Scientific Contributions Oil & Gas, Vol. 47. No. 3, December: 265 - 276

SCIENTIFIC CONTRIBUTIONS OIL AND GAS
Testing Center for Oil and Gas
LEMIGAS

Journal Homepage:http://www.journal.lemigas.esdm.go.id
ISSN: 2089-3361, e-ISSN: 2541-0520

Petroleum Fiscal Regimes Attractiveness in Indonesia, Malaysia and Thailand: Application on Offshore Project Development

Dwi Atty Mardiana[1], Pri Agung Rakhmanto[1], Shabrina Sri Riswati[1], Eleonora Sofilda[2], Saptianta Aribawa[2] and Gabriela Martines[1]

[1]Petroleum Engineering, Trisakti University
Kyai Tapa Street No.1 Grogol, Jakarta, Indonesia.

[2]Economy, Trisakti University
Kyai Tapa Street No.1 Grogol, Jakarta, Indonesia.

Corresponding author: atty@trisakti.ac.id.

Manuscript received: May 21th, 2024; Revised: September 26th, 2024
Approved: October 09th, 2024; Available online: December 13th, 2024.

ABSTRACT - Several factors are required to be considered in offshore and deepwater field development, including uncertainty in geological conditions, advanced technology, investment needed, fluctuating oil and gas prices, as well as fiscal regimes. Therefore, this study aimed to compare and evaluate the economic and fiscal regimes attractiveness ranks in Indonesia, Malaysia, and Thailand, applied to three cases of offshore oil and gas field development. The three offshore field cases included a new frontier gas field (Block A), a developed deep-water gas field (Block B), as well as a mature oil and gas field (Block C) with reserves of more than 100 mmboe and an investment range of 3 to 9 billion dollars. The discounted cash flow model was used to evaluate the contractor profitability, while government take, front loading index (FLI), and composite score (CS) were applied to rank the fiscal regime attractiveness. The result showed that profit split and ceiling of cost recovery affected fiscal attractiveness in government take. Front loading for contractor was observed at the early production phase from royalty and profit split. The fiscal attractiveness ranking generated a different order for each case, with Indonesia PSC CR being the most attractive to use in Block A due to the lowest FLI value. This PSC GS was the most attractive to use in Block B, providing the best economic results. Furthermore, concession scheme in Thailand was the most attractive to use in Block C, showing the best economic and the lowest FLI value. This showed that regardless of fiscal regime used in a country, parameter flexibility should accommodate uncertain conditions

Keywords: rank attractiveness, composite score, offshore development, petroleum fiscal regime, production sharing contract.

How to cite this article:

Dwi Atty Mardiana, Pri Agung Rakhmanto, Shabrina Sri Riswati, Eleonora Sofilda, Saptianta Aribawa and Gabriela Martines, 2024, Petroleum Fiscal Regimes Attractiveness in Indonesia, Malaysia and Thailand: Application on Offshore Project Development, Scientific Contributions Oil and Gas, 47 (3) pp. 265-276. DOI.org/10.29017/SCOG.47.3.1633.

INTRODUCTION

The oil and gas investment climate in Indonesia is less competitive compared to neighboring countries in Asia. This is shown by the lack of interest in bidding for oil and gas offshore field in the last two years. Therefore, several changes to fiscal scheme have been made by the Indonesian government to attract investment, including the use of a new fiscal scheme namely gross split production sharing contract (PSC) in 2018 and additional financial incentives.

A petroleum fiscal regime allows a host country to regulate the benefits derived from exploration and production activities through a set of laws, regulations, and agreements (Gudmestad et al. 2010). It also shows the motives for attracting investment, effectively managing and using national resources, seeking profits, and considering the international oil company (IOC) or national oil company (NOC) desires to generate returns at appropriate risks. Therefore, petroleum fiscal regime is the main non-resource factor that needs to be considered by IOC when attracted to the resources of a country. In this context, project feasibility and economic evaluation become important indicators to assess the environmental attractiveness of the host country (Hvozdyk & Mercer-Blackman 2010).

Generally, a petroleum economic evaluation is essential when an oil and gas company has the opportunity to invest in a project. This shows the need for further analysis to determine the profitability of the investment. The analysis will include the evaluation of project cash flow, profit and loss estimation, financial and technical risks, funding needs, as well as project ranking (Putrohari et al. 2007). There are several influencing factors in the upstream petroleum economy, particularly for offshore oil and gas field development. The factors include uncertain geological and subsurface conditions (Johnston 2008), which require high technology (Acheampong 2020; Acheampong et al. 2015; Willigers & Hausken 2013), development costs (Rush 2012; Willigers et al. 2010a; Willigers et al. 2010b), accompanied by fluctuating oil and gas prices (Salam et al. 2021; Johnston 2003; Lubiantara 2012) and fiscal regime in the host country (Mardiana 2019; Masons 2017).

Evaluating and comparing fiscal regime in various countries helps the IOC select investment areas. It also promotes a complete understanding of the international oil and gas market, developing their business strategy based on certain conditions. The analysis allows the IOC to improve efficiency and ensure the value of the assets is maintained and enhanced.

There are many methods used to evaluate and compare various types of fiscal regimes in countries. The method that is widely used is to compare the results of profitability indicators such as net present value (NPV), internal rate of return (IRR), and profitability index (Echundu et al. 2015; Dharmaji 2002; Gbonhinbor et al. 2016). Another method includes ranking fiscal attractiveness using tax components such as the tax distortion index (Kraychenko 2016; Blake & Roberts 2006; Bock & Rodriguez 2011), the composite score (CS) method with indicators including government take, and the front loading index (FLI) (Swe & Emodi 2018; Luo & Na 2010).

Based on the description, this study was conducted to address both the government and contractor perception by performing profitability evaluations on the same fields using the different fiscal regime of Indonesia, Malaysia, and Thailand. Analysis was also carried out to assess the attractiveness and level of profitability ranking among four fiscal regimes under three different offshore field conditions. Among the offshore field conditions are a new frontier gas field with 500 meters of water depth (Block A), a newly developed deep-water gas field (1000 meters of water depth) (Block B), as well as a mature oil and gas field with a water depth of less than 100 meters (Block C). The reserves on all three fields are more than 100 mmboe, and the investment ranges from 3 to 9 billion dollars on a full-life contract. Fiscal regime includes cost recovery and gross split PSC schemes from Indonesia, revenue-to-cost PSC schemes from Malaysia, and concession schemes from Thailand.

Petroleum Fiscal Regime

Generally, two popular fiscal regimes are the royalty and tax system (concession) as well as the contractual fiscal system. Development and modification of fiscal regime are carried out based on the political and economic conditions of the host country, alongside the dynamics of geological and technological enhancement. The significant difference between these two systems relates to the ownership of petroleum resources as well as the amount and forms of taxation imposed (Johnston 2004). In the concession system, private companies (concessioners) are given the right to

carry out exploration activities. When successful, the companies make royalty and tax payments to the host government. This indicates that companies have the title to produce the reserves, while the host country set rents, royalties, and taxes transparently. In its most basic form, the concession system consists of three components, namely royalties, taxes, and other fiscal deductions. Therefore, several modifications to the royalty and fiscal deduction components have been made to improve the fiscal regime flexibility in resisting the impact of oil price volatility or field maturing, to maintain investment or the split of profits.

Regarding the contractual system, the title to hydrocarbons stays with the states, and unless specifically shared, all production belongs to the government. The contractor (IOC or NOC) carries out the operations under the terms of the contract at personal risk and expense, including providing the financing and technology required for the operation. When the production is successful, the contractor is allowed to recover the expenses of exploration and development incurred with a share of the production or a cash fee for the service. After receiving a share of production, the system is known as a "production sharing contract" (PSC). In the service contract system, the host government hires the contractor and pays a fee for their service without taking a cut of any production extracted. Similar to concessions, host governments design the fiscal component in different ways to improve profit flexibility and the investment climate. Generally, there are five components in the PSC system, namely royalty, cost recovery, profit oil, taxes, and other fiscal deductions.

Factors considered by IOC in the petroleum fiscal regime used in a country are essential to design an attractive fiscal regime. During design activities, some fundamental principles should be considered by the government including simplicity, neutrality, progressivity, risk-sharing, and stability (Nakhle & Lassourd 2019).

Petroleum Fiscal Term Evaluation

Several studies related to the evaluation and comparison of fiscal schemes are used as the basis for making investment decisions in a country (Boykett et al. 2012; Sabaris et al. 2020; Luo & Na 2010; Swe & Emodi 2018). These include some studies on the fiscal regime used by oil-producing countries such as Indonesia (Abidin 2015; Mardiana 2019; Mardiana 2020; Anjani & Baihaqi 2018), Malaysia (Manaf et al. 2014), Thailand (Pusayapaibul 2015), Myanmar (Swe & Emodi 2018), Tunisia (Nakhle & Lassourd 2019), the Pacific region (Mullins & Burns 2016), Brazil (Marques 2015), and Uruguay (Ferro 2017). However, the attractiveness of fiscal terms depends on the type of fiscal regime, reserves, combination effect (Luo & Na 2010), the country political, social, and economic risk (Sitompul 2015). Other non-economic factors include investment rules certainty, geological, contract period, regulation, national participating interest, and institutional governance model (Aprizal et al. 2022).

Fiscal attractiveness in a country does not depend on the type of fiscal regime or specific provisions or their value, but on the combined effect of fiscal requirements (Lucchesi 2019; Masud et al. 2019). Therefore, to evaluate the attractiveness and compare different contracts, several indicators can show the combined effect of fiscal terms, with the following qualifications of: 1).Comprehensive is the ability to show the ratio of revenue allocation between host country (government) and contractor or IOC, including the combined effect of fiscal term and 2). There is a need to consider the impact of the order of allocations, as well as the time value of money, and the sequence of allocations obtained by various parties will affect the final benefits.

Government Take

The objective of the host country in oil production is to ensure the greatest possible economic benefits, with or without having control over E&P conditions. Government take is the price that E&P operators are willing to pay for exclusive access to activities. Moreover, there are several factors affecting the government ability to maximize revenue. These include the ability to attract qualified investors through the fiscal system, the timing of production, price movements, and the capacity to spend revenue productively.

Government take is defined as revenue portion of host country contribution to the total project revenue within the contract validity period (Luo & Na 2010). This includes bonuses, royalties, profit oil split, taxation at all levels, government equity participation, and other factors. Therefore, larger government take is correlated with less attractive contract to the IOC, as also shown by previous studies.

The calculation of government take can be carried out with and without the discounted cash

flow model method. What distinguishes the two is the consideration of the time value of money for government cash flow. The discounted government take is calculated based on the present value of the host country income within the contract cash inflow time at a certain discounted rate. In this context, Circa 99% of IOC used the discounted cash flow method to project the host country income during project life (Swe & Emodi 2018). The formula for discounted and non-discounted government take is shown below:

Non-discounted government take formula:

$$GT = \frac{\sum_{t=1}^{n} GT_t}{\sum_{t=1}^{n} GR_t} x\ 100\% \quad (1)$$

Discounted government take formula:

$$GT_i = \frac{\sum_{t=1}^{n} GT_t(1+i)^{-t}}{\sum_{t=1}^{n} GR_t(1+i)^{-t}} x \quad (2)$$

Where, GT_t is the host government take in year *t,* which includes the state oil company income, *n* is the term of the contract, GR_t is the gross revenue in year *t,* and *i* refers to the discount rate.

Considering the different results with and without discounted rate on the government take, there are time sequence differences in income gained by the host country. The gain is obtained from various taxes and fees that will affect the government and IOC takes project profitability, and fiscal attractiveness.

Front Loading Index (FLI)

The time sequence of the government income gain is an essential matter to be considered by the IOC. This is because the more delayed the payment to the host country, the better the project value for IOC. By deferring payments to the government, the IOC can recover the spending costs earlier and potentially obtain higher returns on a project. Meanwhile, in the case where there is no difference between the results with and without the discounted rate of government take, the income of the host country is based on the profits, and there is no front loading.

The front-loading index for the IOC is used to show the impact of time sequence difference of the host country on the project and the IOC profit. The ratio of the difference between GT and GTi is defined as the front-loading index for IOC (FLI), as shown in the formula below:

$$FLI = \frac{GT - GT_i}{GT}\ x\ 100\% \quad (3)$$

Factors that affect the difference show that there is front-loading for IOC, including: 1). Front loading in the early stages. This occurs when there are expenses before profit-making, such as signature and finding bonuses, business tax, VAT, as well as import tax on exploration and development periods and 2). Front loading at the production phase also affects the difference between GTi and GT. These include duty tax, royalty, profit split, production, and other bonuses that can lead to more government take.

The FLI for the IOC in terms of fiscal attractiveness shows that a smaller FLI value corresponds with less risk of the IOC at early stages. This makes the fiscal regime more attractive (Swe & Emodi 2018).

Composite Score (CS)

Composite score (CS) is defined as a comprehensive indicator showing the attractiveness of fiscal terms. It is called comprehensive by considering the attractiveness assessment of GT and FLI indicators by decision-makers based on their own experiences. The function of the CS is:

$$CS = (w_1\ x\ GT) + (w_2\ x\ FLI) \quad (4)$$

Where w_1 and w_2 are weights based on investor assessment of the contribution of GT and FLI. This function shows that smaller CS correlates with greater attractiveness of the fiscal system.

METHODOLOGY

This study aimed to evaluate and compare the attractiveness of different fiscal regimes in three countries for investment in the development of oil and gas resources. The analysis allows the ranking of different fiscal regimes that apply to three oil and gas resources based on the evaluation and comparison of economic performance as well as investment. 1). Data on three oil and gas offshore fields was collected, as shown in Table 1. These included the development plan, production profile, and cost required for the offshore field development at full contract life. The methods used to calculate the

fiscal regime for Indonesia, Malaysia, and Thailand were similar to the previous study by (Mardiana et al. 2022) and (Sabaris et al. 2020). Table 2 shows the main fiscal assumptions used in the three countries; 2). Economic calculations were performed on three different fields using four fiscal regimes, followed by results evaluation and comparison. The discounted cash flow model was used to evaluate the contractor profitability, such as NPV and IRR. Additionally, fiscal parameters causing an increase or decrease in economic value were analyzed; 3). Fiscal attractiveness rank was carried out using the CS after calculating GT and FLI. This was based on the assumption of a discounted rate of 10%, commonly used in the oil and gas industry. Weights for CS calculation were referred to in a previous study (Swe & Emodi 2018), at 42% and 58% for GT and FLI, respectively.

Table 1
Field condition and assumption

Parameter	Block A	Block B	Block C
Fields	New development gas field Water depth: 500 meters	Newly developed and deep water gas field Water depth: 500 meters	Extension oil and gas field Water depth: < 100 meters
CAPEX	$4.6 Bn	$1.7 Bn	$2.1 Bn
OPEX	2.7 $/boe	1.6 $/mmscf	24 $/bbl
Reserves	1.25 TCF	0.8 TCF	260 MMBO
Price	LNG: 7.3 $/mmbtu Condensate: 70 $/bbl	LNG : 7.3 $/mmbtu	Oil: 70 $/bbl Gas: 5.5 $/mmscf
F&D cost	21.9 $/boe	13.6 $/boe	8.4 $/boe

Table 2
Petroleum fiscal term on PSC and concession

Descriptions	Indonesia - PSC CR		Indonesia - PSC GS		Malaysia - PSC RC		Thailand - Concession	
	Gov	IOC	Gov	IOC	Gov	IOC	Gov	IOC
Royalty					10%		5%-15% subject to production	
FTP		15% shareable						
Cost recovery	100%				30%-70% subject to R/C 40%-80% subject to R/C for deepwater PSC			
Profit split				base + variable + progressive				remaining after royalty
- Oil	85%	15% after tax	base: 57%	base: 43%		50%-80% below THV, 40-60% above THV for deepwater		
- Gas	70%	30% after tax	base: 52%	base: 48%		50%-80% below THV, 40-60% above THV		

Table 2 (continued)
Petroleum fiscal term on PSC and concession

Descriptions	Indonesia - PSC CR		Indonesia - PSC GS		Malaysia - PSC RC		Thailand - Concession	
	Gov	IOC	Gov	IOC	Gov	IOC	Gov	IOC
						for deepwater		
THV					300 mmstb and 2 TCF			
Bonuses - Signature bonus	1 - 5 MM$		1 - 5 MM$				0.3 - 3 MM$	
- Production bonus	0.5 - 5 MM$		N/A				6 MM$ offshore and 12 MM$ onshore	
Government / NOC participation					20% Petronas			
Domestic requirement	25% at discounted price		25% at market price					
Training fund					0,5%			
Export duty					10%			
Land rent							180$/km2	
Supplementary fund					R/C > 1.2		SRB rate up to 75% from profit	
Tax	40% and 44%		40% and 44%		38%		50%	

RESULT AND DISCUSSION

Block A Evaluation

Table 1 shows that Block A is a new frontier offshore field development with a total investment until the end of the contract of 79–83% of gross revenue. Table 3 shows the economic calculation using four different fiscal regimes, which is challenging with a negative NPV and an IRR of less than 10%. Furthermore, some costs will not be recovered when the contract ends under the two PSC cost recovery schemes. Comparing the economic results of NPV and IRR value, Indonesia PSC-CR has better provision than others, with Malaysia being the lowest.

To analyze the attractiveness of the fiscal regime, an evaluation of GT and FLI was carried out. The results showed that higher GT value made the fiscal regime less attractive from the perspective of contractor or investor. In Block A, as shown in Table 4, the largest GT and GTi values were generated from PSC-RC Malaysia. This result was in line with the economic evaluation, where higher rents on the government take reduced the contractor share of profits. PSC with cost recovery schemes (PSC R/C and PSC CR) had a larger GT and GTi value, showing that a higher cost recovery ceiling led to less contract attractiveness. PSC R/C had a maximum 40% limit on deepwater field, while PSC CR showed a maximum 20% limit, affecting the slowing down of the investment return time for IOC. Additionally, in PSC R/C Malaysia, the presence of cost recovery ceiling components and other additional fiscal terms such as less payment, export duty, and supplementary payment components, increased the GT and GTi.

The difference in the amount of GTi and GT in Table 4 showed that government revenue did not only come from project profits, but there were other fiscal components in the early stages of development and production, These included bonuses, royalties, profit sharing ratios, taxes, and windfall profits, affecting the time value of money as well as the order and sequence of the profit. FLI is defined as the difference ratio between GTi and GT, where a smaller value corresponds to lower risk and a more attractive production-sharing contract for the contractor. In this study, the smallest FLI value in Block A was generated by the Indonesian PSC CR scheme at 6.2%. This showed that although Indonesia PSC CR had the second lowest rank in GT and GTi, the risk faced by IOC in the early project stages was

small. Thailand concessions were in the last rank of attractiveness in FLI after PSC non-cost recovery. This showed that the risk faced by IOC in the early production stage of the project was higher. The presence of 13% royalty in Thailand concessions and 16% government share in PSC GS ensured the host country revenue despite no profit by the IOC. Therefore, the royalty and profit split in FLI also affected the attractiveness level of fiscal system. The result confirmed the distribution of GT and FLI in Figure 1, which showed the level of attractiveness of four fiscal schemes in three countries applied to Block A. The distribution showed that fiscal with relatively smaller GT and lower FLI, near coordinate axes, would be more attractive from the perception of contractor. In this case, PSC CR Indonesia was indicated to be more attractive than the other three fiscal schemes with the smallest FLI and GT values.

Table 3
Economic result of four fiscal regimes applied in three different fields

Block	Parameter	INA - PSC CR	INA - PSC GS	MAL - PSC RC	THAI - CONS
A	Revenue, MM$	6,975	7,968	7,968	7,968
	Expenditure, MM$	5,485	6,478	6,478	6,501
	Unrecovered cost, MM$	41		965	
	NPV@10%, MM$	(1,175)	(1,085)	(1,451)	(1,085)
	IRR, %	1.1%	1.0%	-1.2%	1.0%
B	Revenue, MM$	6,464	7,023	6,464	7,023
	Expenditure, MM$	2,281	2,839	2,281	2,886
	Unrecovered cost, MM$	27	-	48	
	NPV@10%, MM$	407	854	314	605
	IRR, %	18.4%	27.4%	16.6%	22.4%
C	Revenue, MM$	15,371	15,371	15,371	15,371
	Expenditure, MM$	8,697	8,697	8,697	9,011
	Unrecovered cost, MM$	-	-	50	-
	NPV@10%, MM$	384	48	756	980
	IRR, %	66.3%	14.2%	87.2%	>100%

Table 4
GT and FLI value

Block	Government Take	INA - PSC CR	INA - PSC GS	MAL - PSC RC	THAI - CONS
A	- Non-discounted, GT	18.2%	16.4%	21.7%	16.6%
	- Discounted, GTi	17.1%	13.0%	19.9%	13.1%
	- FLI	6.2%	21.0%	8.3%	21.3%
B	- Non-discounted, GT	45.2%	32.5%	47.4%	36.9%
	- Discounted, GTi	42.2%	30.0%	44.2%	34.4%
	- FLI	6.5%	7.7%	6.7%	6.7%
C	- Non-discounted, GT	36.1%	40.3%	27.8%	27.3%
	- Discounted, GTi	30.2%	35.6%	25.7%	26.5%
	- FLI	16.4%	11.7%	7.5%	2.8%

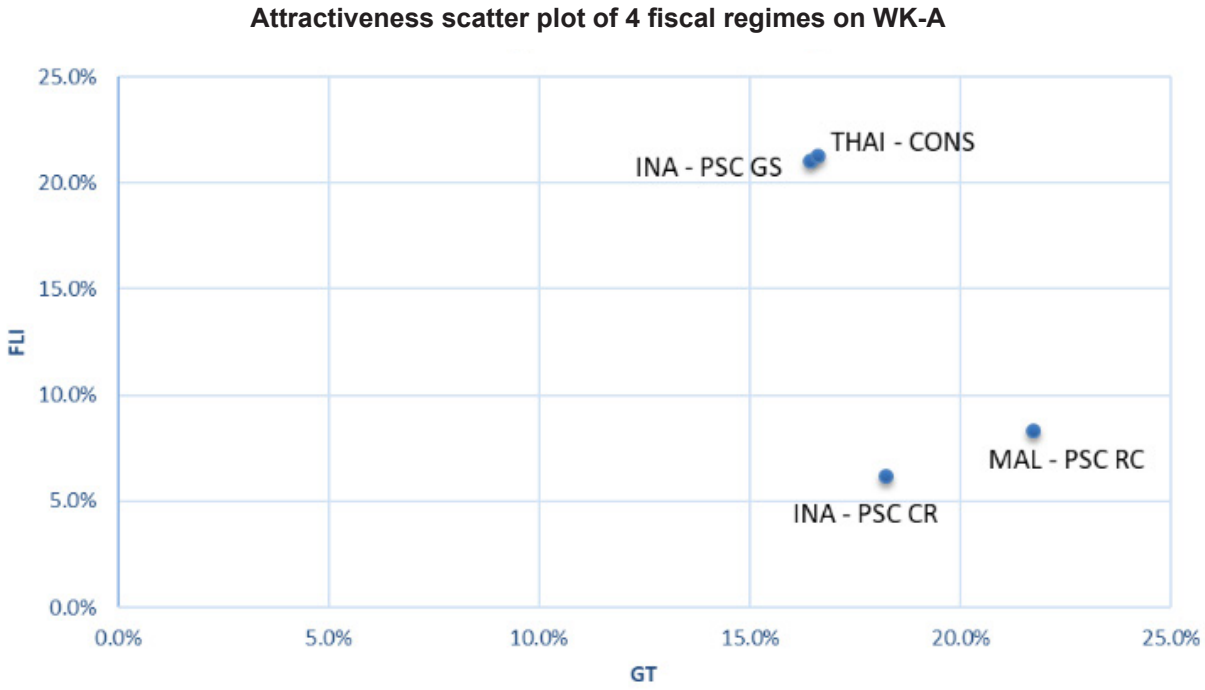

Figure 1
Attractiveness scatter plot of FLI/GT on Block A

Table 5
Attractiveness rank with composite score

Rank	Block A		Block B		Block C	
	CS	Fiscal Scheme	CS	Fiscal Scheme	CS	Fiscal Scheme
1	13.08%	INA - PSC CR	18.10%	INA - PSC GS	13.10%	THAI - CONS
2	16.06%	MAL - PSC RC	19.40%	THAI - CONS	16.10%	MAL - PSC RC
3	24.64%	INA - PSC GS	22.80%	INA - PSC CR	23.70%	INA - PSC CR
4	23.68%	THAI - CONS	23.80%	MAL - PSC RC	24.60%	INA - PSC GS

To compare and rank the attractiveness of a country oil and gas fiscal scheme, GT and FLI must be considered comprehensively. By using the CS method, the rank of fiscal attractiveness was determined based on the decision-maker attitude through the weighting of the GT and FLI. In this case, the weight referred to (Swe & Emodi 2018), which was 42% and 58% for GT and FLI. Table 5 shows the CS values and the order of the fiscal attractiveness rating for Block A. Based on this sequence, Indonesia's PSC CR scheme was the most attractive as shown by IOC, while Thailand concession scheme ranked fourth.

Block B Evaluation

Block B is an offshore field with a sharing facilities concept that provides the advantage of lower investment and operating costs compared to building their production facilities. All four schemes resulted in positive NPV and IRR higher than 15%, as shown in Table 3. Indonesia PSC-GS provides better economic results compared to other schemes on Block B because the contractor achieves a production sharing split of 84%, with a 40% portion of expenses and 44% income tax, leading to an NPV of 854 MM$ and an IRR of 27.4%. In the Malaysian PSC R/C scheme, the ceiling cost recovery affects

the amount of cost recovery on cash flow and the contractor share of unused costs and profit. Similarly, in PSC CR, at the end of the contract period, there is an unrecoverable cost of 48 million dollars due to ceiling cost recovery. The production has also reached the economic limit at the end of the contract period. In the Thailand concession scheme, there are additional costs for land rent, SRB, and higher tax rates, which provide lower economic results compared to the Indonesian PSC-GS.

In GT and GTi, the high contractor split (84%) ranks the attractiveness of Indonesian PSC GS as first with the lowest GT and GTi values. As shown in Block B, the largest GT and GTi values are generated from PSC cost recovery schemes, both the Malaysian PSC R/C and the Indonesian PSC CR. This serves as confirmation of the cost recovery ceiling affecting the attractiveness level of GT.

The smallest FLI value is generated from the Indonesian PSC CR scheme, amounting to 6.5%. This shows that smaller FLI value correlates with lower risk faced by contractor in the early stages, and more attractive fiscal scheme. Indonesian PSC GS is at the last rank of attractiveness in FLI, showing that the IOC faces the highest risk in the earlier stages.

The ranking order of fiscal schemes using a CS in Block B is shown in Table 5. The results show that the Indonesian PSC GS scheme is the most attractive for contractors, followed by the Thailand concession, Indonesian PSC CR, and Malaysian PSC R/C. This suggests that Indonesian PSC GS is the most attractive scheme to be applied in Block B with the lowest GT, GTi, and CT. However, the scheme has the highest risk in the early production phase with the largest FLI.

Block C Evaluation

Block C is a mature offshore field that also requires high operating costs. Assessment of all four fiscal schemes applied to Block C in Table 3 shows a positive NPV and IRR value of more than 14%. In line with NPV and IRR values, the Thailand concession scheme provides better economic results compared to others. All costs required until the end of the contract, amounting to 59% of gross revenue, include additional costs from others. Additionally, income tax can be compensated by 87% of the contractor income after a 13% royalty. In GT and GTi, Thailand concessions rank first with the lowest value, followed by Malaysian PSC R/C, Indonesian PSC CR, and PSC GS. The lower contractor profit split (63%) in Indonesian PSC GS weighs on contractor profit to cover the expense of 59% of gross revenue. Therefore, the profit split also affects the attractiveness level of the fiscal terms for the countries practicing the PSC system.

Based on the different orders shown in FLI, the Indonesian PSC CR rank has the least attractiveness in terms of the IOC risk in the earlier stage. As shown in Table 5, Thailand concession scheme ranks first with a value of 13.1% and is considered the most attractive for contractors for Block C, followed by the Malaysian PSC R/C, Indonesian PSC CR, and Indonesian PSC GS. This result is also consistent with previous analyses of the economic indicators GT and FLI.

CONCLUSION

In conclusion, this study showed that the combination of economic indicator assessment, the GT, GTi, FLI, and CS method was able to indicate the fiscal attractiveness of a country upstream oil and gas business at the selection stage. Based on the assessment in three offshore field, Indonesian PSC with cost recovery and gross split schemes were at the top ranks. This confirmed the Indonesian government goal to increase national production by revising the fiscal terms over time. Improvements in the size of the split in the gross split PSC with discretionary incentives were expected to enhance fiscal attractiveness and risk, as shown in Block C.

The main results of GT and GTi in this study suggested that profit split and the ceiling of cost recovery were significantly affected by attractiveness. Royalty and split also affected the attractiveness of fiscal regimes in the earlier production phase, with and without the time value of money. Various ranking results showed that in any kind of fiscal regime used in a country, the amount and fiscal parameters used were suggested to be flexible. Therefore, the parameters could be adapted to the geological, political, and economic conditions and potential of a country.

ACKNOWLEDGMENT

The authors are grateful for the funding support received from Trisakti University.

GLOSSARY OF TERMS

Symbol	Definition	Unit
GT	Non-discounted Government take	USD
GR_t	Gross revenue	USD
FLI	Front loading index	
CS	Composite score	
w	Weight	
PSC CR	Production Sharing Contract Cost Recovery	
PSC GS	Production Sharing Contract Gross Split	
INA	Indonesia	
MAL	Malaysia	
THAI	Thailand	
SRB	Special Remuneration Benefit	
IRR	Internal Rate of Return	
NPV	Net Present Value	
THV	Threshold Volume	
LNG	Liquid Natural Gas	
F&D	Find and Development	
IOC	International Oil Company	
NOC	National Oil Company	
CAPEX	Capital Expenditure	
OPEX	Operating Expenditure	
FTP	First Tranche Petroleum	

REFERENCES

Abidin, F.A.Z., 2015, Investment Crossroads: Malaysia versus Indonesia, Paper presented at SPE/IATMI Asia Pacific Oil & Gas Conference and Exhibition, Society of Petroleum Engineers, Nusa Dua, Indonesia, October 20–22. https://Doi.Org/10.5957/Issc-2022-Committee-Vol-2

Acheampong, T., 2020, On the Valuation of Natural Resources: Real Options Analysis of Marginal Oilfield-Development Projects Under Multiple Uncertainties. SPE Prod & Oper. DOI: https://doi.org/10.2118/204232-PA.

Acheampong, T., Kemp, A.G., Phimister, E. & Stephen, L., 2015, The economic dependencies of infrastructure assets in the UK continental shelf (UKCS). In: SPE Offshore Europe Conference and Exhibition. Soc. of Petroleum Eng. DOI: https://doi.org/10.2118/175445-MS.

Anjani B.R. & Baihaqi, I., 2018, Comparative analysis of financial Production Sharing Contract (PSC) cost recovery with PSC gross split: Case study in one of the contractor SKK Migas. Journal of Administrative and Business Studies, 4(2), 65–80. DOI: https://doi.org/10.20474/jabs-4.2.2.

Aprizal, M.F., Juanda, B., Ratnawati, A. & Muin, A., 2022, Indonesian upstream oil and gas governance for sustainable innovation. Jurnal Manajemen dan Organisasi, 13(1), 48-60. https://doi.org/10.29244/jmo.v13i1.40427.

Blake, A.J. & Roberts, M.C., 2006, Comparing Petroleum Fiscal Regime Under Price Uncertainty, Resources Policy. doi:10.1016/j.resourpol.2006.08.001.

Bock, N. & Rodriguez, L.R., 2011, A Comparison of Windfall Tax Methodologies in Different Fiscal Regimes, International Petroleum Technology Conference, IPTC-14897. https://doi.org/10.2523/IPTC-14897-MS.

Boykett, T, Peirano, M., Boria, S., Kelley, H., Schimana, E., Dekrout, A. & OReily, R., 2012, Oil Contracts: How to Read and Understand a Petroleum Contract. Version 1.1. Available online: http://www.eisourcebook.org/cms/January%202016/Oil%20Contratcs,%20How%20to%20Read%20and%20Understand%20them%202011.pdf (accessed 20 January 2023).

Dharmadji, T. & Parlindungan, T., 2002, Fiscal Regimes Competitiveness of Oil and Gas Producing Countries in the Asia Pasific Region: Australia, China, India, Indonesia and Malaysia, Society of Petroleum Engineers , SPE-77912. https://doi.org/10.2118/77912-MS.

Echundu, J.C., Iledare, O.O. & Onwuka, E., 2015, Comparative Economic Performance Analysis of Production Sharing Contracts in Angola, Equatorial Guinea, Gaban, and Nigeria. SPE Economics & Management, p.157-166. doi: 10.12691/jfa-2-2-2.

Ferro, F., Tomasini, J., Gristo, P., Romeu, N, Blanquez & de Santa Ana, H., 2017, Uruguayan Petroleum Fiscal Regime', Society of Petroleum Engineers, SPE-185473-MS, doi: https://doi.

org/10.2118/185473-MS.

Gbonhinbor, J., Adebanjo, A., Oruene, A., Onyekonwu, M. & Ikporo, B., 2016, Comparative Economic Analysis on Offshore and Land-Based Liquefaction Facilities in Nigeria. Society of Petroleum Engineers, SPE-184366-MS. https://doi.org/10.2118/184366-MS.

Gudmestad, Ove. T., Anatoly. B. Zolotukhin & Erik. T.J., 2010, Petroleum Resources with Emphasis on Offshore Fields. Southampton: WIT Press.

Hvozdyk, L. & Mercer-Blackman, V., 2010, What Determines Investment in the Oil Sector?: A New Era for National and International Oil Companies. Washington, DC: Inter-American Development Bank. https://www.researchgate.net/publication/254423314; What Determines Investment in the Oil Sector A New Era for National and International Oil Companies.

Johnston, D., 2003, International exploration economics, risk, and contract analysis, Penn Well Books, Tulsa, OK.

Johnston, D., 2008, Changing fiscal landscape, J. of World Energy Law & Bus. 1-1. pp 31–54. DOI: 10.1093/jwelb/jwn006.

Kravchenko, R., 2016, Six seas: Comparative application of investment attractiveness methodology to Arctic offshore petroleum provinces. NORD Universitet.

Lubiantara, B., 2012, Ekonomi Migas: Tinjauan Aspek Komersil Kontrak Migas, Gramedia, Jakarta.

Lucchesi, R. D., 2019, Impacts of Fiscal System in Oil Projects Valuation, Offshore Technology Conference, OTC-29568, doi: https://doi.org/10.4043/29568-MS.

Luo, D. & Na, Y., 2010, Assessment of Fiscal Terms of International Petroleum Contracts, Research Institute of Petroleum Exploration and Development, 37(6): 756–762. https://doi.org/10.1016/S1876-3804(11)60009-8.

Manaf, N.A.A., Saad, N., Ishak, Z. & Mas'ud, A., 2014, Effects of Fiscal Regime Changes on Investment Climate of Malaysia's Marginal Oil Fields: Proposed Model, Procedia-Social and Behavioral Sciences 164: 55–61. http://www.sciencedirect.com/science/article/pii/S1877042814058704.

Mardiana, D.A., Fadhlia, Husla, R. & Kartoatmodjo, R.S.T., 2019, Assessing Indonesia's upstream petroleum fiscal regimes choices, International Journal of Scientific and Technology Research, 8(11), 2439–2444. https://www.ijstr.org/final-print/nov2019/Assessing-Indonesias-Upstream-Petroleum-Fiscal-Regimes-Choices.pdf.

Mardiana, D.A., Burhanudinnur & Kartoatmodjo, R. S. T., 2020, Analysis of extensive use of variable split components on flexible gross split scheme, AIP Conference Proceedings, 2245. https://doi.org/10.1063/5.0010241.

Mardiana, D.A., Saputra, H., 2022, Upstream Petroleum Economic Analysis under Low Price on Offshore Field Development, AIP Conference Proceedings, 2598, 030019: 1-9. DOI: https://doi.org/10.1063/5.0126092.

Marques, L.M., 2015, The Fiscal System Influence on Oil Fields Development and Government, SPE Int. Student Pap. Contest SPE Annu. Tech. Conf. Exhib. Houst., SPE-178752-STU, doi: https://doi.org/10.2118/178752-STU.

Masud, A., Manaf, N.A.A. & Saad, N., 2019, Modeling the Influence of Attractive Petroleum Fiscal Regime Dimensions on Marginal Fields Investment Climate in Malaysia', International Journal of Energy Economics and Policy, 9(4), 81-90.

Nakhle, C. & Lassourd, T., 2019, Assessing Tunisia's Upstream Petroleum Fiscal Regime, Natural Resource Governance Institute.

Putrohari, R.D, Kasyanto, A., Suryanto, H., & Abdul-Rashid, I.M., 2007, PSC Term and Condition and Its Implementation in South East Asia Region, Paper presented at the Indonesian Petroleum Association 31st Annual Convention and Exhibition May 2007; Available online: http://archives.datapages. com/data/ipa_pdf/078/078001/pdfs/IPA07-BC-127.htm.

Pusayapaibul, P., 2015, Investigation of an efficient petroleum fiscal regime for Thailand, thesis, Chulalongkorn University.

Rush, S., 2012, Access to infrastructure on the UKCS the past, the present and a future. Available [Online]. https://www.seanrush.co.nz/

wp-content/uploads/Access-to-Infrastructure-on-the-UKCS-SR-Feb-2012.pdf. (Accessed 11 May 2022).

Sabaris, S.A., Nugrahanti, A. & Mardiana, D.A., 2020, Comparative Analysis of Indonesia Gross Split PSC with Fiscal Terms of Several Southeast Asian Countries, Journal of Earth Energy Science, Engineering and Technology, Vol.3, No.3. https://doi.org/10.25105/jeeset.v3i3.7964.

Salam, A.Y., Kemp. A., Phimister, E., 2021, Unlocking the economic viability of marginal UKCS discoveries: optimising cluster developments. Energy Econ. 97, 105233. DOI: https://doi.org/10.1016/j.eneco.2021.105233.

Sitompul, Y., 2015, Upstream Oil Industry Country Attractiveness Assessment by Integrating Potential Value and Risk, Society of Petroleum Engineers, SPE-176170-MS. https://doi.org/10.2118/176170-MS.

Swe, W.T. & Emodi, N.V., 2018, Assessment of Upstream Petroleum Fiscal Regimes in Myanmar, Journal of Risk and Financial Management, 11(4), 85. https://doi.org/10.3390/jrfm11040085.

Willigers, B.J., Prendergast, K. & Muslumov, Z., 2010a, North Sea dominos: the economic dependencies of infrastructure assets and their user-fields, Soc. of Petroleum Eng. SPE-130156-PE, in Proceedings of the Hydrocarbon Economics and Evaluation Symposium Held in Dallas, Texas, USA, 8–9 March 2010. DOI: https://doi.org/10.2118/130156-MS.

Willigers, B.J., Hausken, K., Bratvold, R., 2010b, Uncertainty and preferences in a joint E&P development program analyzed in a game-theoretic framework, J. Petrol. Sci. Eng. 74 (1–2). 88–98. DOI: https://doi.org/10.1016/j.petrol.2010.08.013.

Willigers, B.J., Hausken, K., 2013, The strategic interaction between the government and international oil companies in the UK: an example of a country with dwindling hydrocarbon reserves, Energy Pol. 57, 276–286. DOI: 10.1016/j.enpol.2013.01.054.