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Selecting The Optimum Project Delivery Method For Gasoline Sulfur Hydrotreating Project at Plaju and Balongan Refineries of PT Kilang Pertamina International (Kpi) By Using Analytic Hierarchy Process (AHP)

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ABSTRACT

PT Kilang Pertamina International (KPI), as a subsidiary of PT Pertamina (Persero), currently operates and fully administers the refinery business subholding, intends to build new Gasoline Sulfur Hydrotreater (GSH) unit to comply with the latest government regulation for Sulphur content of Gasoline shall be adjusted maximum 50 ppm by the end of 2027. In doing the project execution, it is important to find and decide the optimum Project Delivery Method (PDM) that shall be used effectively for GSH Project at the Plaju and Balongan Refineries to achieved PT KPI ultimate goal which is OTOBOSOR (On Time, On Budget, On Specification, On Regulation). Wrong decision to decide PDM will impact to potential delay in construction period that initiate potential change order in term of time and cost. Therefore, Evaluation and Selecting the optimum PDM will be done between 4 (four) alternative concepts of strategy contract scheme, namely Conventional Design-Bid-Build (DBB), Dual FEED Competition (DFC), Design Build Competition (DBC), and Co-current Design-Bid-Build (Co-current DBB) by using Analytic Hierarchy Process (AHP) Analysis. Author had already evaluate some parameters that give a big impact or influence to run PDM's strategy contract scheme to achieve OTOBOSOR target by using PESTEL analysis and interview through In-depth Questionnaire with Subject Matter Expert. Those parameters are analyzed through Pair Wise Comparation Analysis of AHP Model. Based on the analysis, the best alternative to be implemented is Co-Current DBB. In terms of sensitivity analysis, Co-Current DBB is also robust and gives a solid highest value compared with the other alternatives. Therefore, Co-Current DBB is a suitable scheme to be implemented for accelerating Project step from design bidding process until EPC Phase of GSH Project.

Keywords : Project Delivery Method (PDM), OTOBOSOR, Analytic Hierarchy Process (AHP), Co-current DBB

INTRODUCTION

Based on new regulation from government (KepDirjen Migas ESDM No. 110.K/MG.01/DJM/2022 tentang Standar dan Mutu (Spesifikasi) BBM jenis Bensin (Gasoline) RON 91 dan RON 95), the Sulphur content of Gasoline shall be complied to be adjusted maximum 50 ppm by the end of 2027. Currently, PT. Kilang Pertamina International (KPI) as a gasoline producer form its refineries cannot comply with the requirement because the gasoline production from the Plaju and Balongan Refineries still produce gasoline with sulfur content above 200 ppm. Therefore, PT KPI intends to build new Gasoline Sulfur Hydrotreater (GSH) unit included supported facilities at the Plaju and Balongan refineries to reduce the sulfur content of Gasoline produced in order it can comply with Dirjen Migas Specification. One of the most important milestones in starting

the project execution period in PT. KPI is selecting and deciding the Design Project Delivery Method that will be used in the contract for the project implementation. Selected Project Delivery Method will impact to achieved PT KPI goal which is OTOBOSOR (On Time, On Budget, On Schedule, On Regulation). The Project Delivery Method (PDM) is a strategy to select the perfect contractors/ licensors/consultant. To identify the contractor's service needs, the company should prepare bidding packages, conduct bidding processes, and sign contracts to handle the physical construction of the project. The goal of this approach is to find contractors with the necessary skills, tools, and methods to carry out construction projects efficiently and economically, minimizing significant difficulties and potential change orders during the Engineering, Procurement, and Construction (EPC) works.

To make the best decision, it is important to understand the various criteria and conditions of all Project Delivery Methods (PDM) strategies. This understanding helps achieve faster project delivery and optimized engineering design while minimizing unnecessary deviations during the EPC execution stage, ultimately lowering the total project cost. Therefore, PT KPI will consider selecting the most suitable Design Project Delivery Method for executing the Gasoline Sulfur Hydrotreating (GSH) Project. Project Delivery Method (PDM) that usually implemented in bidding or procurement system in PT. KPI as follows:

1. Separated and co-operative procurement system (conventional)
2. Integrated procurement system

PDM, which is usually used in PT. KPI, is Design-Bid-Built (DBB) as a conventional way where the responsibility for design and construction is separated responsibility on consultant for design and contractor for construction/execution phase. This method had a clear responsibility between design consultant and contractor but took a long time to build the project until start up period. On the other hand, PT. KPI also has well defined the other PDM to accelerate the project speed, namely Dual FEED Competition (DFC) and Design Build Competition (DBC) where design and construction are the responsibility of one organization in contractor. However, the actual duration to run bidding process until execution phase does not have a big difference among conventional way (DBB) compared with alternative ways (DFC and DBC). Another alternative option “co-Current DBB”, as a development of DBB to accelerate the sequence project but with clear responsibility matrix, is also under review to ensure no constraint happened when it is implemented later on. Those conditions need to be investigated in finding the perfect criteria of condition that can be used to determine the suitable Project Delivery Method for the next GSH project.

Based on the explanation above, it is interested to evaluate PDM’s strategy scheme between Conventional Design-Bid-Build (DBB), Dual FEED Competition (DFC), Design Build Competition (DBC), and Co-current DBB to find the suitable PDM that shall be used effectively for Gasoline Sulfur Hydrotreating (GSH) Project at the Plaju and Balongan Refineries. The right choice of Project Delivery Method will take a gain faster project delivery, and optimized engineering design with minimize unnecessary deviations during EPC execution stage that impact to lowering total project cost. This study will develop some justifications approach to define various criteria & conditions of all PDM’s strategy scheme needs for selecting the best strategy to be implemented in executing Gasoline Sulfur Hydrotreating (GSH) Project.

Company Profile of PT. Kilang Pertamina Internasional

PT Kilang Pertamina Internasional ("KPI") is a subsidiary of PT Pertamina (Persero), currently operates and fully administers the refinery business in Indonesia as a corporate entity with the intention of making a profit. PT. Kilang Pertamina International (KPI) as a gasoline producer has to comply with Government Regulation (KepDirjen Migas ESDM No 110.K/MG.01/DJM/2022 tentang Standar dan Mutu (Spesifikasi) BBM jenis Bensin (Gasoline) RON 91 dan RON 95), the Sulphur content of Gasoline will be adjusted to 50 ppm by the end of 2027. Currently, its refineries cannot comply with the requirement because the gasoline production from the Plaju and Balongan Refineries still produce gasoline with sulfur content above 200 ppm. Therefore, PT KPI intends to build a new Gasoline Sulfur Hydrotreater (GSH) unit included supported facilities at the refineries to reduce the sulfur content of Gasoline produced to comply with Future Government Regulation cq. Dirjen Migas Specification.

Business Issue

As mentioned above, The Business Issue is selecting and deciding the optimum Project Delivery Method (PDM) that shall be used effectively for Gasoline Sulfur Hydrotreating (GSH) Project at the Plaju and Balongan Refineries. The right selected PDM will impact to achieved PT KPI ultimate goal which is OTOBOSOR (On Time, On Budget, On Schedule, On Regulation). However, a wrong decision to decide PDM will impact to potential delay in construction period that initiate potential change order in term of time and cost. There are some issues that will be raised during project implementation if we cannot run PDM effectively, as follows:

1) Schedule delay
   Project schedule's delay occurs when the actual progress lags behind the planned schedule due to factors such as additional time needed for FEED and EPC bidding, scope changes, resource constraints, dependencies on external factors, poor planning and estimation, and unexpected issues and risks.
2) Cost overruns.
   Cost overrun typically potential occurs when the actual project cost starts to exceed the planned budget. It can occur due to various factors, including scope changes, poor cost estimation, unexpected expenses, inefficient resource utilization and vendor or supplier issues that coming from unclear detail scope or planning that lead to low budget estimation in planning stage and unexpected large expenses in construction stage. In order to enhance cost estimation and management procedures for upcoming projects, it's also critical to solve the problem costs exceed budget.
3) Change Order
   Change order may occur due to unclear/undefined scope of work, inadequate FEED documents, updated licensor documents, etc. It is driven from some factors such as shortened time and inexperience for several specific items to prepare supporting document for bidding process.

Novelty

This research introduces a novel approach by specifically evaluating and comparing Project Delivery Methods (PDM) tailored for the Gasoline Sulfur Hydrotreating (GSH) Project at PT Kilang Pertamina Internasional, in response to the recent regulation mandating reduced sulfur content in gasoline by 2027. Unlike general studies on PDM, this research focuses on the unique challenges of complying with environmental regulations in the energy sector. It critically examines traditional and alternative PDMs,

including the innovative Co-current DBB method, to determine the most effective strategy for timely, cost-efficient, and compliant project execution.

RESEARCH METHOD

In this study, qualitative data will be used in the analysis to provide more opportunities and space for gaining a deeper understanding of a certain subject, allowing for flexibility and exploration. Additionally, various quantitative data will be included to support the study as appropriate. Although there are many methods to gather information, generally, there are seven different approaches to data collection: media-based, interview-based, timeline-based, intuitive/generative, actor-oriented, consequence-focused, and system methods (Lindgren, M., & Bandhold, H. (2003)). This research will primarily gather qualitative data through interview-based methodologies using in-depth questionnaires and secondary data collection focused on literature reviews. After collecting data through these primary and secondary sources, data analysis will be conducted using the Analytical Hierarchy Process (AHP) method. AHP is a decision-making method that gains importance through pairwise comparisons between attributes within a hierarchical structure. It divides the decision-making process into several stages, leading to the final decision by objectifying subjective judgments based on the analysis results. This method systematically sorts the alternatives and derives them as a percentage scale reflecting their weights. Analyzing Step of AHP Method will be followed up as described in Figure 1. Research Design.

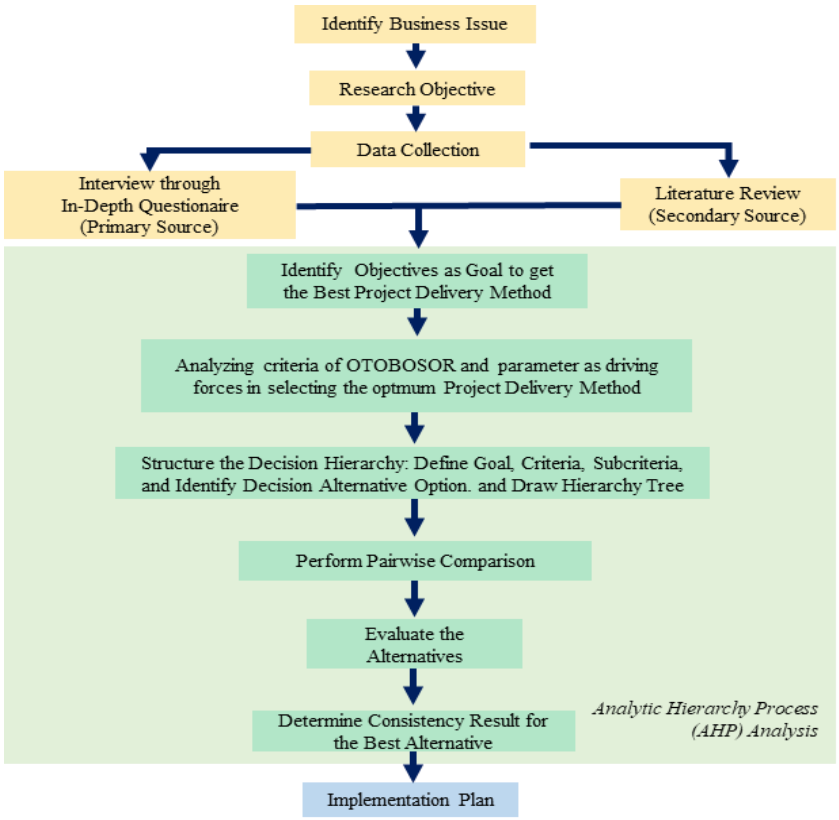


Figure 1. Research Design

RESULT AND DISCUSSION

Analysis

Defining Alternative Strategy of PDM's

The Project Delivery Method (PDM) dictates how the contractor executes the project and can significantly affect both the budget and schedule. It is crucial to select a project delivery method and contract format early in the planning phase, taking into account variables such as project scope, timeline, budget, risk issues, and lessons learned from previous experiences. PDM as the strategy that typically implemented in bidding system or procurement in PT. KPI as follows:

1. **Separated and co-operative procurement system (conventional),** where the responsibility for design and construction is the responsibility of a different organization. The design responsibility goes to the design (BED/FEED) consultant and construction is the responsibility of the contractor. In this term, PT. KPI knows it as Design-Bid-Build (DBB) Project Delivery Method. Currently, there is concerned to accelerate this method by implementing **co-current DBB** that is still under evaluation to determine its optimum criteria & condition for selected project.
2. Integrated procurement system, where design and construction are the responsibility of one organization. Examples of this system are: **Dual Feed Competition (DFC)** and **Design Build Competition (DBC)**.

There are 4 alternative strategy that will be analyzed using AHP to determine the best strategy, that shall be implemented in the GSH project, with explanation as below:

1. Scenario Conventional Design Bid Build (DBB)

Design-bid-build (DBB) / Conventional Contract scheme is a traditional or standard project delivery method in the construction industry. In this scheme, the owner does design engineering work through a design consultant (BED/FEED) before doing construction. Then, the owner creates requirements based on the engineering work to invite contractors to follow the bidding process for construction phase (EPC). All those sequences are done in series so there will be a clear separated responsibility & duties between design consultants and contractor's scope although it will take longer time schedule for the project's completion. However, by implementing this scheme, The owner has complete control over the design and specifications of the project as mandatory reference to be detailed and constructed well by contractor in EPC Phase. Practically, DBB contract scheme usually consists of three major phases:

a. Design Phase

- Basic Engineering Design Package (BEDP): Project owner hires Licensor to prepare BEDP. In this step, basic design will be finalized. Licensor will develop a conceptual design based on the approved basic design that covers configurations, preliminary drawing, material balances, specifications and datasheet including cost estimates, equipment lists, and project schedules that meet AACE class III with accuracy -20% to +30%.
- Front End Engineering Design (FEED): After BEDP had been done, Owner hires FEED Contractors to prepare FEED Package. The packages will be developed to be more detailed and with the BEDP as basic reference that is mandatory to be followed. It will cover detailed engineering specifications, technical datasheet, material balance, the identification of potential risks and mitigation strategies, cost estimates, and project schedules, as an output of engineering package to meet estimation AACE class II (-15% to +20%). The deliverable report will be used for procurement and construction of the project in EPC Phase.

In PT. KPI, hiring a consultant will be done through an engineering bidding process from the invitation list of potential consultants. Each process is implemented in series process.

b. Bidding Phase: After design engineering documents are completed, the project owner makes bidding requirement (administration and technical) and solicits bids from EPC contractors. Then, Contractors submit their bids that cover all technical aspects, project timeline, and pricing for completing the project in EPC Phase. The project owner evaluates the bids, often considering factors like contractor technical qualifications & experience, and cost. The contract is then awarded to the selected contractor, typically the lowest responsible bidder.
c. Construction Phase: After EPC Contractor has been awarded, it will enter into a formal contract with the project owner to construct the project according to the design documents. Then, the contractor begins and completes the construction work as per the specifications and drawings provided in the design documents. Upon completion, the project is inspected to ensure it meets the design specifications, and the contractor hands over the finished project to the owner.

2. Scenario Dual FEED Competition (DFC)

The Dual FEED (Front-End Engineering and Design) Competition (DFC) contract scheme is a project delivery strategy primarily used in large, complex industrial projects, such as those in the oil and gas, petrochemical, and energy sectors. It involves a competitive approach to the front-end engineering design phase to enhance project value and reduce risks. In DFC Concept, the project owner selects two engineering firms or contractors to independently develop separate FEED packages for the same project. Both contractors work concurrently to develop detailed FEED studies which include detailed engineering, project execution planning, cost estimation, and risk analysis. At the end of the FEED phase, the project owner evaluates the two FEED packages based on various criteria, such as cost, schedule, technical quality, risk mitigation, and overall project execution strategy. The owner selects the more favorable FEED package, typically with the lowest price, and awards the EPC contract to the corresponding contractor for executing the project. The other failed Contractor will be compensated for its FEED execution.

In DFC contract scheme, the competitive nature encourages contractors to develop more innovative and higher-quality designs to win the contract, to optimize costs and schedules to present the most attractive bid, provide the owner with multiple perspectives on project risks and mitigation strategies for decision making, and to enhance the accuracy of cost estimates and project schedules based on 2 source of detailed FEED studies. However, DFC contract scheme also need higher upfront costs, longer time & resources, and required complex and extensive analysis to evaluate and analyze the best FEED Package if we compare this contract scheme with the conventional study because of 2 separate FEED studies involved.

3. Scenario Design-Build Competition (DBC)

This approach combines design and construction services under a single contract, streamlining the project delivery process. In DBC Contract scheme, the owner prepares a Request for Proposals (RFP) that outlines the project requirements, goals, and evaluation criteria. The RFP is issued to pre-qualified contractors with design-build teams typically include both architectural/engineering and construction firms. Then, contractors will compete to develop comprehensive proposals that include both the design concept and the construction plan. In PT. KPI, contractors will provide

proposals for design concept & engineering study as reference for the owner to choose 2 best contractors to do design study based on on the optimum proposed technical aspect (included design quality, schedule, innovation, technical approach, and team qualifications) and commercial aspect (cost). After engineering study was completed, the 2 best contractors prepare detailed proposals for EPC Phase that covering aspects such as detailed engineering design as like detailed drawings, construction methods, schedules, cost estimates, and project management strategies. Then, the competing 2 contractors submit their proposals to the project owner. A selection committee evaluates the proposals based on predefined criteria that are dominantly based on commercial aspects such as cost and local content. Finally, the project owner selects the most advantageous proposal and awards a single design-build contract to the winning team. The selected contractor team then proceeds with their final design into EPC Phase.

By implementing DBC contract scheme, there will be better coordination and collaboration between the design and construction teams, reducing the potential for conflicts and misunderstandings because designer and construction team comes from the same contractor. The integrated nature of DBC allows for overlapping of design and construction phases, potentially reducing the overall project timeline although it takes more time in designing work because there are 2 contractors involved. DBC can make contractors to do a competitive proposal that encourage cost-effective solutions & innovations. It will also have a single point of responsibility which can help control costs and minimize change orders.

4. Co Current Conventional DBB

The Co-Current Design-Bid-Build (DBB) contract concept is a variation of the traditional DBB project delivery method, designed to streamline and accelerate the project timeline. In Co-Current DBB, certain phases of the project overlap or run concurrently, rather than sequentially, to reduce overall project duration. Unlike the conventional DBB approach where the entire design phase is completed before bidding begins and all phase included bidding process shall be done in series, in Co-Current DBB, portions of the design are completed and released for bidding in phases or there will be overlapping design phase with bidding process in front end design and EPC phase. By overlapping design, bidding, and construction phases, the overall project timeline can be shortened significantly.

However, overlapping phases in Co-current DBB concepts require meticulous planning and coordination to avoid conflicts and ensure smooth transitions between phases. If issues are discovered during early construction phases, it may necessitate design changes in subsequent phases, potentially leading to increased costs and delays. Therefore, in this phase, it is needed a strong monitoring from owner to maintain planning & scheduling and design criteria on track consistently. By this concept, owner interest or control on the project is stronger compared with the integrated procurement scheme, where design and construction are the responsibility of one organization (DFC and DBC) because there is clear responsibility for design and construction is in different organizations on each designer/consultant and EPC contractor. By having different responsibilities, it is possible for owner to take control to do enough design iterations to ensure the final design already consider worst cases of owner interest in order construction phase aligned with owner's project objectives. Close monitoring and coordination on owner side to contractor is a key to ensure minimizing or not much

design changes in subsequent phase at construction phase to avoid increased cost and delay.

The Co-Current DBB concept is particularly useful for a project where time is a critical factor, such as infrastructure projects, large-scale commercial developments, or fast-track construction projects especially related with compliance or government regulation. By strategically overlapping design, bidding, and construction activities, the Co-Current DBB approach aims to achieve faster project completion while maintaining the benefits of the conventional DBB concept.

Based on Interview through in depth Questionnaire, In term of Responsibility matrix between Owner & Contractor and Owner Control, the actual duration to run bidding process until execution phase does not has a big difference among conventional way (DBB) compared with alternative ways (DFC and DBC). In PT. KPI, implementing DBB Concept from conceptual phase into Contract Award of EPC Phase will need duration typically around 26 months. Meanwhile, it will take typically less 1 or 2 month earlier for DFC and DBC. There will be longer time to do FEED design typically around 9 months in DFC scheme vs 6 months in Conventional DBB scheme. There will be longer time also to do design work (BEDP+FEED) and EPC Contract alignment in DBC Scheme, typically around 9 months & 12 months, vs 6 months for each steps in Conventional DBB scheme.

In Co-current DBB scheme, by overlapping design, bidding, and construction phases, the overall project timeline can be shortened significantly compared with the other scheme. For GSH Unit as compliance project, the potential total project timeline simulation of Co-current DBB is around 6 months earlier than conventional DBB scheme from conceptual design until EPC contract awards,. Overlapping all DBB's step has higher risk of design changes in later phases that lead to change order and delay schedule because different Contractor's involvement in the planning and execution stage of the project and unforeseen issues during construction. However, it is known that Gasoline Hydrotreating Unit (GSH) is a process unit with common technology used in Oil & Gas Industry where project owner had already experienced with for many years. The project owner knows very well about the technology provider of GSH unit and EPC contractors. Therefore, the potential risk that leads to change order and delay schedule, had been mitigated by the project owner to minimize any potential change order happened during using Co-current DBB scheme.

Based on the explanation above, selecting the optimum contract strategy scheme as the selected alternative of Project Delivery Method (PDM) is needed to be done by using Analytic Hierarchy Process (AHP) Analysis that shall consider several criteria's & sub criteria's, as described in table 1 below, as driving force to give big impact or influence in achieving OTOBOSOR target.

Making a Pairwise Comparation of AHP Model

Calculation

Using data from the questionnaire results, the correspondents predominantly determine the selection of criteria, sub-criteria, and alternatives based on personal judgment, which is informed by their knowledge, skills, and experience. The correspondents include decision-makers from high, middle, and lower levels, all of whom hold responsibilities and positions related to compliance or oil and gas projects, providing them with the relevant experience. In doing calculation of pair wise comparison result for having weight sum of each criterion's, sub criteria's, and alternatives from AHP Model. The Super Decision software is used to simulate a hierarchy process, calculate criteria,

and sub criteria and calculate the best alternative. Tables 1 show conclusions the total weight sum calculation for criteria, sub criteria and alternatives as follows:

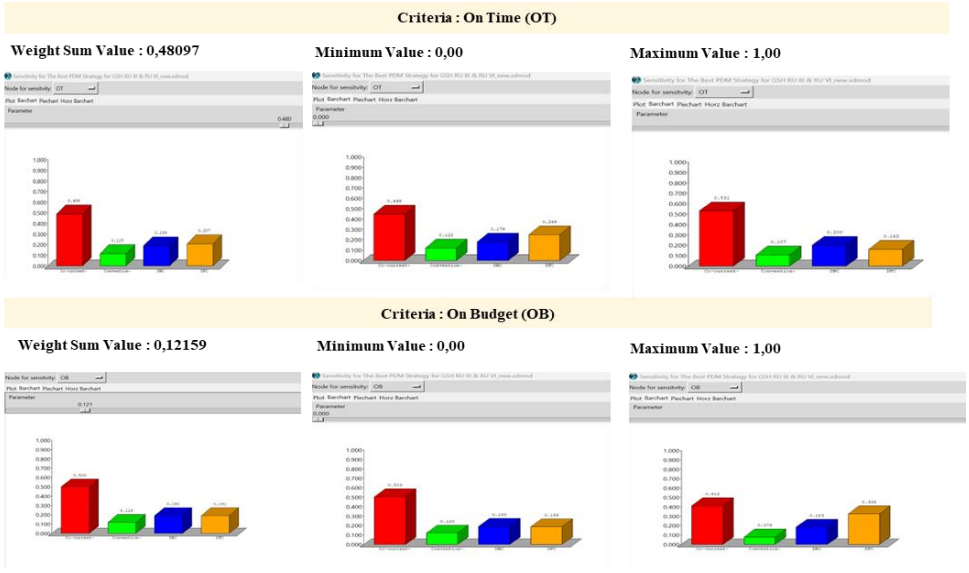
Table 1. Weighted for Criteria, Sub criteria, and Alternatives

Hierarchy AHP Results	Weighted Sum
Criteria:	
On Time_Schedule (OT)	0,48097
On Budget (OB)	0,12159
On Specification (OS)	0,25743
On Regulation (OR)	0,14001
SubCriteria:	
Overall Project Schedule	0,80000
Owner Control to Contractor	0,20000
EPC Cost	0,85714
Potential Change Order	0,14286
Consistency & Maturity Design	0,80000
Human Resources	0,20000
Tender Rule & Guidance	0,75001
Potential Audit Findings	0,24999
Alternatives:	
Conventional DBB	0,11453
DFC	0,2051
DBC	0,18945
Co-current DBB	0,49092

Based on calculations result on the table above, it is shown that the very important main criteria to achieve OTOBOSOR target is On Time Schedule with a priority weight 0,48097. Then followed by other criteria. Based on the four alternatives listed above, it can be seen that Co-Current DBB is the first-choice alternative with a priority weight 0,49092, then followed by the second alternative DFC with a priority weight 0,2051, the third alternative is DBC with a priority weight 0,18945, and finally the alternative in the fourth position is Conventional DBB with a priority weight 0,11453.

Sensitivity Analysis

In this study, author uses The Super Decision application for doing sensitivity analysis by changing the criterion parameter values of OTOBOSOR Target (On Time (OT), On Budget (OB), On Specification (OS), and On Regulation (OR)) from original into minimum and maximum value. Based on the sensitivity analysis simulation, it shows that **the best alternatives remain at Co-Current DBB** compared with the other alternatives. Therefore, it can be concluded that the outcome of the decision is robust. The simulation results can be described as follows:



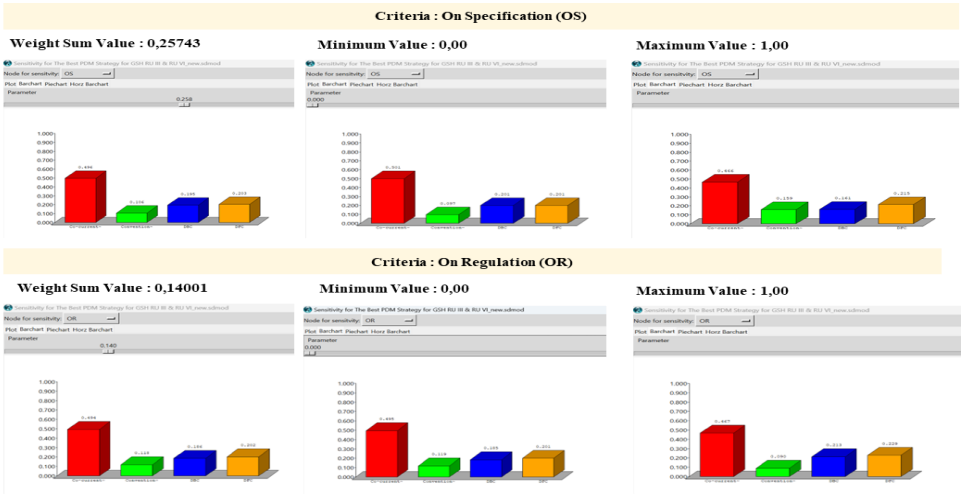


Figure 2. sensitivity analysis by changing the criterion parameter values of OTOBOSOR Target

Business Solution

In selecting the optimum Project Delivery Method that shall be used effectively for Gasoline Sulfur Hydrotreating (GSH) Project at the Plaju and Balongan Refineries, it is needed to develop some justifications approach to define various criteria & conditions need for selecting the best strategy to be implemented in executing the Project by using Analytic Hierarchy Process (AHP). Therefore, some analysis had been conducted through literature studies and interview through in depth questionnaire to answer Research Question with solutions as follows:

1. What are the differences between each Project Delivery Method?

Based on the analysis had been done, the main difference of each Project Delivery Method as follows generally:

- **DBB** is conventional project delivery method in procurement system, where the responsibility for design and construction is clear and separated on a different organization. It is the best choice for straightforward projects with a well-defined scope and well-planning schedule. In this scheme, the owner can take full control and easily influence the variation and design change if required in design work before construction phase. Therefore, the timeline of the project is not too crucial.
- **DFC and DBC** are included in the integrated project delivery method in procurement system, where design and construction are the responsibility of one organization. In DFC, the responsibility of contractors starts from engineering package (FEED) to EPC Phase. In DBC, the responsibility of contractors starts from basic into front-end engineering package (BEDP+FEED) to EPC Phase. So, the responsibility of DBC is higher than DFC. However, both schemes are ideal for large, complex industrial projects, especially the project owner has no experience, that needs a high-quality, innovative solutions, and effective risk management with integrated efficient timeline.
- **Co-current DBB** as a development/modification of conventional DBB with clear responsibility matrix to set up parallel design activity (BEDP/FEED) with bidding process of detail design EPC phase. It is the best option for large, complex projects where reducing the timeline is crucial and the project owner had a lot of experience related with scope of the project such as common technology provider and EPC

Contractors as owner's feedback to mitigate any potential risk using Co-current DBB scheme.

2. **What is the criteria or parameters that should be considered and give impact or influence as driving forces to run a selected Project Delivery Method of the project to achieve OTOBOSOR target?**

By having In-Depth Questionnaire from related function, it is classified totally 8 (eight) parameters or 2 parameters per each criterion of OTOBOSOR that give big impact or influence driving forces to run a selected Project Delivery Method to ensure minimizing potential delay, high budget, unmatched specification and regulation in order OTOBOSOR target can be achieved. Those parameters are as follows:

Table 2. List of Parameter as Driving Force of OTOBOSOR Target

OTOBOSOR Target	Parameter as Driving Forces
a. On Time/Schedule	Overall Project Schedule, Owner control to contractor
b. On Budget	EPC Cost, Potential Change Order
c. On Specification/Quality	Consistency & Maturity Design, Human Resources
d. On Regulation	Tender Rule & Regulation, Potential Audit Findings

3. **What is the appropriate contract strategy to be recommended for future Project Delivery Method strategy (PDM) scheme on GSH Project to minimize potential project issue happened (schedule delay, cost overruns, change order) to achieve OTOBOSOR target?**

Based on AHP analysis, the best alternative to be implemented as PDM scheme on GSH Project is Co-Current DBB with accumulative weight 0,49092 compared with the other alternatives. AHP Analysis also show the most target to be taken concerned in the selected scheme is On Time/Schedule with the most parameters to be considered and giving impact/influence on the project are overall project schedule and Owner Control to Contractor. For additional consideration, GSH project is a familiar scope that the project owner had a lot of experienced for many years with the technology provider and EPC Contractors.

Co-Current DBB also a robust sensitivity analysis. By simulated range minimum value into maximum value for each criterion of OTOBOSOR Target (On Time, On Budget, On Specification, and On Regulation), Co-Current DBB gives a solid highest value compared with the other alternatives. It shows that the Project Team agree Co-Current DBB is suitable scheme to be implemented for accelerating Project step from design bidding process until EPC Phase of GSH Project.

Implementation Plan

Aligned with the simulation result of AHP Analysis and explanation above, related function in PT KPI had been discussed and decide the Co-current DBB as selected optimum project delivery method for GSH Project that has been implemented during engineering phase on year 2024 and shall be overlapping with the sequences of EPC bidding process, started on the same year, and predicted to be normal operation tentative in the middle quadrant of 2027.

CONCLUSION

First, there are 4 alternative strategies of Project Delivery Method that shall be potentially implemented in the GSH project with the differences are as follows: a) DBB is a conventional project delivery method in the procurement system, where the responsibilities for design and construction are clear and separated in different

organizations. This is the best choice for straightforward projects with a well-defined scope and a good planning schedule. In this scheme, the owner can take full control and easily influence design variations and changes if needed in the design work before the construction phase. Therefore, the project timeline is not very important. b) DFC and DBC belong to the integrated project delivery method in the procurement system, where design and construction are the responsibility of one organization. In DFC, the contractor's responsibility starts from the engineering package (FEED) to the EPC Phase. In DBC, the contractor's responsibility starts from the basic engineering package to the front-end (BEDP+FEED) to the EPC Phase. Both schemes are ideal for large and complex industrial projects that require innovative and high-quality solutions, as well as effective risk management with an efficient and integrated timeline. c) DBB concurrently as a development/modification of conventional DBB with a clear responsibility matrix to prepare parallel design activities (BEDP/FEED) with the EPC detailed design stage bidding process. This is the best choice for large and complex projects where time-line reduction is critical and the project owner has extensive experience related to the project scope such as general technology providers and EPC Contractors. Second, there are 8 (eight) parameters or 2 parameters per OTOBOSOR criteria as driving forces that have a major impact or influence during the project work related to the achievement of OTOBOSOR targets as described in table 2 above. Third, based on the AHP analysis, the best alternative to be implemented as a Project Delivery Method (PDM) scheme on the GSH Project is Co-Current DBB with a higher accumulative weight compared to other alternatives. The highest OTOBOSOR target in the selected scheme is On Time/Schedule with the parameters that have the most impact/influence on the project being the overall project schedule and Owner Control to Contractor. Co-Current DBB is a robust sensitivity analysis. During the simulation, Co-Current DBB gave a solid highest score compared to other alternatives. This shows that the Project Team agrees that Co-Current DBB is a suitable scheme to be implemented to accelerate the Project steps from the design bidding process to the EPC Stage of the GSH Project.

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