Available Online : https://proceeding.researchsynergypress.com/index.php/cset/index
RSF Conference Series: Engineering and Technology
ISSN 2809-6843 (Online) | 2809-6878 (Print)
Volume 1 Number 1 (2021): 549-558

Evaluation of Oil and Gas Economy using Economics Profit Indicators and Prototype Macro VBA Excel

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Abstract

The oil and gas sector is an important factor in sustainable development, so it is considered necessary to make serious changes in conducting economic analysis on the oil and gas business. Oil and gas industry activities consist of upstream activities, and downstream activities. Activities in these upstream and downstream operations have high risk, high costs and high technology, so the company continuously tries to reduce the importance of the adverse impact of these risks on the work environment and people. Thus, evaluating the factors that affect sustainable production in this sector becomes a necessity. In this research will be evaluated the economy of the oil and gas field using methods of economic indicators, among others; NPV, POT, ROR, where these factors are estimated in order to be able to estimate the prospects of the oil and gas field so that the decision that the field development project can be implemented or cannot be taken immediately. Implementation of oil and gas field economic evaluation in this study using Macro VBA Excel. From several methods of economic analysis obtained that the results of this study show high precision compared to other methods, in addition to the way of evaluation using the above economic indicators is very popular.

Keywords: Economics, Indicator, Oil and Gas, Prototype, VBA Excel

INTRODUCTION

The oil and gas industry is an investment activity that requires high technology, high costs and also high risks. The classic problem in managing oil and gas fields is the economic analysis of the field (Kaiser and Pulsipher, 2007), (Jemielniak and Kociatkiewicz, 2008). The estimated economic calculation (cash flow projection) of the prospects for the development of oil and gas fields in the upstream sector (exploration and production), and then able to analyze some investment opportunities (investment) of an oil and gas field, can ultimately take the most appropriate decision whether or not economically viable development of the field. Some of the things that underlie the economic calculation of oil and gas fields are reserve measures, Cash Flow analysis, Economic Indicators and also fiscal patterns in oil and gas projects. In this study is more focused on reviewing several similar studies, and how to utilize VBA Excell on the implementation of oil and gas field economic calculations. Some of the prototypes used were also discussed in the study (Wood, 2016). The method used in this research is, literature studies, then display economic models in the form of prototypes, especially those in their implementation using VBA Excel, because the use of excel VBA is easier, the available tools are quite complete, from statistics, graphs, and most importantly macro programming features as programming languages available in VBA Excel (Kuzevanov *et al.*, 2017).

LITERATURE REVIEW

Several related studies in terms of economic evaluation of oil and gas field have been widely conducted, one of which was conducted by Elhuni et al in 2017, this research based on Performance Indicators (KPIs) and triple bottom line to evaluate sustainable production believed to be in accordance with the oil and gas sector. To prioritize performance indicators applied metode Analytical Hierarchy Process (AHP) with reference to some opinions of experts. The proposed KPIs are expected to help the oil and gas sector to achieve better performance in sustainable production and to ensure business sustainability (Elhuni and Ahmad, 2017).

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DOI: 10.31098/cset.v1i1.429

Oil and gas fields with small reserves can give greatly to increased profit, increased employment opportunities and can increase trust in local oil companies if professionally managed by local companies. The research was conducted in Nigeria, where indigenous human resources face challenges in exploiting the oil and gas sector, although the initiative has been widely supported and praised by the government. The study evaluated the economic factors of indigenous companies, particularly the oil and gas sector, which could hinder the development of these oil and gas fields. The financial cash flow results show that marginal oilfield projects are viable with projected net present value after tax calculation (NPV) with the expectation of monetary value exceeding US $ 29 million. Oil profit taxes, royalties and crude oil prices have more of an impact on the NPV field. This study shows that periodic evaluations of fiscal regimes and appropriate policies by governments can encourage domestic players in developing marginal oil fields (Akinwale and Akinbami, 2016).

The idea of developing and upgrading marginal oil and natural gas reserves in Nigeria, has not been well defined since its inception. It is said by some experts, and various parties, that the development of oil fields that are considered marginal is often discretionary allocated to the Federal Government of Nigeria, which the government monopoly feels has the only prerogative to control marginal oil and gas fields. Oil fields in Egypt, oil reserves that have reserves of less than five million barrels are categorized as very low reserves. For this purpose, this study intends to define and review the concept of a marginal oil field, in a concrete and measurable manner, while taking into account the reserves that can be developed, the prevailing fiscal circumstances and the availability of technologies as well as the conditions of economic stability that occur. Thus a new fiscal policy can be recommended on marginal oil and gas lading, by examining and reviewing contracts for operatsor. It is necessary to determine at what point it can make investors interested in investing in oil and gas sketor with existing technology. A comprehensive economic analysis conducted shows that these areas are actually valuable investments. The government should consider providing adequate incentives, then reviewing bonuses to operators with a 50% contract, and which have very low or no impact on the rate of return on investment. In addition, the amount of royalties and oil taxes as proposed in the 2012 Oil Industry regulation, will increase investment in marginal reserve areas more passionately and benefit investors, than the previously stipulated fiscal requirements. The decline in future oil prices below the proposed limit of $50, this study also displays an adverse effect on the development of marginal oil fields. Project expenditures and financing with a high degree of uncertainty pose challenges for marginal oilfield development and various alternatives are suggested, including; equity financing, technical partnerships, loan sources from local and foreign banks. (Adeogun, 2015)

Another study evaluates the historical and current costs of drilling and completing oil and gas wells compared to geothermal wells. Initially, developed a new cost index for offshore oil and gas wells in the United States based on API Joint Association Survey data from 1976 to 2009. From year to year cost indexes vary widely in drilling costs and allow one to develop and analyze drilling previously. Expenses are calculated on a current year dollar basis. To distinguish it from other cost indices, it is necessary to label it on the Cornell Energy Institute (CEI) index. The index consists of nine sub-indices for different well depth intervals and has been fixed and corrected for annual changes in drilling activity. The CEI index shows an increase in well costs by 70% from 2003 to 2008 when compared to the Producer Price Index (PPI) which is commonly used for drilling in oil and gas wells. Fee waivers for various depths were found to be significantly different and reflect differences in oil and gas prices, costs, and availability of main well components and services in a particular oil and gas field or well. Several methods were evaluated to conclude there is a cost depth correlation for geothermal wells in current year dollars. Analysts report the reported costs of the most recently completed geothermal well, that research resulted in the WellCost Lite predictive geothermal well cost model. In addition, it has developed a customized database at the cost of 146 historic geothermal wells. Initially the CEI Index was used to normalize well costs to current year dollars. A comparison of the cost of normalizing historic wells with the recently drilled WellCost Lite and predictions shows that the cost escalation rate of geothermal wells is much lower than that of hydrocarbon wells and that a cost index based on hydrocarbon wells does not apply to geothermal well drilling. In addition to evaluating average well costs, the study also examines the economic improvements that result from a better drilling experience. This study also shows that the drilling of several similar wells in the same field has a correlation (Lukawski *et al.*, 2014) .

The study by Safuullin et al, conducted in the Republic of Tatarstan, examined the economic and sociological analysis of oil and gas companies. This study examines the improvement of the

competitiveness of local commodity producers and uses practical tools to estimate economic indicators in the development of oil and gas fields. The focus of this research is on the structural analysis of indicator dynamics by type of economic activity, according to the industrial profile of the Republic of Tatarstan. Based on the data obtained in semi-structured interviews with various heads of oil and gas companies of the Republic of Tatarstan that the main trends, advantages and challenges were identified in the field. The main trends in the development of the oil and gas field are improvement in financial and economic indicators, strengthening global competition in key commodity markets, transition to modern technology and advancement of oil and gas production. (Safiullin *et al.*, 2013)

Another study examined the economics of several North Sea oil and gas fields in the UK and Norwegian sectors based on investment and cost estimates and lastly against projected production profiles and estimates. From this research, which is based on the sensitivity of each project, it concludes that there are important factors that influence the economic analysis of the oil and gas field, these factors are; An economic analysis of the current changes in the fiscal regime in the above sectors during 1979-80, as well as a cost study considering general up-to-date statistics, recent developments regarding cost escalation, and some cost correlations. Finally, the North Sea reserves and the potential and supply of oil and gas are discussed (Nystad, 1981)

Other studies have also previously conducted observations and investigations on the impact and causality of oil and gas on economic growth in the Caspian Sea region. This study applies the ordinary least squares method (OLS) and the Granger causality test using time series data from 1997 to 2015 to ascertain the impact and causality of crude oil and natural gas on economic growth. The results showed that with the OLs method, crude oil and natural gas had a significant impact on economic growth in the region. This study also makes correlations between factors such as; gross domestic product (GDP), crude oil prices, and oil exports. The results show that GDP can help forecast crude oil prices and exports; But not the other way around, where crude oil prices and exports cannot help estimate GDP. However, the trend of this correlation, the direction of the forecast is not possible for GDP and natural gas. GDP and natural gas have a mutually influencing relationship with a unidirectional trend, but on the contrary, namely natural gas prices and Granger exports cause GDP which indicates that natural gas prices and exports can help estimate GDP; But not the other way around, GDP cannot be used to set forecasts for crude oil prices and exports (S M Rashed Jahangir, 2009).

The challenge for operations managers is to analyze the impact of risk in making decisions to invest in the oil and gas sector, because this is a consideration of whether or not a proposal to invest in oil and gas is economically feasible or not. This decision is to ensure that the project is implemented or not. This study discusses an innovative valuation method based on probabilistic using MS excel software to perform simulations, wherein, Monte Carlo Simulation with an integrated Markov chain stochastic process is used in developing cash flow statements. This Monte Carlo simulation was carried out on more than 1000 samples using independent variables and other related variables and was carried out randomly to analyze business risk and the sensitive influence of various macro and micro economic factors and their subsequent impact on economic indicators, including IRR. The projects under study are ongoing projects, where decisions regarding investment in Oil and Gas, Greenfield and candidate assessments. The case of infrastructure, equipment and offshore platforms in an oil and gas field, in this simulation is illustrated focusing on the financial risks of business operations. As with any business, other things that get attention are the dynamic developments and market uncertainty, namely, productivity of skilled and unskilled labor, oil prices, steel prices, coal prices, market segments, market scale, tariffs and taxes, foreign exchange rates, interest rates. Loans, competition, political risks and of course such as the tsunami and economic crisis, events that are not conducive in other economic fields. Most of these factors can have an impact on various probability variations, for other factors depend on these probabilities, and indirectly affect other measurable risk factors, including the size of the market itself. The estimation results from this study are able to predict the probable values of P50, P75 and P90 of the assets IRR, IRR-equity and Stock Price for each scenario, followed by analysis. The results of the study show that it is very surprising not only in terms of the risks that may actually occur, but another thing is how big it is like other economic indicators. (Srivastava, 2011).

Economics Profit Indicators

Calculation of economic indicators is needed to measure the level of profit and compare the level of profit to be obtained from various oil and gas development investment opportunities from several fields. Howmany economic parameters are often used in the prospects for oil and gas development, among others; POT (Pay Out Time), NPV (Net Present Value), ROR (Rate of Return), DPR (Discounted Profit to Invesment Ratio), and PIR (Profit to Investment Ratio). An economic indicator is said to be good if it has such characteristics; Must be able to compare and summarize the level of profit from each investment opportunity, economic parameters must be able to state the "Time Value" of the company's capital, must be able to measure the level of profit even though small, and quantitatively must be able to take into account risk factors.

Pay Out Time (POT) or Pay Back Periode

POT is an economic Indicator that shows how long the investment will return.

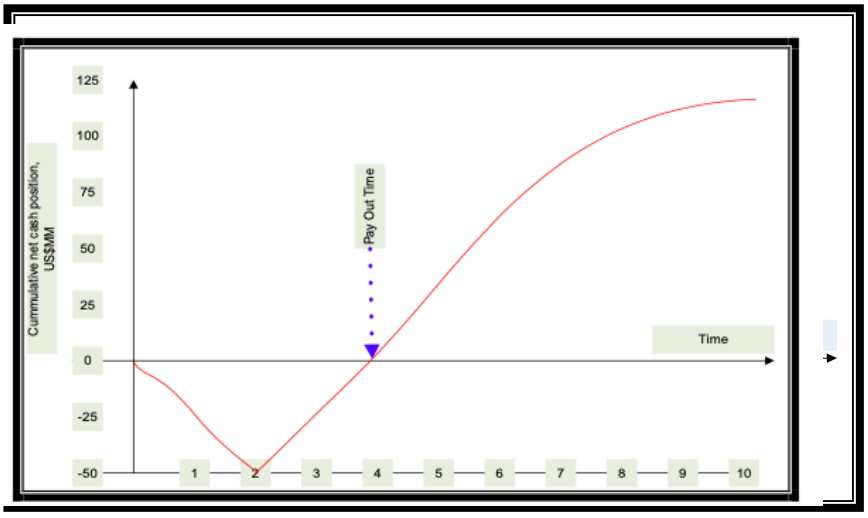

Figure 1 . POT

Net Present value (NPV)

NPV is the algebraic amount of all Net Cash Flow that k worth now.
Mathematically:

$$NPV = NCF_0 + \frac{NCF_1}{(1+r)^1} + \frac{NCF_2}{(1+r)^2} + ...+ \frac{NCF_n}{(1+r)^n}$$

Table 1. NPV Calculation

Years	Production (Mbbl)	NCF undiscounted ($M)	Discount factor R = 10 %	NCF discounted
0		-9500		-9500
1	215	2318	0.87	1860.06
2	425	4300.2	0.76	3268.15
3	740	7293.78	0.66	4813.89
4	825	8082.41	0.57	4606.97
5	710	6953.76	0.49	3407.34
6	525	5155.59	0.43	2216.90
7	350	3455.63	0.38	1313.14
8	150	1517.66	0.33	500.83
9	130	1309.5	0.28	366.66
10	110	1102.95	0.25	275.74
		+ 31989.48		**NPV = + 13129.68**

A. Rate of Return (ROR)/ RIR

Defined as interest (discountrate) which results in the npv equal to zero (NPV=0). Mathematically:

$$NPV = 0 = NCF_0 \cdot \frac{NCF_1}{(1+r)^1} \cdot \frac{NCF_2}{(1+r)^2} + ...+ \frac{NCF_n}{(1+r)^n}$$

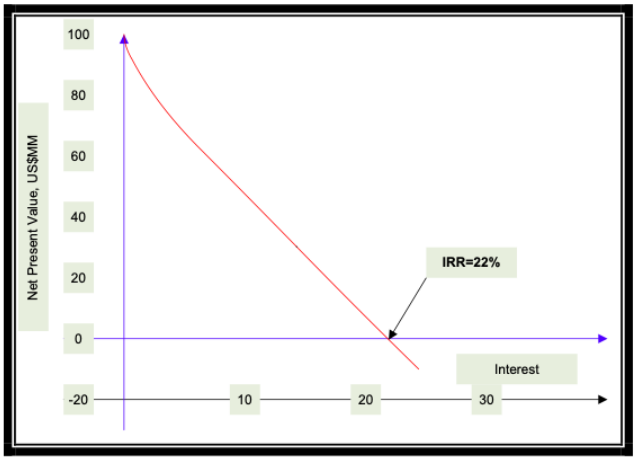

Figure 2. ROR

After getting r then calculate again discount factor and NPV on r obtained from the chart, if the value (-) then r is too big then look again for r so that NPV = 0.
ROR cannot be calculated if the NCF is all (+).

$$NPV = 0 = NCF_0 + \frac{NCF_1}{(1+r)^1} + \frac{NCF_2}{(1+r)^2} + ...+ \frac{NCF_n}{(1+r)^n}$$

Table 2. ROR Calculation

Year	Produksi Minyak (Mbbl)	NCF undiscounted ($M)	Discount Factor (r = 40%)	NCF discounted (r = 40%) ($M)	Discount Factor (r = 45%)	NCF discounted (r = 45%) ($M)
0		-9500		-9500		-9500
1	215	2318	0.71	1655.71	0.69	1598.62
2	425	4300.2	0.51	2193.98	0.48	2045.28
3	740	7293.78	0.36	2658.08	0.33	2392.48
4	825	8082.41	0.26	2103.92	0.23	1828.39
5	710	6953.76	0.19	1292.94	0.15	1084.88
6	525	5155.59	0.13	684.72	0.11	554.72
7	350	3455.63	0.09	327.82	0.07	256.42
8	150	1517.66	0.07	102.84	0.05	77.67
9	130	1309.5	0.05	63.38	0.04	46.22
10	110	1102.95	0.03	38.13	0.02	26.85
				NPV= +1621.52		**NPV = + 411.53**

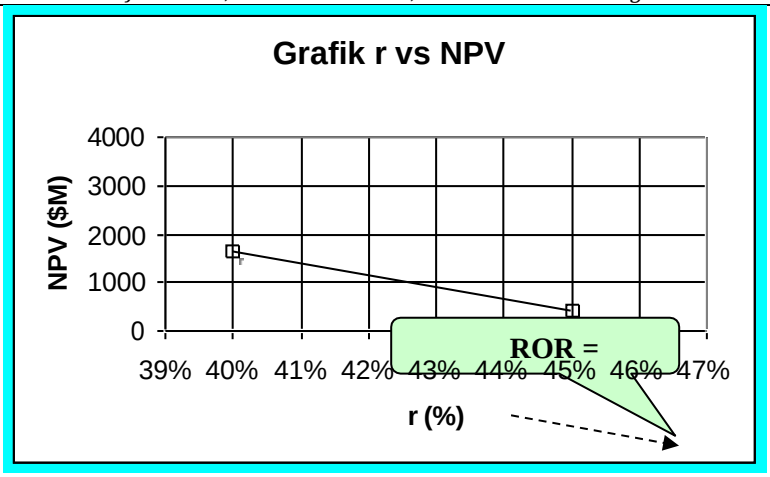

Figure 3. ROR

Discounted Profit to Invesment Ratio (DPR)
In the DPR the value of money is brought to its present value. Mathematically:

$$DPR = \frac{NPV}{Investment}$$

Profit to Invesment Ratio (PIR)
At PIR the value of money has not been brought to its present value. Mathematically:

$$PIR = \frac{\Sigma NCF_{undiscounted}}{invInvestmentestasi}$$

RESEARCH METHOD

The method used in this research is, literature studies, then display economic models in the form of prototypes (Pressman, 2010), (Fleck *et al.*, 2015), especially those in their implementation using VBA Excel, because the use of excel VBA is easier, the available tools are quite complete, from statistics, graphs, and most importantly macro programming features as programming languages available in VBA Excel.

FINDING AND DISCUSSION

Oil and Gas Field Economic Prototypes Using VBA Excel

VBA stands for Visual Basic for Applications, a programming language from Microsoft that is now widely used with Microsoft office applications such as MS-Excel, MS-Word, and MS-Access, VBA is used to build applications to improve the capabilities of those applications. VBA can be used directly in all versions of office MS-Office 97 to the latest MS-Office available.

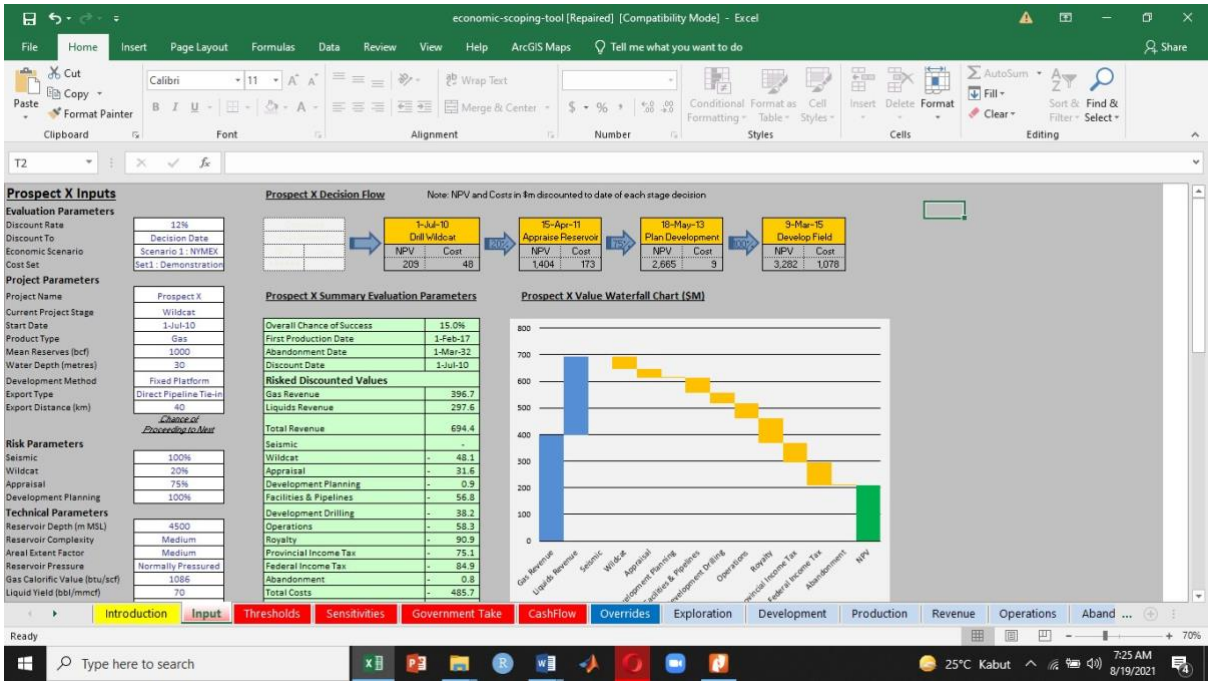

Figure 4. Prototype 1 Model Economics Oil and Gas

The use of VBA in this office application is very popularly used in Excel VBA. The advantage of using VBA is that it can build applications / tools using programming. As for some of the economic prototypes of the Oil and Gas field can be seen in the Excel display below:

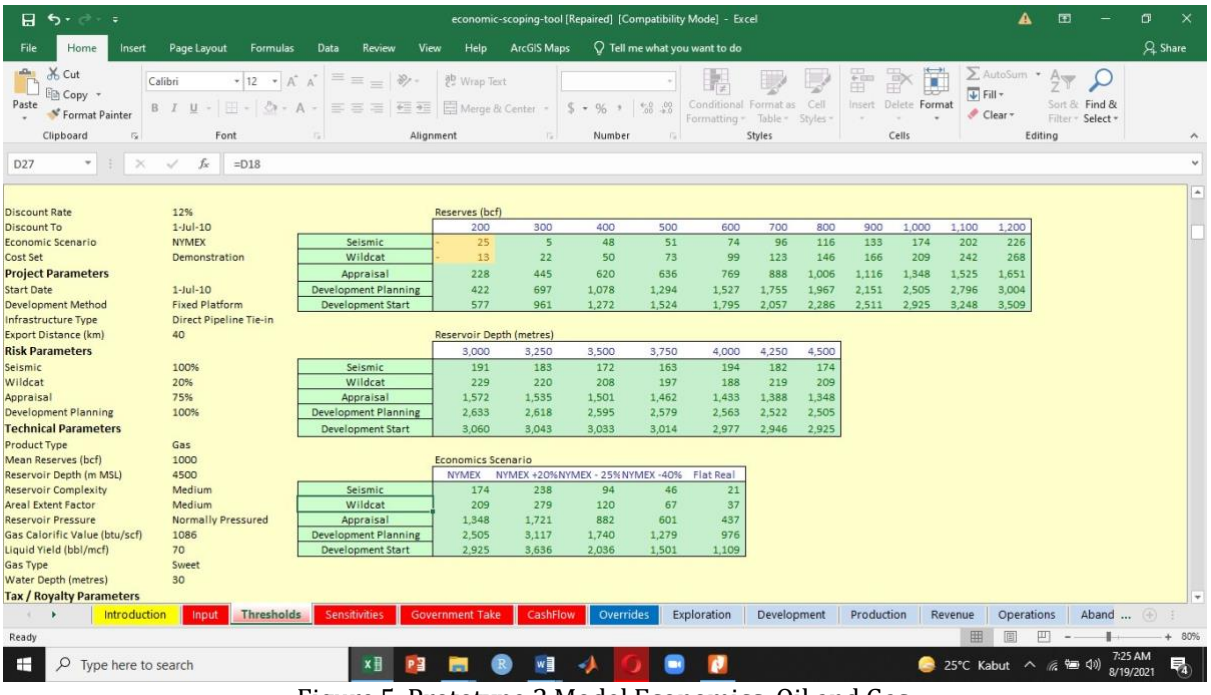

Figure 5. Prototype 2 Model Economics Oil and Gas

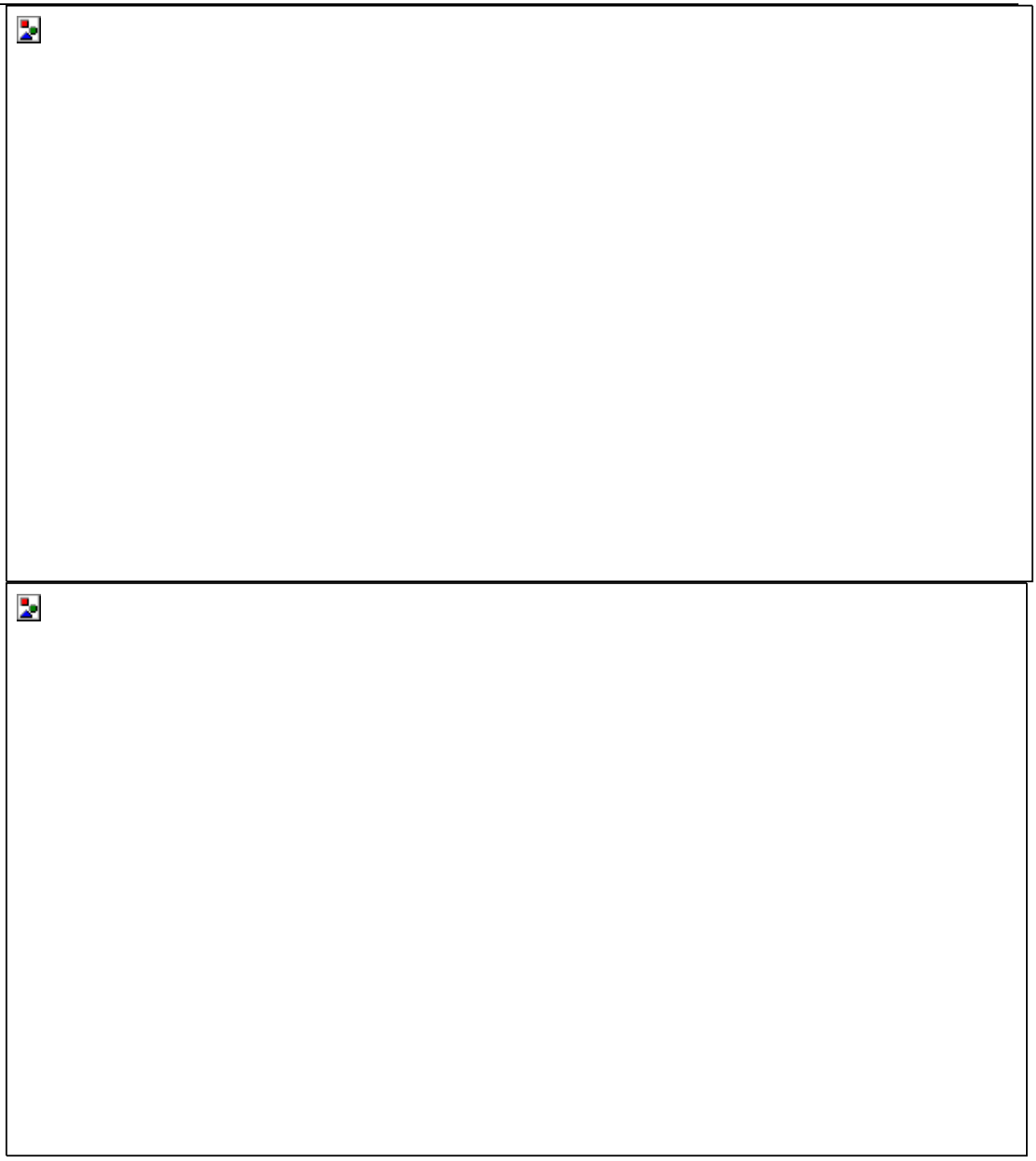

Figure 6. Prototype 3 Model Economics Oil and Gas

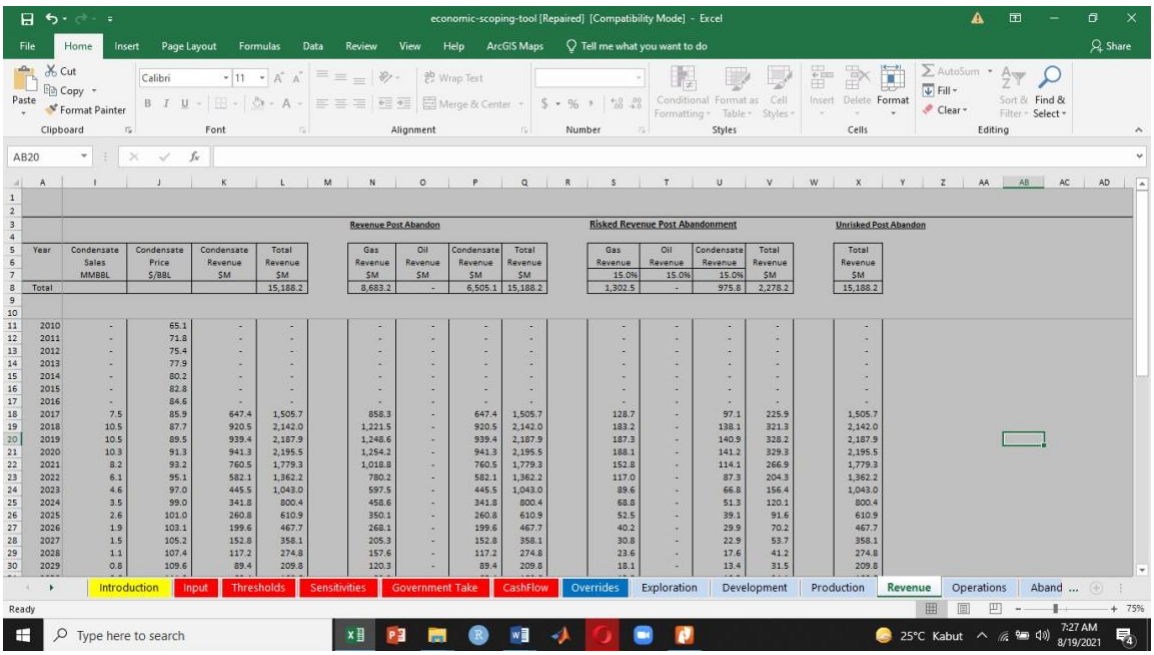

Figure 7. Production and Risked Revenue Model

CONCLUSION AND FURTHER RESEARCH

The results of the review of several studies on economic analysis of the oil and gas field, there are several prototype calculations using economic methods of profit indicator, and in its implementation it is easier to use VBA Excell is that it can build applications / tools using programming, But in terms of user authority, work that is collaborative and also from security needs to be considered its use. For future development, collaboration with other programming languages is needed, so that it will be more flexible, user friendly and this software will be of higher quality.

REFERENCES

Adeogun, O. (2015) 'Developing a framework for maximizing marginal oil and gas field economics', *Society of Petroleum Engineers - SPE Nigeria Annual International Conference and Exhibition, NAICE 2015*, (2013). doi: 10.2118/178347-ms.

Akinwale, Y. O. and Akinbami, J. F. K. (2016) 'Economic evaluation of Nigerian marginal oil and gas field using financial simulation analysis', *International Journal of Energy Economics and Policy*, 6(3), pp. 563–574.

Elhuni, R. M. and Ahmad, M. M. (2017) 'Key Performance Indicators for Sustainable Production Evaluation in Oil and Gas Sector', *Procedia Manufacturing*, 11(June), pp. 718–724. doi: 10.1016/j.promfg.2017.07.172.

Fleck, S. *et al.* (2015) 'A Prototype BEA/BLS Industry-Level Production Account for the United States', *Measuring Economic Sustainability and Progress*, pp. 323–372. doi: 10.7208/chicago/9780226121475.003.0011.

Jemielniak, D. and Kociatkiewicz, J. (2008) 'Management practices in high-tech environments', *Management Practices in High-Tech Environments*, pp. 1–407. doi: 10.4018/978-1-59904-564-1.

Kaiser, M. J. and Pulsipher, A. G. (2007) 'A review of the oil and gas sector in Kazakhstan', *Energy Policy*, 35(2), pp. 1300–1314. doi: 10.1016/j.enpol.2006.03.020.

Kuzevanov, M. A. *et al.* (2017) 'Building and Application of Integrated Model of a Large Sakhalin Offshore Oil and Gas Condensate Field'.

Lukawski, M. Z. *et al.* (2014) 'Cost analysis of oil, gas, and geothermal well drilling', *Journal of Petroleum Science and Engineering*, 118, pp. 1–14. doi: 10.1016/j.petrol.2014.03.012.

Nystad, A. N. (1981) 'Economic Analysis of the North Sea Oil and Gas Region.', *JPT, Journal of Petroleum Technology*, 33(12), pp. 2515–2527. doi: 10.2118/9566-PA.

S M Rashed Jahangir, B. Y. D. (2009) 'Crude oil, natural gas, and economic growth: impact and causality analysis in Caspian Sea Region', *The Handbook of Business Discourse*, 54(3), pp. 269–278. doi: 10.5465/amr.1976.28118671.

Safiullin, M. R. *et al.* (2013) 'Interdisciplinary approach to the analysis of the competiteveness types of the economic activities based on the example of the oil and gas industry (republic of tatarstan case)', *Middle East Journal of Scientific Research*, 18(1), pp. 42–49. doi: 10.5829/idosi.mejsr.2013.18.1.12353.

Srivastava, P. (2011) 'Business risk analysis using Monte Carlo simulation on macro & micro economic trends', *Society of Petroleum Engineers - SPE Asia Pacific Oil and Gas Conference and Exhibition 2011*, 2, pp. 1746–1786.

Wood, D. A. (2016) 'Asset portfolio multi-objective optimization tools provide insight to value, risk and strategy for gas and oil decision makers', *Journal of Natural Gas Science and Engineering*, 33, pp. 196–216. doi: 10.1016/j.jngse.2016.03.103.