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Decision Analysis Process to Develop New Well Investment Under Production Sharing Contract (PSC) Transition Period: Case Study Block Alpha by PT. XYZ

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Abstract - ***With only remaining 3 years towards end of contract, PT. XYZ decided to stop capital investment on new developmental well drilling in 2018 while in fact, they are still contractor until August 2021 under PSC schematic. The decline in national production in 2019 was among others the result of this company's move and will continue towards end of contract. Therefore, what is the alternative solution for the oil company to fulfil GOI request to keep continue new well investment towards end of contract in Aug 2021? This research aims to help PT. XYZ to find alternative economics new well drilling investment strategies to optimize the production and manage decline of block Alpha and oversee the continuation of investment prior to the end of contract by exercise and analyze solution alternatives and seek optimum potential agreement proposal as win-win solution. Using actual data from existing well production and other project typical data of new well development, this research will use PSC economic calculation to evaluate various alternative investment strategies which are Accelerated Depreciation Cost Recovery, Tax holiday and combination of both proposed alternative. In addition, Multi criteria Decision analysis (MCDA) approach is used to enhance decision quality. As the result, the selected investment strategy is expected to increase oil incremental of 1,5 million barrel of unrealized oil production until the end of contract in August 2021. The proposed alternative might provide additional contractor's Net Present Value (NPV) of $10,7 million with DPI of 1.35. It is critical to have decision soon after the problem exist between PT. CPI and GOI where both parties must decide what agreement should be made to continue new well drilling investment. Once the decision timing become delay then PT. CPI and GOI will be facing critical situation to make an agreement. The decision potentially no longer considering project economics but expose to other irrelevant aspect which might have an impact to additional cost and resources.***

Keywords - **multi criteria decision analysis, production sharing contract, capital investment**

I. INTRODUCTION

Indonesia has been active in the oil and gas sector for more than 135 years, after its first oil discovery in North Sumatra in 1885. As part of globalization, Indonesia become member of OPEC from 1961, and then suspended its membership in 2009 after years of declining production. Rejoined the organization back in January 2016 but suspended its membership again in November 2016. According to the BP Statistical Review of World Energy 2019, Indonesia holds proved oil reserves of 3.2 billion barrels at the end of 2018.

Indonesia has a diversity of geological basins that continue to offer sizeable potential for oil and gas exploitation with about 60 sedimentary basins, including 36 in Western Indonesia that have already been thoroughly explored. Fourteen of these are producing oil and gas. In under-explored areas of Eastern Indonesia, 39 tertiary and pre-tertiary basins show rich promise in hydrocarbons.

About 75% of exploration and production is located in Western Indonesia. The four oil producing regions are Sumatra, the Java Sea, East Kalimantan and Natuna. The three main gas-producing regions are East Kalimantan, South Sumatra and Natuna operates by contractors under SKKMigas supervisory.

PT. XYZ is one of the as upstream subsidiaries of Chevron Corporation had started oil and gas exploration in Riau Province since 1924 based on historical geological survey. The company made its first production in 1952 in Minas Field, part of the block Alpha. At that time, the level of production in the Minas field was still at the level of 15,000 barrels per day (bpd) and continued to increase by more than 100,000 bpd.

Block Alpha has an area of 6,264 km2, has two of the largest oil fields, namely Mega and Delta. These two fields are the largest oil fields due to their abundant oil production. PT. XYZ operate block Alpha since 1944 under Production Sharing Contract (PSC) schematic, where the end of current contract will be on 2021. Due to its unique geological structure, PT. XYZ hydrocarbon extraction activity in block Alpha area is mostly dominated by oil production. The oil production is ranging from light oil or know as Sumatra light oil (SLO) to Heavy oil (HO) products from more than 100 fields

With only remaining 3 years towards end of contract, PT. XYZ decided to stop capital investment on new developmental well drilling in 2018 because the block is no longer economic, while in fact, they are still contractor until August 2021 under PSC schematic. This decision highly disrupts national oil and gas stocks. The decline in national production in 2019 was among others the result of this company's move and will continue towards end of contract. Block Alpha is currently the second largest contributor to national oil production as much as 28.68% and also has extraordinary oil deposits.

PT. XYZ has stopped drilling new wells in the Alpha block since the Indonesian government rejected their renewal proposal for a contract extension in July 2018. As a result, the production of the Alpha block, which used to

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be the biggest contributor to national oil production, has continued to decline in the last two years. In 2018, the Alpha block still produced oil at an average of 210 thousand barrels per day. The number keep decreasing significantly until now with average of 160-170 thousand barrels per day.

PT. XYZ's decision to stop drilling in the block Alpha has not only affected the national oil and gas production but also caused difficulties for PT. PHE as successor to raise production when it starts managing the block in August 2021.

New well drilling activity is one of the major capital projects in block Alpha by PT. XYZ. Based on internal project lookback for 5 years period from 2013 – 2017, PT. XYZ drilled average 300 – 400 wells/year with annualized oil incremental volume of 5 million barrels and revenue up to half billion US dollar per year of value creation. Payout time of new well investment took about 3 – 4 years and return of depreciation on cost recovery is distributed within 5 years as ruled under PSC.

With current recovery factor of 56%, block Alpha still have large remaining oil reserves or Original Oil in Place (OOIP) and every year, this major capital project always delivers and proven as highest economic value and to the company ang the host country.

In this study, author will determine alternative new well drilling investment strategies or agreements between PT. XYZ and GOI to optimize the production and manage decline of block Alpha during transition period. Analysis in chapter result will exercise and identify best solution between investment scenarios when the problem raised at the end of 2017 during WP&B preparation for 2018 Business Plan.

II. METHODOLOGY

Development of the solution in this business issue is conducted in accordance with the framework as shown in the figure 1. The framework consists of 3 phases which are Company Analysis, Formulation of Solution and Implementation of Solution. In first phase, we need to analyze business situation and problem root-cause. Before developing an investment strategy, it is important to conduct a situation analysis of the internal and external factors of a business. It clearly identifies a business's opportunities, project economic, customers orientation, business environment, and their impact on the company. In the second phase where formulation of solution conducted in order to identify alternative solution and perform decision analysis to make optimal choice of business strategy under uncertain conditions. The final stages of the framework are to conduct Implementation of the chosen solution for the capital project and conduct lookback on the results.

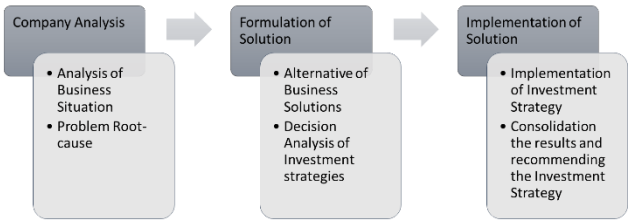

Fig. 1. Problem-solving framework

The research methods used in conducting this study are:

1. Literature study is carried out as an initial stage in solving a problem, by taking a literature approach to problems related to research, which are in the form of theory, processing formulation data, discussion, and problem solving.
2. Secondary data collection, such as the initial plan for the production amount project, tangible and intangible costs, oil prices and operating costs.
3. Data processing is done by determining the value of the net present value (NPV), rate of return (ROR), pay out time (POT), and discounted profitability index (DPI) of the project.
4. After taking and processing the data using the appropriate formulas based on study of literature. Data analysis is carried out by determining the benefits obtained from the drilling proposal new wells and a conclusion will be drawn to make a decision whether the project proposal is feasible or not implemented.

The workflow of the study as shown in figure 2, is to conduct quantitative analysis using PSC economic result comparison between scenarios using economic indicators such as Payout time (POT), Net Present Value (NPV), Rate of Return (ROR), Discounted Profitability Index (DPI) and combine with other criteria using multi criteria decision analysis (MCDA).

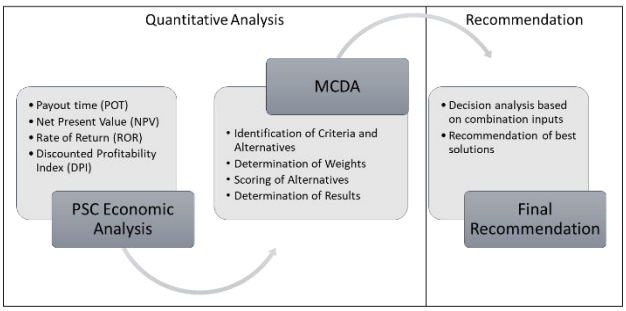

Fig. 2. Workflow of business solution analysis

A. PSC economic evaluation process

The theoretical basis of this analysis is to determine the value of the parameters used in economic studies. These parameters include Net Present Value (NPV), Rate of Return (ROR), Pay Out Time (POT), and Profit to Investment Ratio (PIR).

As the input to economic calculation of the investment we need production profile, capital expenditure (capital cost), operational expenditure/cost (operational cost), drilling schedule, oil price assumption, exchange rate/discount rate and escalation rate/factor. The workflow of the economic analysis shown by figure 3. The economic calculation parameter results will be used as one of criteria in the MCDA analysis among other criteria.

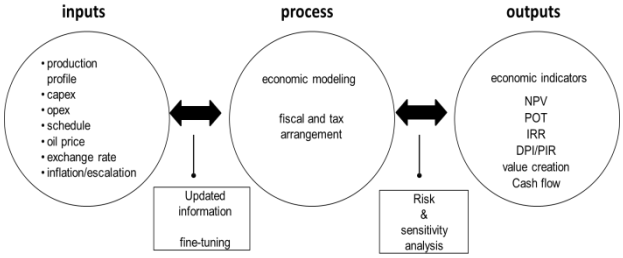

Fig. 3. Economic evaluation process

Net present value (NPV) is the difference between the present value of an investment and the present value of future net cash receipts. Net present value (NPV) functions to change the cash flow value of an investment to its current equivalent value and must be positive. The general form of the NPV equation is *(Kaplan, S. 1983)*:

$$NPV = -C + \frac{S_1}{(1+i)^1} + \frac{S_2}{(1+i)^2} + \cdots + \frac{S_n}{(1+i)^n} \quad \text{..... (1)}$$

where;

NPV = net present value, U $
-C = initial investment, U $
S_1 = net cash flow year 1
S_2 = net cash flow year 2 and so on until year n
n = number of years (project age), years
i = discount rate

Rate of return (ROR) is the average rate of return on investment from an investment during the investment. To get the ROR value, it is done by using the trial-and-error method, which is experimenting with several discount rates until a negative and positive NPV value is obtained. Then, interpolation is carried out where the total NPV results are equal to zero or close to zero. A project is considered feasible if the ROR is greater than the discount rate (bank interest). In this study, the project can be said to be feasible if the ROR is greater than that determined by the company, which is 10%. The ROR price must meet the following equation:

$$ROR = i_1 + (i_3 i_1)\left(\frac{a}{a+b}\right) \quad \text{..... (2)}$$

where;

a = net present value at the discount factor x
b = net present value at discount factor y
i_1 = 1st discount rate
i_2 = 2nd discount rate

Pay Out Time (POT) is an investment valuation method that measures how fast an investment can be back. In the process of analyzing the payout time (POT) value as the first step is determining the cumulative cash flow. The amount of pay out time can be simply found by interpolating the following equation *(Kaplan, S. 1983)*:

$$POT = n_1 + (n_2 - n_1)\left(\frac{CF\ cumm}{CF\ cumm_1 + CF\ cumm_2}\right) \text{..... (3)}$$

where,

POT = pay out time
CF $cumm_1$ = 1st cumulative cash flow
CF $cumm_2$ = 2nd cumulative cash flow
n_1 = year when CF cumm is negative (-)
n_2 = year when CF cumm is positive (+)

Discounted Profitability Index (DPI) states the measure of how much net cash flow a project can cover all values initial investment. If the value of the profit to investment ratio is greater than one, then this investment is profitable. If on the contrary, the project is not profitable. To determine the profit to investment ratio using the following equation *(Kaplan, S. 1983)*:

$$DPI = 1 + \frac{Total\ contractor\ cash\ flow}{Discounted\ investment}) \text{ ..... (4)}$$

Calculation of drilling investment *cash flow* can be done by calculating the production rate to the limit of the well, gross profit, operating cost, cash earnings, depreciation, PT. XYZ taxable income, tax payment, profit after taxes, then calculating cash flow. Production rate can be used by this following equation *(Kaplan, S. 1983)*:

$$Q_1 = q_0 e - \frac{t - t_0}{k} \text{ ..... (5)}$$

where;

Q_1 = Production rate at time $t \geq t_0$
Q_0 = Initial production rate
t_0 = The first year of production

Gross Profit can be calculated as follows:

GP = Oil production (bbl./year) x oil price (US$/bbl.)

Operating Cost can be calculated as follows:

OC = Q_0 (bbl./year) x operational cost (US$/bbl.)

Cash Earning can be calculated as follows:

CE = Gross Profit 1 – Operating Cost 1

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The depreciation method used in this calculation is the Sum of The Year Digit Depreciation:

$$D_i = [N - (n-1)]\frac{2.P-L}{N(N+1)}$$

where;

P = purchase, U $
N = project age, years
n = year of *i*
L = salvage value, U $

Profit can be calculated as follows:

Profit = Cash Earning 1 – Depreciation 1

Profit can be calculated as follows:

Profit = Cash Earning 1 – Depreciation 1

Taxable Income of PT. XYZ can be calculated as follows:

Taxable Income = Profit x PT. XYZ split (%)

Taxable Payment of PT. XYZ can be calculated as follows:

Taxable Payment = Taxable Income x Gov. tax (%)

Profit after tax can be calculated as follows:

Profit after tax = Taxable Income (US$) – Tax Payment (US$)

Cash flow can be calculated as follows:

Cash flow = Depreciation 1 + Profit after tax

Escalation factor can be calculated as follows:

Escalation factor $=(1 + escalation\ rate)^{(i-1)}$

where;

i = year of 1

B. Multi criteria decision analysis (MCDA)

In the decision-making process, decision makers are faced with situations that require alternative strategy choices or decisions in order to achieve its objectives. Alternative decisions are needed as a comparison decision that may be taken, i.e., the decisions that are most capable of increase the success of a strategy, increase the value (value) obtained or reduce the negative effects received as a consequence of an event. Therefore, a comprehensive approach is needed, how a decision maker determines which decisions have the possibility of better outcomes compared to other decision alternatives (Gavade, 2014). Techniques multi-criteria decision analysis or MCDA (MCDA) is one of the approaches that is able to sort out which decisions are better or in accordance with existing conditions.

Multi-Criteria Decision Analysis, or MCDA, is a valuable tool that we can apply to many complex decisions. It is most applicable to solving problems that are characterized as a choice among alternatives. It has all the characteristics of a useful decision support tool: It helps us focus on what is important, is logical and consistent, and is easy to use.

When used for group decision making, MCDA helps groups talk about their decision opportunity (the problem to be solved) in a way that allows them to consider the values that each view as important. It also provides a unique ability for people to consider and talk about complex trade-offs among alternatives. In effect, it helps people think, re-think, query, adjust, decide, rethink some more, test, adjust, and finally decide.

MCDA problems are comprised of five components:

a) Goal
b) Decision maker or group of decision makers with opinions (preferences)
c) Decision alternatives
d) Evaluation criteria (interests)
e) Outcomes or consequences associated with alternative/interest combination

Due to the absence of an optimal solution in all conditions, then decision makers should be able to assess which alternative decisions are more appropriate and appropriate to apply to the conditions being experienced. Step in conducting MCDA technique:

a) Define problem and generate analysis
b) Identify criteria to compare alternatives
c) Gather value judgement on relative importance of the criteria
d) Screen/eliminate clearly inferior alternatives
e) Determine performance of alternatives of criteria
f) Rand/Select final alternatives

C. Analysis of business situation

In determining the root cause of the explained problem, there are a lot of methods within the company and identified as effective ways to conduct analysis and determine root cause, which are fishbone, 5-Whys, Why Tree, RCA, FMEA, Waste Analysis and Scatterplot. The most popular method used are fishbone and 5-Whys method. In this problem case, the root cause of the problem for this case determined using fishbone method. Some of the major or significant cause identified in such way create problem which shown by figure 4.

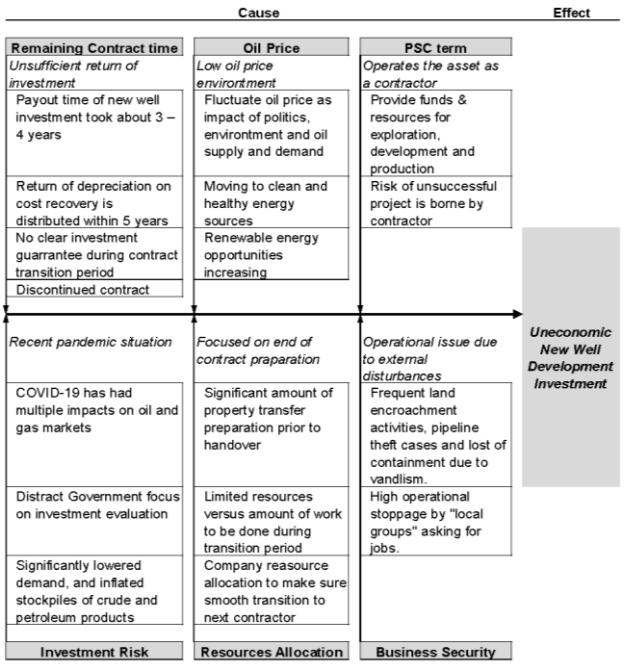

Fig. 4. Problem root-cause analysis using fishbone diagram

By observing the root cause factors as well as business situation in PSC economic concern approaching the end of Block Alpha contract by mid-2021, it could be derived that PT. XYZ and GOI requires a breakthrough in investment agreement to optimize the production and manage decline of block Alpha during transition period and oversee the continuation of investment prior to the end of contract by exercise and analyze chooses solution alternatives and seek optimum potential agreement proposal as win-win solution. A head of agreement (HOA) is one of the strategies to overcome the capital investment issue under specific circumstances.

III. BUSINESS SOLUTION

A. Business solution alternatives

The main objective of the study is to exercise various investment alternative using combination of drilling year (2018 – 2020), operation area between Sumatera Light Oil and Heavy Oil and investment PSC with scenario of accelerated depreciation cost recovery, tax holiday and combination between those two scenarios. Chosen investment scenarios which meet economic hurdle of DPI > 1.2 and NPV > 0 then will be analysis using multi criteria decision making using MCDA. Economics parameter among other criteria will be used in the analysis to find ultimate investment strategy which will be presented during Head of Agreement between PT. XYZ and GOI in order to continue new well drilling as towards end of contract in August 2021. Detail investment scenarios explained in the table 1.

TABLE 1
ALTERNATIVE INVESTMENT SCENARIOS JUSTIFICATION

No.	Scenario	Justification
1	Accelerated Depreciation Cost Recovery	• Depreciation cost recovery under PT. XYZ PSC is conducted within 5 years started on 1st year investment with distributions of: 25%; 19%; 14%, 11%; 32% • With offering to accelerate all depreciation cost recovery into year 1 then the revenue for contractor will be optimized and increased NPV.
2	Tax Holiday	• Fiscal term for PSC with PT. XYZ includes 48% income tax. • Tax holiday will increase contractor shares and improve project economics. This scenario most likely will have significant impact to the project economics.
3	Combination 1 & 2	• Combination above scenarios to mitigate once the agreement between PT. XYZ and GOI needs more time than expected and delays drilling execution. PT. XYZ will need to optimize investment scenario to meet project economic hurdle.

B. Analysis of alternatives

Based on proposed alternative in the previous sub-topic, in this part author will conduct exercise to find project investment scenarios and conduct multi criteria decision making using MCDA. Project economic results will be one of the criteria among other criteria.

Decision Criteria are the measures that decision makers will consider when making key project decisions, such as selecting a preferred alternatives and approving funding. Establish a small set of primary decision criteria to focus our analysis. For the funding decision for Chevron projects, the primary decision criteria generally include the economic measures NPV, DPI and ROR. Other important economic decision criteria include Value Creation and PV Investment. Also include additional "secondary decision criteria" to use only if the decision is too close to call using the primary decision criteria. In projects where PT. XYZ has multiple partners with different Decision Criteria:

a) Ensure the project team understand the different Decision Criteria each party will be using to evaluate the alternatives.
b) Ensure the information you provide enables the different parties to evaluate the alternatives.
c) It is a good idea to evaluate the alternatives using the different Decision Criteria of the various parties to better understand their preferences.

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C. Data and assumptions

Before conducting PSC simulation for all project investment scenario, data and assumption for PSC calculations are explained in table 2.

TABLE 2
DRILLING WELL CANDIDATE GROUP

Well Group	Unit	SLO	HO
Well count	Wells	48	52
Scenario	n/a	Contract Limit	Contract Limit
Price	n/a	Mid case	Mid case
Oil Prod.	MBO	972	1,532
Water Prod.	MBO	22,306	7,673
Lifting cost	$M	4,615	7,142
Capital	$M	9,467	23,840
Tangible Drilling	$M	1,720	5,424
Intangible Drilling	$M	6,918	14,059
Production Facility	$M	829	4,357

Other input that important for PSC calculation is oil price. Oil price forecast is critical parameter which will impact on project revenue. It is important to have robust oil forecast in order to predict revenue and cashflow which impacting the amount of government and company shares.

Fig. 5. Oil price forecast

D. Project economic calculation

PT. XYZ apply economic hurdle by 1.2 for any proposed capital project in the company. The profitability index (also referred to as the benefit-cost ratio) is the present value of future cash flows divided by the initial investment. Under PSC schematic, proposed capital project economic calculation in PSC model for Block Alpha should be determined by fiscal term. The fiscal term for PSC in PT. XYZ can be shown in table 5.

TABLE 3.
PSC FISCAL TERM

Constants	Unit	Active
Discount Year	year	2021
Discount Factor	%	10%
Fiscal Terms		
FTP Rate	%	20%
DMO Split	%	25%
DMO Price	%	15%
Tax Rate	%	48%
Profit Split	%	19.2%
Investment credit	%	17%

Another data should be provided to conduct PSC economic calculation is production forecast. Total production forecast shown by figure 6 and 7 are provided by asset development team engineers. This production forecast is total production from each well candidate based on historical data information and also study among asset team development where the study conducted to incorporate geological data (HPT, TOW data), pattern recovery and maturity, and latest surveillance data. Then each well projected using Decline Analysis (DA) based on analog data.

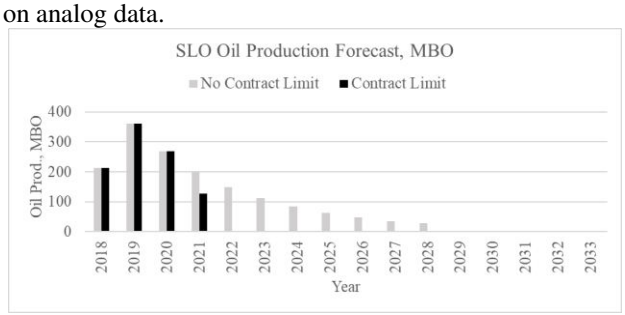

Fig. 6. SLO oil production forecast

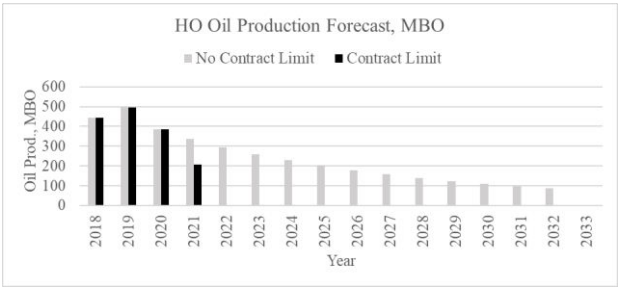

Fig. 7. HO oil production forecast

Lifting costs or operational cost are the costs to operate and maintain wells and related equipment and facilities per barrel of oil equivalent (BOE) of oil and gas produced by those facilities after the hydrocarbons have been found, acquired, and developed for production.

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Fig. 8. SLO Lifting Cost Forecast

Fig. 9. HO Lifting Cost Forecast

Discount rate for PT. XYZ both SLO and HO in fiscal term using rate of 10%. Yearly discounter factor then calculated based on below formula:

$$Disc.fac. = \frac{1}{(1+discount\ rate)^{(year-discount\ year+0.5)}}$$

Then, for example discount factor for year of 2018, calculated as:

$$Discount\ factor = \frac{1}{(1+0.1)^{(2018-2021+0.5)}}$$
$$Discount\ factor = 127\%$$

Discount factor scalar for PSC model in PT. XYZ shown by figure 3.7.

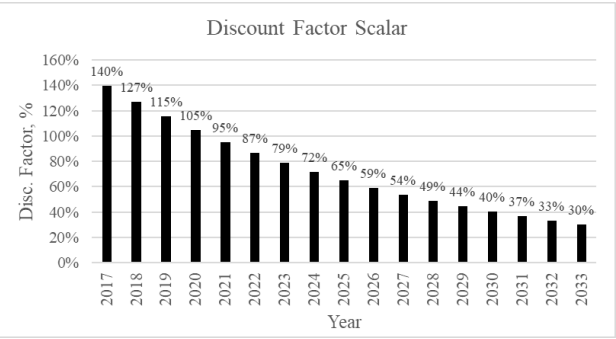

Fig. 10. Yearly Discount Factor Scalar

As all the input data for PSC calculation have been determined above, then the next task is to calculated all proposed investment scenarios based on table 3 and conduct exercise y combination of drilling year alternative of 2018 – 2020 and also both operation area Sumatra Light Oil (SLO) and Heavy Oil (HO) drilling well candidates.

III. RESULTS

A. Economic result comparison

By doing PSC exercise for all combination scenarios between SLO & HO, drilling year 2018 – 2020 and investment scenarios which mentioned in table 1, economic results summary can be shown in table 4.

Based on table 4, we can observe that all based case does not meet economic criteria of DPI > 1.2 and this is the reason why PT. XYZ decided discontinued capital investment on 2018. From the table also almost all scenario which drilling in 2020 also not meet with economic criteria. Meaning that, it is critical to have decision with GOI in 2018 whether investment should be started in 2018 or at least 2019. The only scenario which met with economic criteria in 2019 is drilling new well in SLO with combination scenario where the DPI at 1.21.

The next step is to select best alternative scenario which meet with economic criteria and then the decision-making process will continue with another quantitative decision-making process using Multi Criteria Decision Analysis (MCDA).

TABLE 4.
ALL PROPOSED SCENARIO ECONOMIC SIMULATION RESULTS

No.	Scenario	NP, $M	DPI	ROR, %	POT, yr.
1	HO-Combine-2018	10,701	1.35	130%	1.66
2	SLO-Combine-2018	4,011	1.33	276%	1.34
3	SLO-Taxhol-2018	3,572	1.30	78%	1.96
4	SLO-Combine-2019	2,347	1.21	246%	1.34
5	HO-Combine-2019	5,063	1.18	98%	1.66
6	HO-DepAcc-2018	5,564	1.18	130%	1.66
7	SLO-Taxhol-2019	1,948	1.18	58%	1.96
8	SLO-DepAcc-2018	2,086	1.17	276%	1.34
9	SLO-BaseCase-2018	1,597	1.13	41%	2.51
10	SLO-DepAcc-2019	1,221	1.11	246%	1.34
11	HO-Taxhol-2018	3,062	1.10	25%	2.71
12	HO-DepAcc-2019	2,633	1.10	98%	1.66

Now we can select investment alternative which meet with project economic criteria which are DPI > 1.2,

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positive NPV and ROR. All scenario selected based on table 4 are *HO-Rindu-Combine-2018, SLO-Combine-2018, SLO-Taxhol-2018, and SLO-Combine-2019.*

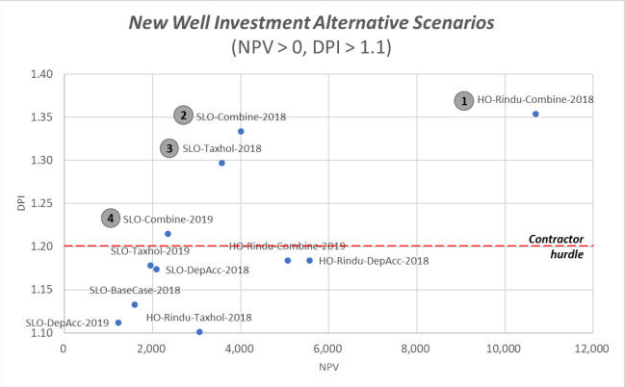

Fig. 11. New well investment selected scenarios

B. Multi criteria decision analysis

The next step of the decision-making process is to conduct multi criteria decision analysis. As mentioned in the research methodology chapter, objective of the study is to conduct quantitative analysis using PSC economic result comparison between scenarios using economic indicators such as Payout time (POT), Net Present Value (NPV), Rate of Return (ROR), Discounted Profitability Index (DPI) and combine with other criteria using multi criteria decision analysis. The goal of this exercise to determine best project investment scenario for new well drilling investment which will be review by decision makers where in this particular company of PT. XYZ which called Decision Review Board (DRB).

C. Identification of criteria and alternatives

The next step of the analysis is to identify stakeholder interest or criteria. Board member interest serve as the criteria by which to evaluate each scenario. Interests are identified through a facilitated discussion of the board members. New Well Drilling Board members identified 3 key interests, many of which were further broken down into sub-interest which shown by table 5.

TABLE 5
INTEREST AND SUB-INTEREST FOR MCDA

Interest	Sub-interest	Remark
Project Economic	Economics calculation result	Project meet contractor internal hurdle DPI at 1.2 and NPV > 0
	Negotiation Strength Point	Scenario proposal consideration during negotiation between contractor and GOI
Company Reputation	Company Partnership & Reputation	Contractor legacy as commitment to continue supporting national oil production with drilling activities success legacy for decades.
Execution Readiness	Execution Flexibility	Support execution alternative between SLO and HO due to different operation condition
	Site & Material readiness	Well pad, road & location and power supply readiness
	Security Readiness	Less land encroachment and other community issue will reduce execution delay risk

Now that the problem has been specified as goals, interests, and alternatives, it can be depicted as a set of individual components, and their linkages made explicit. Illustrating the framework in this way allows DRB to understand the relationships between the overall goal, the interests they view as important to the decision, other board members' interests, and the alternatives available to them.

D. Determination of weights

This is where personal preferences matter. Each board member assigns his/her own weights to each interest or sub-interest. An individual's weighting preferences are kept intact, they are not averaged or blended with other board members' weights. In fact, it is the differences in how people assign weights that engenders discussion among the group. The weight from each main interest have been determined which shown by table 6.

TABLE 6
INTEREST & SUB-INTEREST WEIGHTING

Interest	Weight	Sub-interest	Weight
Project Economic	50	Economics calculation result	25
		Negotiation Strength Point	25
Company Reputation	30	Company Partnership & Legacy Impact	30
Execution Readiness	20	Execution Flexibility	10
		Site & Material readiness	5
		Security Readiness	5

E. Scoring of alternatives

Once they identified the key interests that would be considered in selecting a site, the Board took on the task of rating the alternatives relative to how well they satisfied each interest. Because this was a technical exercise, they sought the input of experts. They asked planners, petroleum engineers, and environmental experts

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for their input. Scoring result can be shown by table 3.15. In this exercise, the scoring using ordinal scale, a five-point scale: 5 = excellent; 4 = Very good; 3 = Good; 2 = Fair; 1 = Poor.

TABLE 7
SCORING OF ALTERNATIVES

Interest	Sub-interest	HO-Combine-2018	SLO-Combine-2018	SLO-Taxhol-2018	SLO-Combine-2019
Project Economic	Economics calculation result	5	4	4	3
	Negotiation strong point	3	3	4	3
Company Reputation	Company Partnership & Reputation	5	5	5	5
Execution Readiness	Execution Flexibility	4	3	3	3
	Site & Material readiness	4	3	3	3
	Security Readiness	5	4	4	4

F. Determination of results

Each board member identifies his/her preferred site by multiplying the sub-interest weight by its corresponding rating value to calculate a score for that sub-interest. Summing the score yields his/her most preferred scenario. In the exercise shown in table 3.16, this particular board member scored the HO-Rindu-Combine-2018 highest, followed by SLO-Taxhol-2018 and SLO-Combine-2018. SLO-Combine-2019 received the lowest score.

TABLE 8
MULTI CRITERIA DECISION ANALYSIS RESULT

Interest	**Sub-interest**	**HO-Combine-2018**	**SLO-Combine-2018**	**SLO-Taxhol-2018**	**SLO-Combine-2019**
Project Economic	Economics calculation result	125	100	100	75
	Negotiation Strength Point	75	75	100	75
Company Reputation	Company Partnership & Legacy Impact	150	150	150	150
Execution Readiness	Execution Flexibility	40	30	30	30
	Site & Material readiness	20	15	15	15
	Security Readiness	25	20	16	16
Total		**435**	**390**	**411**	**361**

IV. DISCUSSION

The study aims to help PT. XYZ to find alternative economics new well drilling investment strategies or agreements between PT. XYZ and GOI to optimize the production and manage decline of block Alpha during transition period and oversee the continuation of investment prior to the end of contract by exercise and analyze solution alternatives and seek optimum potential agreement proposal as win-win solution.

The study uses PSC economic calculation to evaluate various alternative investment strategies which are Accelerated Depreciation Cost Recovery, Tax holiday and combination of both proposed alternative. Using Multi criteria Decision analysis (MCDA) approach, economic calculation results and other identified criteria will help the team to solving problems that are characterized as a choice among alternatives.

Based on table 4, it is critical to have decision with GOI in 2018 whether investment should be started in 2018 or at least 2019. The only scenario which met with economic criteria in 2019 is drilling new well in SLO with combination scenario where the DPI at 1.21.

Four alternatives were identified and multi criteria decision making using MCDA is carried out to select best alternative for new well investment strategy, using three key criteria: economics result, company reputation impact, and execution readiness.

The analysis suggested that the new well drilling investment at Heavy Oil using combination of accelerated depreciation cost recovery and tax holiday in 2018 is the most preferred alternative, despite the remaining three investment strategies which are SLO-Combine-2018, SLO-Taxhol-2018, and SLO-Combine-2019, still economic to be executed.

V. CONCLUSION

Project economic evaluation with integration of MCDA into existing contractor decision making process is clearly help company to decide investment strategy to be discussed with GOI in commitment to continue new well drilling investment as step to optimize the production and manage decline of block Alpha during transition period and oversee the continuation of investment prior to the end of contract in August 2021.

The analysis suggested that the new well drilling investment at Heavy Oil using combination of accelerated depreciation cost recovery and tax holiday in 2018 is the most preferred alternative. The alternative selected is expected to provide best solution for both contractor and Government of Indonesia and deliver superior economic impact and optimize the production and manage decline of block Alpha during transition period and oversee the continuation of investment prior to the end of contract. The selected investment strategy is expected to increase oil incremental of 1,5 million barrel of unrealized oil production until the end of contract in August 2021. The

proposed alternative might provide additional contractor's Net Present Value (NPV) of $10,7 million with DPI of 1.35.

Business implication by continuing new well investment during contact transition period as agreement with the GOI are maintain company's reputation as global company which most admired by its partnership and legacy in commitment to continue supporting national oil production and execute new well development project without disturb financial well-being of the company

It is critical to have decision soon after the problem exist between PT. XYZ and GOI where both parties have to decide what agreement should be made in order to continue new well drilling investment. Once the decision timing become delay then PT. XYZ and GOI will be facing critical situation to make an agreement. The decision potentially no longer considering project economics but expose to other irrelevant aspect which might have an impact to additional cost and resources.

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