaints in the planning and implementation of existing projects in the procurement phase, among others:

- The item does not in the scope of local.
- The item does not Authorized Material List.
- The delivery item does not fit with PO.
- A letter of agreement / invoice from the vendor is too long in publication.
- Transportation distance is far (Singapore, Australia, Malaysia).
- Frequent revisions of documents thus slowing down the processing of the document.

Phase 3: Design To-Be Process

This stage performed by determining remediation strategies gained through focus group disscussion with General Manager of the project and Project Planner & Control Manager. The strategies for improvement are described in the Table 1.

Improvement Scenarios

From the sub-strategies that exist in the engineering phase can be developed three scenarios for business process improvement in the engineering phase. For a combination of sub-strategies into several scenarios are described in the Table 2. This combination is obtained based on the feasibility of implementation in each sub-strategy. After that the three scenarios will be compared with the time and outputs using Igrafx simulation and Microsoft Project.

Table 1. Business Process Strategies and KPI

Strategy	Explaination	Solving	Improvement
1	Create index drawing document.	E1, E2, E3	KPI
2	Optimizing the deal when tendering projects (the distance, location, and other information must be clear at the beginning).	E4, E5, P1, P5	KPI
3	Create historical vendor performance document.	P2, P3, P5	KPI
4	Create a new standar time of process from historical data.	E6, P6	Process
5	Doing the implementation of work early.	EP	Process, KPI

Table 2. Scenarios of Engineering Phase

No	Substrategies	Scenario		
		E1	E2	E3
1	Simplify process time by reducing the standards activity of the longest time and eliminate the activities held discussions with the client on engineering calculations at the subprocess receives the design specifications from the customer.	✓	✓	
2	Eliminating the activity of engineering drawing with manual counting on a sub process of making material take off (MTO).	✓		✓
3	Combining the activity of makes cutting plan, cutting lists, and print pattern on the cutting into a sub process to make the bill of quantity (BOQ).		✓	✓

Table 3 shows the scenarios of procurement phase which developed from sub-strategies in Table 1. This combination is obtained based on the feasibility of implementation in each sub-strategy. After that the four scenarios in procurement phase, this result will be compared the time and outputs using Igrafx simulation and Microsoft Project.

Phase 4: Reengineered Process

From the scenarios that are made of sub-strategies that exist in each phase then design process to-be was simulated.

From the comparison of scenarios in Table 4 that have been made, all the scenarios in engineering phase consisting scenario E1, scenario E2, and scenario E3 have a total time results in the engineering phase of the process under standard time set by the company. The best scenario at the engineering phase is the scenario E3 with the results of the process simulation time 29.19 days with an efficiency reaching 55%. In the procurement phase, the Scenario has been created that scenario P1, scenario P2, scenario P3, scenario P4, and scenario P5 all have the results of a total phase procurement process under a standard set by the company. Simulation on procurement phase did not include the activity of payments because the process is running for the project activity until three months after the ordering process, even for some projects payments made after the project is completed. The best scenario at the procurement phase is the scenario P5 with the results of the process simulation time 49.03 days with an efficiency reaching 35%.

Mapping the Best Scenario with Microsoft Project

After obtaining primary and secondary data to determine the existing business processes in EPC company in the oil and gas industry, It made the process mapping of the business processes in Microsoft Project. The selected scenario is scenario E3 (a combination of strategy 2.3) and scenario P5 (a combination of strategies 1,2,3,4,5). The total duration of activity in Microsoft Project is 89.5

Table 3. Scenarios of Procurement Phase

No	Substrategies	Scenario				
		P1	P2	P3	P4	P5
1	Simplify process time by reducing the standards activity of the longest time on the activity makes the process of preparation of a beauty contest in subprocesses make purchase requisition.	✓	✓	✓		✓
2	Combining the activities of making requisitions, creating and sending the estimated price be the activity with the same time.	✓	✓		✓	✓
3	Simplify process time by reducing the standards activity of the longest time in the delivery of quotation activity undertaken by the vendor.	✓		✓	✓	✓
4	Simplify process time by reducing the standards activity of the longest time in the activity of making documents Goods Receive Inspection Report and reducing the purchase of long lead items by 30%.		✓	✓	✓	✓

Table 4. Results of Scenario

Phase	Scenario	Scenario Process Time (Days)	Actual Project Time (Days)	Standard Time (Days)	Efficiency
Engineering	E1	32,6	65	50	50%
	E2	43,04	65	50	34%
	E3	29,19	65	50	55%*
Procurement	P1	61,45	75	50	18%
	P2	50,29	75	50	33%
	P3	57,29	75	50	24%
	P4	51,58	75	50	31%
	P5	49,03	75	50	35%*

days with the detail in engineering phase is 38.8 days and 57.5 days in procurement phase.

Phase 5: Improve Continously

To be able to control the quality and system as well as making continuous improvements, monitoring and controlling the performances of the new system is necessary. This can be done by creating and using Key Performance Indicators (KPIs). The KPIs constitute of:

- Create index drawing document,
- Optimizing the deal when tendering projects (the distance, location, and other information must be clear at the beginning),
- Create historical vendor performance document.

4. Conclusion

This study has resulted an improved project planning of business process re-engineering method with time of new process after improvement on the engineering phase is reduced to 29.19 days with an efficiency up to 55% and 49.03 days of the procurement phase with an efficiency up to 35%. The improvements can be calculated and the estimation of project cost savings is approximately 11%. Improvements have also been under a standard performance set by the company.

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