

FINAL INVESTMENT DECISION (FID) PROCESS IMPROVEMENT IN OIL & GAS MAJOR CAPITAL PROJECT CASE STUDY OF PT. VUL'S DECISION-MAKING PROCESS

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Abstract Uncertainties from many factors, oil price, production, execution and operational risks, external factors, are issues that impact project profitability. For major capital projects (MCPs), with magnitude of investment well into hundreds of millions or billions of dollars, a robust, structured rational process is required to minimize uncertainties and provide all the required information for a decision maker to make a high-quality, measured decision in continuing with execution of the project. Semi-structured interview for projects with CAPEX valued around \$500 million, and above \$10 billion were performed; coupled with comparison between appropriation and actual results, and literature reviews to uncover the complexities, experienced issues that happened in the process. Process and bias analysis were performed to provide solution. Reviews were made on Decision Executive (DE)/Decision Review Board (DRB) effectiveness, market price intelligence, high-grading or project sequencing options, external alignment, optimum time period of investment, biases encountered and how to mitigate them. To mitigate above identified issues, inclusion of mitigation in the FID process, through DE/DRB alignment, project sequencing, market condition scenarios, technology maturity review, debiasing methods, external stakeholder engagement, and optimize time to FID, including transformation and implementation process is presented as part of the study's conclusion.

Keywords: Bias, Decision Review, Final Investment Decision, Major Capital Projects, Oil & Gas.

1. Introduction

Under current global oil price condition, where after mid-2010s oil price crash, trend is still largely dominated by global trade, geopolitics, and commodity transportation security, there are very little number of oil & gas Major Capital Projects (MCPs) that obtained Final Investment Decision (FID) approval. In this paper, business case exploration was performed on the overall process, including understanding the process utilized to reach FID with focus on decision analysis (DA) in PT. VUL.

There are many examples of MCPs with disastrous results: Shell's Sakhalin II project was sanctioned at \$10 Billion, with actual cost in excess of \$28 Billion. BP's deep-water Thunder Horse platform fell into 30 degrees list and was in danger of foundering after Hurricane Dennis in 2005 (see

Figure 1). Statoil's Snøhvit LNG project sparked political controversy in Norway, resulting in 10 days construction blockade by protesters in the summer of 2002. Other example from nuclear power generation projects, Finland's Olkiluoto-3 reactor project was sanctioned in 2005, with start of commercial operation planned for 2010; as of November 2018, the estimate for start of regular production is pushed back to January 2020 (Rolstadås, Jergeas, Hetland & Westney, 2011). What above examples have in common, as termed by Flyvbjerg et al. (2009), "over budget, over time, over and over again". They are examples of worldwide projects which lessons learned (or not learned) by individuals or teams based on experience and research, and provided valuable insights that are required to add to the understanding of project challenges.

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Figure 1. BP's Thunder Horse Platform Listing after Hurricane Dennis

PT. VUL is a subsidiary of foreign oil and gas company that have operated for nearly a century in Indonesia, with business focus on upstream exploration and production, and considered as one of the top oil & gas producer in the country. The company operates under cost recovery Production Sharing Contract (PSC), and having key competitive advantage in Enhanced Oil Recovery (EOR) or tertiary recovery, where the use of thermal, gas, and chemical injection are used to improve the ultimate recovery of oil from a reservoir. Through this technology, PT. VUL has developed its concession in Indonesia as one of the largest EOR field in the world, and have produced

more than 12 billion barrels of oil from its concessions in Indonesia.

The company employs a staged or phase-gated approach in project sanctioning, with projects typically divided into 5 phases: 1) Identification and Assessment of Opportunities, 2) Generation and Selection of Alternatives, 3) Development of Preferred Alternative, 4) Execution, 5) Operation and Evaluation; which require DE/DRB approval for progressing from one phase to the next. FID decision point are typically required between phase-3 and phase-4, which include the objective to secure all external/regulators required support prior to FID. Figure 2 is showing current Decision Analysis (DA) process that PT. VUL is using.

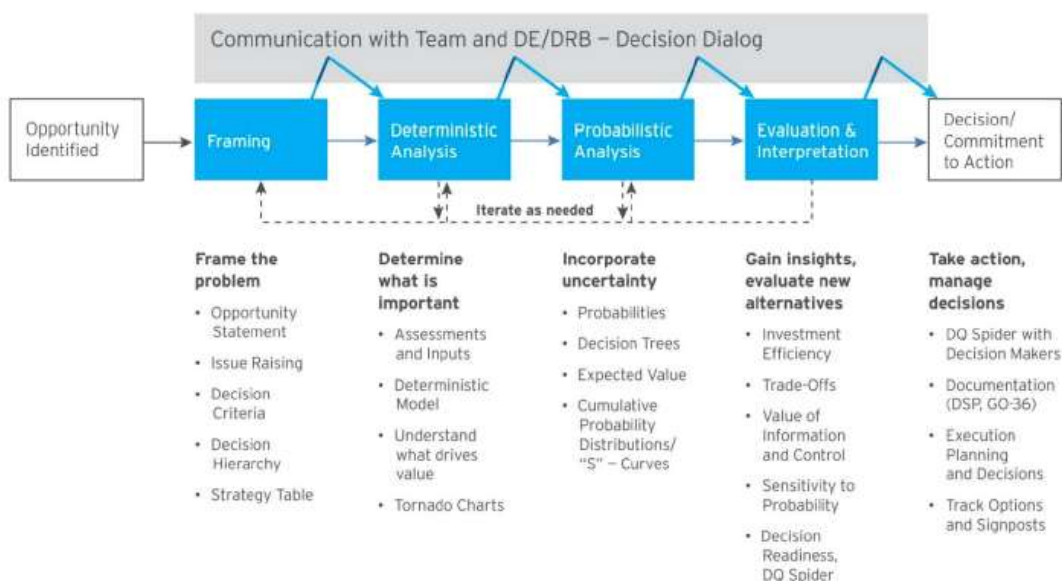


Figure 2. PT. VUL's Decision Analysis Process

2. Methods

Conceptual framework from this case study are referring the decision analysis process and assurance processes in PT. VUL's current project management & investment analysis process, where data collection is performed through semi-structured interview sessions with key personnel related to reference projects: 1) YXBA project, where the onshore project is executed as three different subpart of the whole project; YXBA-1 and YXBA-2 (about \$500 million CAPEX each) obtained FID sanctioning and was completed with overall satisfactory result, whereas YXBA-3 (about \$500 million) did not obtained FID due to oil price crash and uncertainty on concession renewal; and 2) OSS project, deep water project with >\$10 billion CAPEX estimate in which FID was not obtained due to conditional precedents that are required from external/regulator parties could

not be secured in a timely manner. In hindsight, OSS project's decision to back away from execution due to conditional precedents is a lucky break for PT. VUL, since not long after the decision was made, the mid-2010s oil price crash occurred. Continuing the project with low commodity prices would have been a financial catastrophe to the company, with much longer timeline to achieve payout level.

Besides semi-structured interviews, comparison between appropriation estimates (oil price, production, project completion cost, timeline) were made to actual values after project completion (for those passing FID), and literature research more towards organizational and psychological nature in decision making or judgement under uncertainties. Research flowchart could be found in Figure 3.

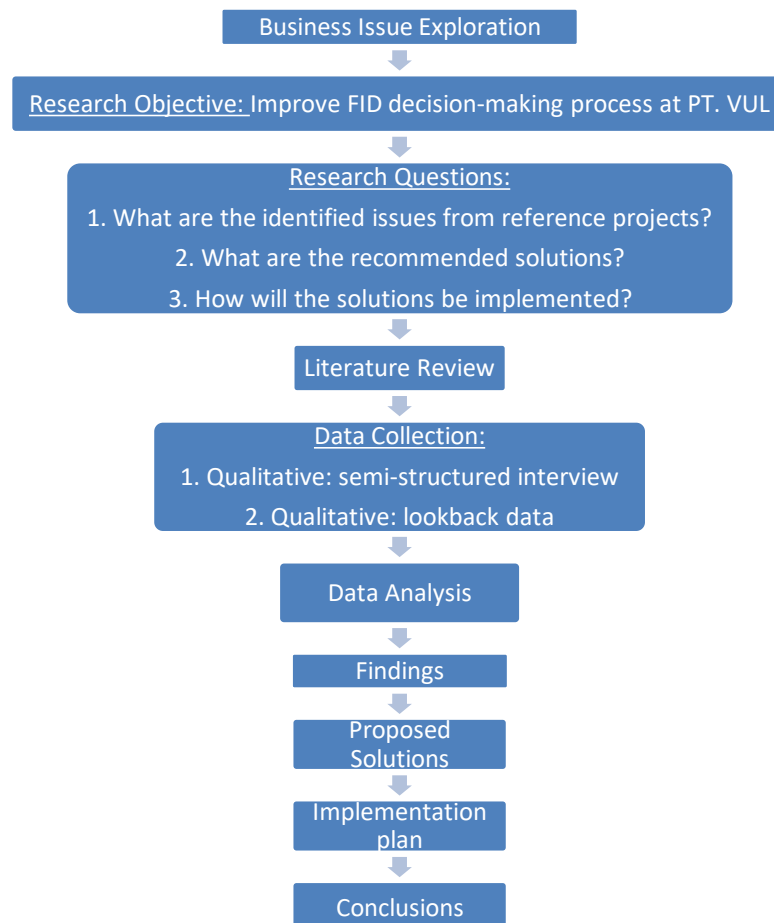


Figure 3. Research Flowchart

3. Results and Discussion

Analyzing the collected data, several resulting highlight issues are:

1. Commonly occurring biases in FID process:
 - a. Availability heuristic & anchoring: key personnel comparing the project at hand with another project that they are perceiving as similar, and use the project with whom they have greater familiarity as an anchor in estimating budget, schedule, or technical aspects in the newer project – flagged and corrected in assurance processes
 - b. Groupthink: in an unbalanced DE/DRB temperament alignment, an overly dominant DE might steer decision-making process into a top-down process, and limiting diversity of opinion and issue exploration before coming into a decision
 - c. Illusion of control/selective perception: typically observed from external stakeholder engagements, where key personnel assume that their external counterpart will use/could be driven to use similar rationale that they are using
 - d. Planning fallacy/well-travelled road effect: happens on most projects, for very familiar tasks, project team will typically provide shorter than actual schedule, with the assumption that for common tasks, project team will already have sufficient experience in performing it to accelerate the process – flagged and corrected in assurance processes
2. Investment sequencing options – could be used to reduce upfront risk of overall project, if the project could be executed as several sub-projects, and in several cases, might increase PSC-term incentives
3. For YXBA-3 and OSS project, failure to identify global market forecast through market intelligence
4. Captured from OSS project, where 5-7 years timeline could make a big difference in long-distance subsea tieback technology. In earlier reviews, this technology was not considered as proven or mature enough for long distances, causing the project team to opt the use of Floating Production Unit (FPU) technology. After the additional timeline, the technology that have been demonstrated on many different projects are considered safe and reliable enough, significantly reducing the upfront required investment
5. Time to FID, where PT. VUL is considerably lagging to competitors, in which current company culture to complete most of the optional steps required to make a decision. DE/DRB and key project leadership must be more discerning in identifying which activities will create more value.

Gap Analysis		
FID process improvement for PT. VUL		
Area Under Consideration:	Current State	Action Steps
Desired State		
Well forecasted energy market conditions	Still experienced surprises in regard to 2014 oil price crash	1. Strengthen energy intelligence process 2. Local energy market monitoring and combine into global trend reading
Improved profitability	Identification of project sequencing into smaller parts sometimes not identified upfront	1. Include project sequencing option and profitability impact in phase-2
Strong, continuous external stakeholders alignment	Changes in external support after change of personnel, lack of historical documentation on external support	1. Formalize required documentation proces for external stakeholder engagement 2. Mapping of critical external stakeholder organization for required supports
Identify and mitigate biases in decision making	Lack of understanding on biases for judgement under uncertainty, how to mitigate them	1. Provide socialization and training on commonly encountered biases 2. Develop CoP for continuous education on handling biases
Cross-functional review for optimized decisions	In a very small number of cases, DE/DRB could act under a top-down direction instead of full uninterested parties	1. Formal process in DE, DRB members nomination and approval by Endorser/Sponsor 2. Strengthen feedback and leadership behavior process in decision-making boards
Optimum investment timing	Lack of understanding on timeline impact on cost for up and coming technologies	1. Include identification of significantly cost impacting technologies in phase-2 2. Develop cost reduction impact forecast in future years for these technologies prior to alternative selection
Best against competitors in time to FID	Consistently slower than competitors in moving from conceptual design to FID	1. Provide difference of decisions required from PT. VUL operations 2. Empower decision makers in using different types of decision-making process (standalone, iterative, phase-gated) 3. Monitor time to FID across projects

Figure 4. Gap Analysis from Current to Desired State

Following the above captured issues, solutions to improve each issue are provided below:

1. DE appointment by project Sponsor/Endorser, DRB members nomination by DE, DRB members list approval by Sponsor/Endorser

Project Sponsor/Endorser to pick the most appropriate DE for the project, in relation to his/her experience to type of project, complexity in technical/external stakeholder issues, who has continuously demonstrated the ability to cultivate an optimized decision-making culture in the DE/DRB panel with project leadership team.

DE with Sponsor/Endorser to develop a list of possible DRB members for the project, with specific capabilities (technical & non-

technical) to improve the project's decision-making capability, with DRB members expected to have good working relationship with DE to maintain open communication channel for high quality feedback.

2. Corporate oil price deck refresh - L/M/H cases, multiple market condition scenarios (oil & gas bear/bull market, etc.)

Significant scenario that impact YXBA-3 project freeze was due to the 2014 oil price crash, something that was quite unexpected under previous scenarios being reviewed. With increasing shale production, global economic slowdown, threat of trade war, current energy market is in a far more unpredictable condition compared to early 2000s. And it is not improbable that a significant occurrence of climate change event (extreme weather, species extinction,

etc.) will spark higher society rejection of carbon-based energy extraction and usage, and drive higher demand on transition to greener energy.

3. Identification of the possibility of sequencing the project as multiple smaller phases

Common with investment strategy in highly uncertain times, it might be better to invest smaller in shorter-cycle projects to limit the probabilistic Tornado swings from external market conditions.

4. Upfront close-coordination with GoI stakeholders

Necessary regulatory approvals are considered as one of the key results required in Phase-3 prior to making an FID commitment, and for MCP projects in cost recovery regime areas, early and continuous engagement with regulators are considered as a critical key success factor for getting regulator buy-ins and support on the initiative, or at least for the project team to understand the remaining key concerns or alignment required with multiple regulator bodies.

5. Identification of new technologies that might be able to significantly affect the overall capital required, and expected time to mature that technology (now vs. later)

Picking-up the lessons learned from OSS project, where waiting for an unconventional subsea tieback technology maturity could significantly reduce project required investment, move many of the fabrication process from abroad to domestic, and higher confidence in refinery capacity allocation to the project, some uncertainties might be reduced if the investment is decided to be made after waiting for a more beneficial conditions – of course the challenge with this type of decisions (delay), many things could change from initial assumption which require significant strategy shift in the future.

6. Optimize time required for project development up to point of FID

Comparing time from initial conceptual phase to FOP or First Gas Production, it is clear that ALT Corp typically require longer period compared to its competitors – especially independent companies – which

raise the question, for a reservoir with which the company already have high level of familiarity, operations already matured, and domestic fabrication, contractor capabilities already at a known and relatively uniform performance level, some decisions could be streamlined to a fit-for-purpose activities deliverables to support only the critical decision making required.

7. Usage of debiasing methods in Phase-3 probabilistic analyses

One of the key results expected from Phase-3 is identification and quantification the full range of risks and uncertainties, which could be adversely impacted if some of the key biases built-in into the model has not been identified and debiased yet. Though PT. VUL is typically using external assurance processes, the typical range of biases listed above could be mitigated through nudges and trainings, whereas incentives are considered as lower having lower effectiveness in this type of decision-making process.

From the analysis and captured solutions above, the results are expected to improve overall process as below list:

1. Improved decision-making culture, preferably quantified to mitigate bias crutches in human psyche
2. Decision makers and project teams easily identify the difference between standalone, iterative, and phase-gate decisions and implement fit-for-purpose processes, optimizing time to FID
3. Alleviate limitations of external affairs engagement and alignment, well-documented engagement minutes of meeting, decision register with required external parties to maintain continuity between rotating personnel
4. Strengthened market intelligence team, nodal/shared information flow from multiple countries, instead of one-way only from headquarters to subsidiaries
5. Improved lessons learned information flow between key decision maker positions and project leadership teams

4. Conclusions

Referring to previous work by Bazerman & Moore [1], we could do small checklist on their proposed strategies on improving decision-making:

1. Use Decision Analysis tools
PT. VUL has multiple DA software available to use, with decision analysts' understanding to use them, and selection process on what DA tool usage is most appropriate for the case at hand as the main limitation in current condition. Understandably, DA career ladder and development just have been started in the company in early 2010s, where historically most of its capabilities in this aspect was still centralized in the Corporate headquarters, but some improvements have been made along the years to increase capabilities of local decision analysts to switch between multiple tools (Simultaneous Decision Analysis/SDA, Excel, Crystal Ball, DTRIO, Supertree, Decision Programming Language, etc.)
2. Acquire Expertise
Already being continuously built, internally and externally, however, with current internal expertise in PT. VUL that is varying across many detailed subjects of expertise. As a company, PT. VUL awards higher incentive for personnel development as a generalist compared to a specialist. This is quite typical for oil and gas company, where under difficult market conditions, the organization are usually undergoing employee reduction programs, or people being rotated to other positions that may or may not be their strong points. Currently the process to acquire expertise for MCPs are usually performed using seconded, contracted employees, or usage of specialist companies performing services for PT. VUL.
3. Debias Your Judgment
This is something that have not manifested itself sufficiently in decision-making meetings for MCP projects and perceived as one weak point in the decision-making process. The transformation process for FID proposed under this paper is quite focused towards strengthening the company capability in this aspect.
4. Reason Analogically
Organizationally, this analogical reasoning capability is already quite ingrained. It has manifested and demonstrated in many DRB meetings, where decision-makers are testing the piece of information he/she received, and typically a clarifying question are being asked to test his/her understanding as correct or not. These questions are typically in the form of analogies.
5. Take an Outsider's View
For this process, PT. VUL typically do rely on actual outsiders in performing cold-eyes review, peer review process to its projects. For all MCPs under PT. VUL's Corporate parent, the assurance process reviews and key steps are coordinated closely with headquarters, where expert outsiders will be introduced to MCPs under review, with skillset and experience match to the project.
6. Understand Biases in Others
For understanding biases in others, the required comparison process is mandatorily performed by PT. VUL through FEL (front-end-loading) results to a set of IPA (Independent Project Analysis Inc.) metrics, and DE and DRB have a prescribed minimum FEL score threshold under the company's project management process before the panel could support the project to pass the phase-gate process to the next phase.
7. Nudge Wiser and More Ethical Decisions
This item, which arguably, might be one of the most critical decision-making improvement processes, have different quality of implementation across different projects. It requires high degree of confidence of the DE in opening up his concerns to DRB panel and project leadership, even up to the level of second-guessing the option he/she is leaning towards, openly discussing trade-offs, the possibility of some options that might be more appealing, however sacrificing other aspects that might not be ethical nor wise. In this process, the DE typically requests additional feedback and inviting involvement from DRB and project leadership, building higher commitment from others in the decision-making process. For this improvement, experience, breadth of experience, expertise, and ultimately

moral values of the person himself will largely drive the process, and currently are being cultivated in PT. VUL's leadership development programs and managerial expertise building.

The proposed solution to these identified issues are expected to be a part of the transformed FID process, with implementation process as below:

1. Socialization & training
2. Pilot project
3. Organizational capability development and selection process
4. Decision analysis university
5. Continuous training program
6. Decision-making newsletter

Step-1: Socialization & training

Top-down push from PT. VUL higher management would be a critical factor to get the organization on board, development of steering committee with cross-team involvement would be a plus in building initial rapport from middle management.

Objective and impact to bottom line should be clearly communicated in initial wave of socialization, and training program should be customized for different layers of the organization, with critical focus on personnel having direct involvement in critical decision-making process, specifically for FID. To increase effectiveness in training cost, decision-making improvement process could be developed as a Computer Based Training (CBT), and included as mandatory requirement for decision makers, decision analysts, and project leadership positions.

Step-2: Pilot Project Implementation

Proof of concept is a powerful tool in building higher interest from multiple groups on process adoption, after socialization and training program, focus is to be geared towards pilot project implementation, metric measurement, and monitoring across multiple FIDs. Care must be taken that quality FID does not translate to winning in any environment, for some high uncertainty projects, where risk outweighs potential benefit, decision to move away from project execution is the way to go.

Equally critical, in selecting the suitable project for pilot project implementation, and strong enough support from DRB and project leadership

in implementing them. This is where the implementation of steering committee and process sponsor be very important in ensuring strong adoption and willingness to attempt a new or improved process.

Step-3: Organizational Capability Development and Selection Process

After pilot project implementation, identification and selection process across PT. VUL's employees must be focused on identification of current and potential decision-makers, with focus on decision making and decision analysis capabilities. For emerging decision makers, process might be started with smaller scale decision and FIDs, grooming and preparing his/her capability towards higher complexity projects and building early the understanding of common biases, how it impacts decision-making, and confidence in making decisions in raplex environment.

Step-4: Decision Analysis University

Not a real university, but setting up a community of practice where community members could learn from each other, with expected quarterly program developed in conjunction with steering committee. This is where mentoring/coaching program is expected to take place, decision analysis toolboxes will keep on be upgraded from identification of current needs of its practitioners. The control of this skillset development may be better built together with the Corporate parent of PT. VUL (ALT Corp.) to ensure alignment between business units, and continuous development and keeping up with the latest developments in the subject.

Step-5: Continuous Training Program

Supervised by steering committee, this program could be developed together with Human Resources (HR), certification and training team, or related career ladder Champions (Project Professional, Decision Analyst, Cost Engineering career ladders) for setting-up periodic training classes for beginner, experienced, and supreme mastery level of decision analysis gaps, possible biases and debiasing techniques, with periodic skill sets measurement and strategic staffing/succession program.

As part of succession and preparation between each career maturity level related to project works, mentoring program between DE/DRB, project

leadership level with project team members should be encouraged to continuously maintain trickle-down effect of knowledge in this matter.

Step-6: Decision-Making Newsletter

Managed by decision-making community of practice under ALT Corp’s coordination, several key members/administrators to route monthly newsletter with critical experienced and learnings from inside and outside the organization, quite

similar to Harvard Business Review articles. The aim of this step is to continuously maintain interest, knowledge sharing, lessons learned, and other critical leadership behavior related to FID and decision-making.

Refer to Figure 5 for improvement focus on each phase of PT. VUL’s project management & assurance process.

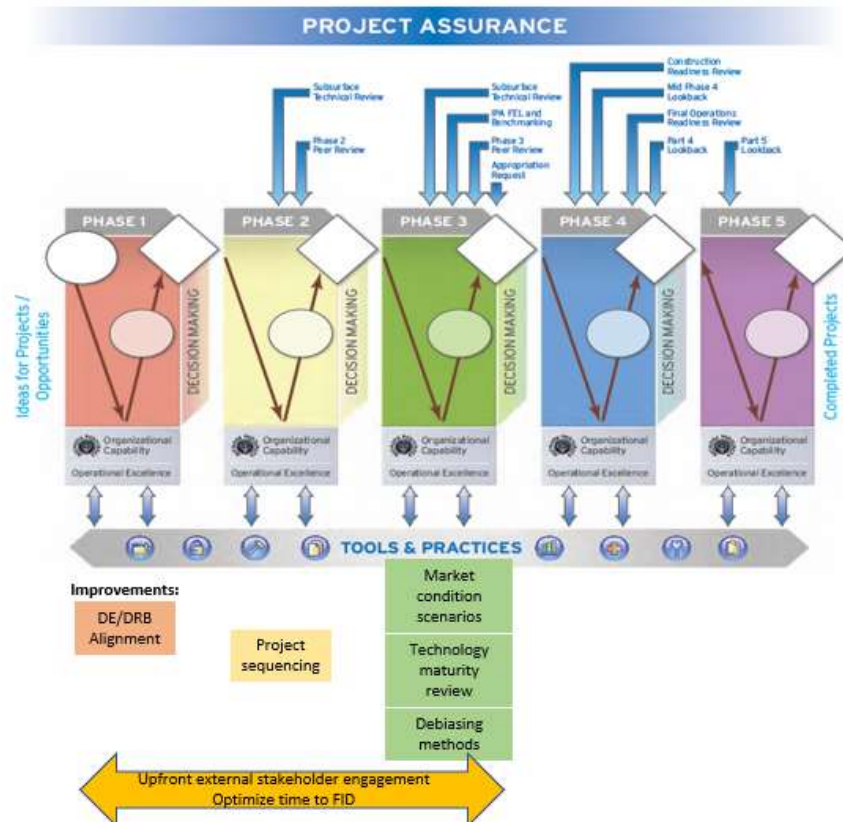


Figure 5. Improvement Implementation in PT. VUL’s Project Management Timeline

Since the reference projects in this study is based on cost recovery PSC, future research related to implementation of gross split PSC might benefit newer concession contracts. Under the

gross split mechanism, challenges in managing external stakeholders dependencies might be minimized.

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