

African Group Submission on the ISA Payment Regime for Deep-Sea Mining in the Area

The African Group's Pledge to Mankind

1. The African Group is committed to ensuring that deep-sea mining in the Area only occurs if it is demonstrably beneficial to mankind. Deep-sea mining will involve a process through which resources currently owned by mankind are transferred through mining, transportation and processing to private ownership. The African Group will ensure that mankind is fairly compensated for this loss of resources to common ownership from the commencement of commercial mining.

The Proposed Payment Regime

2. The International Seabed Authority (ISA) published a revised edition of the Draft Regulations on Exploitation of Mineral Resources in the Area in July 2018 (Regulations). These Regulations outlined a payment regime containing an ad-valorem royalty as the only significant fiscal instrument/tax.ⁱ
3. The Regulations outline a royalty that is levied on the value of minerals exported from the contract area. The value of minerals is based on the average grade and list price (as determined by the authority) of relevant minerals (likely cobalt, copper, manganese and nickel) contained in the nodules. The Regulations also outline that different royalty rates can be applied to different relevant minerals and that these royalty rates will vary between the first and second periods of commercial production.
4. The Regulations did not include the rate for the royalty or the length of the different periods of commercial production. Presentations to an ISA working group by the Massachusetts Institute of Technology (MIT)ⁱⁱ in February 2019, however, appearedⁱⁱⁱ to suggest an ad-valorem royalty with a rate of 2% for the first five years of commercial production and 6% for the remaining years of commercial production. The MIT Report^{iv} to the ISA on the 3rd of June 2019 also included this option.
5. The African Group would like to complement the ISA and MIT on the detailed work undertaken on modelling the economics of deep-sea mining. In particular, the African Group welcomes the detailed work MIT has undertaken to better understand the deep-sea mining process.
6. The African Group does, however, have a number of concerns regarding the proposed payment regime consisting of a 2%/6%^v ad-valorem royalty and the methodology underlying this proposal. These concerns are discussed below and taken in totality mean that will be very difficult for the African Group to support a payment regime where the only significant fiscal instrument/tax is a royalty with a rate of 2% and then 6%. In addition, the African Group will shortly submit a proposal to the ISA proposing an alternative payment regime.

The African Group's principal concerns with the proposed payment regime

Concern one: that the payment regime is designed around the overarching goal of ensuring post-tax profits are sufficient to motivate commercial mining

The proposed payment regime is based on the underlying philosophy, as outlined on slide two of MIT's February 2019^{vi} presentation of:

'identify payment systems that maximise the return to the common heritage of mankind while providing sufficient revenue to motivate the construction and operation of a mine'

The African Group considers that this philosophy alone is insufficient. More specifically, the African Group will only support a payment regime that demonstrably:

- a.) results in deep-sea mining contractors facing rates of payment (an overall burden of taxation) that are within the range of those prevailing for land-based miners;
- b.) results in substantial and fair compensation to mankind whenever deep-sea mining occurs; **and**
- c.) either i.) constrains production from deep-sea mining to a level that does not result in lower metal prices and a loss of government revenue from land-based mining; or ii.) results in high enough revenue from deep-sea mining for governments with revenues from land-based mining to be fully compensated.

Going forward, the African Group would request that any further modelling of the payment regime directly addresses these objectives.

Concern two: the overarching method applied by MIT

The recent MIT Report is clear that the method used is to:

- a.) 'we first identify the systems that model results indicate would provide some target level of return (the minimum attractive rate of return (MARR)) to the contractor.';
- b.) 'Then from this limited set, we identify the systems that maximize the return to the ISA.'; and
- c.) 'our best estimates of MARR come from three sources of data. First, what are typical MARR values for land-based mines. Second, what risk premium might be expected above a land-based mine return because deep sea mining is unprecedented. Third, what do contractors claim are their MARR.'

In other words, the higher the MARR required the lower taxes/rates of payment. And one main source of data for the MARR is 'what do contractors claim are their MARR'. The view of the African Group is that the underlying logic for following this method and the inherent risks it entails require careful consideration. Going forward, the weighting given to the source of data 'what contractors claim are their MARR' should be carefully considered.

Concern three: that the proposed payment regime does not result in rates of payment within the range of those prevailing from land-based mining

7. The Implementing Agreement Section 8.1.B states

"The rates of payments under the system shall be within the range of those prevailing in respect of land-based mining of the same or similar minerals in order to avoid giving deep-seabed miners an artificial competitive advantage or imposing on them a competitive disadvantage'.

8. A proper interpretation of the phrase 'rates of payment' is the share of profits received by the government/authority in the jurisdiction where mining (land-based or deep-sea) is occurring. Data from Otto et al (2006) shows that governments in the jurisdiction where mining occurs on average receive 47%^{vii} of the profits from mining.
9. Importantly this study is measuring the share of profits received by the government in the jurisdiction where mining occurs. It does not include any corporate income taxes paid by mining companies in the tax jurisdiction where their company is headquartered.
10. The MIT Report^{viii} concluded that with a 2%/6% royalty the ISA share of profits would be 21%. A payment regime with a royalty of 2%/6% thus results in a lower 'rates of payment' for deep-sea mining than for land-based mining and does not conform to UNCLOS. The opinion of the African Group is that any payment regime should ensure that the ISA receives at least 40% of profits under a wide range of possible future scenarios.

Concern four: that the proposed payment regime does not result in fair compensation to mankind

11. The African Group reiterates that, as stated in our July 2018 submission to the ISA^{ix}, we do not consider the ISA receiving 2% of the value of nodules when commercial mining commences to be fair compensation to the common heritage of mankind for the loss of resources to common ownership.

Concern five: the assumption that deep-sea mining should face lower rates of payment because it is riskier than land-based mining

12. The MIT Report argues that deep-sea miners require a higher post-tax internal economic rate of return (IRR) than land-based miners to motivate investment. Specifically, MIT argue deep-sea mining requires an IRR of between 17% and 18% (with 17.5% seeming to be the favoured value) compared to their consideration of a 15% IRR^x being required for land-based mining. The underlying reason given for deep-sea miners requiring a higher IRR is that they face greater risk.
13. With regards to the above argument, the African Group notes that:
 - a.) land-based mining contractors commonly argue that high internal economic rates of return are required due to (as they perceive it) political instability in some land-based mining jurisdictions. Mining in the Area is not subject to a high degree of political instability and this speaks to a lower IRR being required for deep-sea mining;
 - b.) if deep-sea mining requires a higher internal economic rate of return than land-based mining to motivate investment, then it follows that deep-sea mining must be a riskier way of producing the same metals as land-based mining. It is not clear how moving from a less risky (land-based mining) to a riskier (deep-sea mining) form of mining is beneficial to mankind; and
 - c.) if the argument that deep-sea mining requires a higher IRR is used to justify a payment regime with lower rates of payment than those prevailing for land-based mining, then this directly contradicts the Implementing Agreement with mandates that deep-sea mining faces the same rates of payment as land-based mining.

Overall the African Group cannot support any payment regime that offers an artificial competitive advantage to deep-sea mining compared to land-based mining. In addition, the

African Group cannot support any payment regime that encourages risky forms of mining compared to less risky ones. We reject the underlying argument that because deep-sea mining is risky it should face lower rates of payment.

Concern six: the assumption that a contractor undertaking deep-sea mining in the Area will pay a 25% corporate income tax on its profits from each mine to its sponsoring State

14. The MIT Report assumes a sponsoring State tax rate of 25% of profits. This assumption appears to be based on the average of corporate tax rates in sponsoring States. The view of the African Group is that it is incorrect to average sponsoring States' corporate income tax rates and include them in the economic model for the following reason:
 - a.) land-based miners potentially have to pay taxes in two jurisdictions, namely where mining occurs and corporate income tax where their global headquarters are located. In contrast, contractors undertaking mining in the Area potentially have to pay taxes in three jurisdictions, namely to the ISA, to the sponsoring State and where their global headquarters are located. The only additional tax paid by deep-sea miners compared to land-based miners is then any specific tax or fee related to the sponsorship of deep-sea mining. There is no reason to consider a priori that this specific sponsoring State fee/tax is equal to the corporate income tax rate in the sponsoring State;
 - b.) models of rates of payment/the burden of taxation for land-based mining account for taxes in the jurisdiction where mining occurs: they do not include any corporate income tax liability where the head office is located; and
 - c.) corporate income tax is levied on the corporation: not the mine. For a corporation, losses from one economic activity can be deducted from the profits of another economic activity when determining taxable income and tax liability.
15. It follows from the above discussion that it is incorrect to simply average sponsoring States corporate income tax rates and include them in a model of profits from a single mine. An economic model of a single mine should either not include any tax from the sponsoring State (e.g. it should be a model of taxes in the jurisdiction where mining occurs) or it should only include a realistic estimate of the specific fee/tax paid to the sponsoring State.
16. The specific fee/tax paid to the sponsoring State should be based on a detailed review of every contract between contractors and the relevant sponsoring State. This is unfortunately not possible as in direct contradiction to the principle of transparency many sponsoring States and contractors have not published such contracts. **The African Group hereby issues a clarion call for transparency. We request that all sponsoring States and contractors immediately publish all their contracts including details of all the taxes/fees/royalties paid to the sponsoring State.**
17. In the absence of the publication of the contracts described above, it is not possible to know with any degree of certainty the taxes/fees contractors pay to sponsoring States. It is, however, worth noting that many sponsoring States are in a weak position to negotiate a large sponsoring fee/tax as they do not own the resources being mined and the contractor can be sponsored by any ISA Member State. This observation combined with informal discussions the African Group has held with sponsoring States leads us to consider that it highly unlikely that contractors pay

taxes/fee to sponsoring States that amount to more than 1% of the mine's profits. The African Group thus requests that all future economic models of the payment regime include a rate of 1% as the sponsoring State tax/fee. The African Group is, however, happy for this figure to be revised based on the average sponsorship fee/tax once **all** sponsoring States have published the contracts they have with contractors and transparently made public the details of all sponsorship fees/taxes.

Concern seven: the royalty varying between periods of production

18. The logic initially proposed at the Payment Regime Workshop 3 (Singapore April 2017)^{xi} for a royalty that varied between periods of commercial production was that first mover contractors needed to be given an incentive to invest. This logic was, however, falsely premised as a lower royalty rate during the first period of commercial production is not encouraging first movers, rather it is providing a low burden of taxation for a set number of years of commercial production for all contractors that are awarded an exploitation contract, regardless of whether they are the first, second or nth movers.

19. The current proposal maintains the idea of a royalty rate that varies between periods of commercial production, but a new logic has now been put forward as justification. The logic now proposed is that the ISA has a lower discount rate than contractors. This means that for a specific targeted contractor IRR the ISA's revenues on a discounted basis are maximised with a royalty rate that varies overtime. Our principal concern with this argument is that it should not simply be assumed that the ISA (or more importantly its members) have a lower discount rate than contractors, any such conclusion should be based on detailed discussions with members. Moreover, the view of the African Group is that there should be significant financial compensation to mankind from the outset of commercial mining (not five years after it has commenced) and that there is a pressing need for developing countries to immediately receive additional resources to achieve the Sustainable Development Goals.

Concern eight: the lack of a tax on the transfer of rights

The Draft Regulations allow for the transfer of rights, but the proposed payment regime does not include any tax on the transfer of rights. It is common for land-based mining regimes to tax the transfer of rights.

The mining rights of a contractor may increase in value due to fortuitous factors completely outside of its control. For example, the value of rights to mining in the area held by a contractor may increase in value due to an increase in metal prices or other contractors proving that mining is commercially viable. In such a situation, a contractor may be in a position to make substantial profits from the sale/transfer of such rights. The African Group considers that the payment regime must fairly tax such profits.

Concern nine: the highly unusual structure of the payment regime

The ISA is proposing a tax regime that includes a single significant tax instrument, namely an ad-valorem royalty. It is almost unheard of for tax systems to only include a royalty. For example, a study undertaken by PwC in 2012^{xii} summarizes 22 land-based mining tax regimes and shows that no country has a tax system where the only fiscal instrument is an ad-valorem royalty.

The justification advanced for the ISA only including an ad-valorem royalty is that auditing a contractor's profits will be inherently difficult and that the ISA lacks auditing capacity. Four arguments can be advanced to support this justification, namely:

1. the ISA has no experience auditing tax returns;
2. there is a lack of historical data on costs against which to compare a contractor's reported costs;
3. there are currently few/no experts in deep-sea mining tax auditing; and
4. there is no international benchmark price for unprocessed nodules.

On the other hand, many developing countries have raised millions of dollars through profit based taxes on land-based mining and petroleum production. These countries had to build audit capacity while hiring expertise on salaries determined by civil service pay scales. In contrast, the ISA is an international organization that can pay attractive salaries and is regulating an important new industry; as such it would be in a strong position to hire audit expertise from experts with relevant experience in the offshore petroleum industry and land-based mining. The ISA hiring MIT (a world leading University) to programme an economic model is a concrete example of its ability to quickly ameliorate capacity constraints.

On balance, the African Group has no strong preference regarding whether the payment regime only includes a royalty or includes a royalty and a profit share. However, if the payment regime only includes a royalty then that royalty must result in an overall burden of taxation/rates of payment within the range of that prevailing in land-based mining tax regimes that include royalties and other taxes. That is, there must be overall comparability. This means that the royalty rate, if it is the only significant tax in the ISA's payment regime, must be much higher than the royalty rate prevailing in land-based mining tax regimes (as these also levy profit based taxes).

Concern ten: it has not been demonstrated that the proposed payment regime will result in enough revenue for the ISA to fully compensate countries with land-based mining for the decline in manganese prices

The Implementing Agreement provides for a portion of the revenue the ISA collects from contractors through the payment regime to be paid into an economic assistance fund. The purpose of the economic assistance fund is to compensate developing land-based mining States whose economies have been seriously affected by deep-sea mining.

MIT have provided convincing evidence that deep-sea mining will cause manganese prices to significantly decline. Specifically, MIT's February 2019 Presentation concluded that:

- Processors will want to sell Mn into the high value EMM market
- EMM market is of limited size and is not expected to be able to handle all of the additional Mn coming from nodules
- This will cause EMM prices to drop until it is no longer the most valuable market, at which point processors will want to sell into the next highest value market, Low Carbon Ferromanganese
- The combined EMM & Low Carbon Mn price will then drop until it reaches the price of the next lowest market and so on, until all Mn is sold.

MIT have not explicitly reported the decline in future manganese prices caused by production from deep-sea mining. However, in MIT's initial price forecast (which may not account for the increased supply from deep-sea mining) for Electrolytic Manganese Metal was \$3,500 per tonne^{xiii}, while its updated forecast^{xiv} (which does account for the impact of increased supply from deep-sea mining)

appears to be \$1,561 per tonne. This implies a very significant downward revision in prices, at least partly caused by deep-sea mining.

The African Group notes that Ghana and South Africa exported \$155 million and \$2,527 million of manganese ores and concentrates respectively in 2017^{xv}. The view of the African Group is that Ghana, South Africa and other developing countries should receive full financial compensation for any loss of export earnings and other economic losses that occur due to deep-sea mining reducing metal prices. In light of this, it is a necessary condition for the payment regime to result in revenues to the ISA in excess of the amount of this financial compensation to land-based miners.

The consideration of the African Group is that future models of the payment regime should:

- a.) calculate all economic losses to land-based miners; and
- b.) demonstrate that the payment regime results in sufficient ISA revenues for the ISA to fully compensate land-based miners for economic losses.

The current MIT economic model does not include such an analysis. In addition, without prejudice to the African Group forming an opinion based on more detailed economic analysis, it is quite difficult to see how a 2% royalty or a 6% royalty from deep-sea mining could result in the ISA receiving high enough revenues for the ISA to fully compensate land-based miners.

Concern eleven: the lack of robustness to the conclusion that a 2%/6% royalty is the maximum that can be paid by contractors while leaving sufficient post-tax profits to motivate investment

The economic model proposed by MIT demonstrates that with certain assumptions a royalty of 2%/6% maximises the ISA's revenues while providing a high enough IRR to contractors to motivate them to undertake risky deep-sea mining. In other words, the royalty rates are fine-tuned to give a specified post-tax IRR given forecasted profits.

This method of 'fine-tuning' the royalty rate is only logical if:

- a.) the underlying forecast of profits is robust; or
- b.) the conclusion about the correct royalty rate is not sensitive to different forecasts of profits.

Profits in the MIT model are based on thirty-seven year forecasts of deep-sea mining costs and metal prices. The costs of deep-sea mining are of course extremely difficult to accurately forecast as no contractor has ever undertaken commercial deep-sea mining before and deep-sea mining will involve substantial technological risk.

Commodity prices are notoriously difficult to forecast. For example, price forecasts for oil which is the world's most traded commodity are consistently inaccurate. The notion that 37-year price forecasts of all valuable metals in nodules will end up being accurate is fanciful. This is doubly the case as presently there is even uncertainty concerning whether rare earth elements will be extracted from nodules and sold.

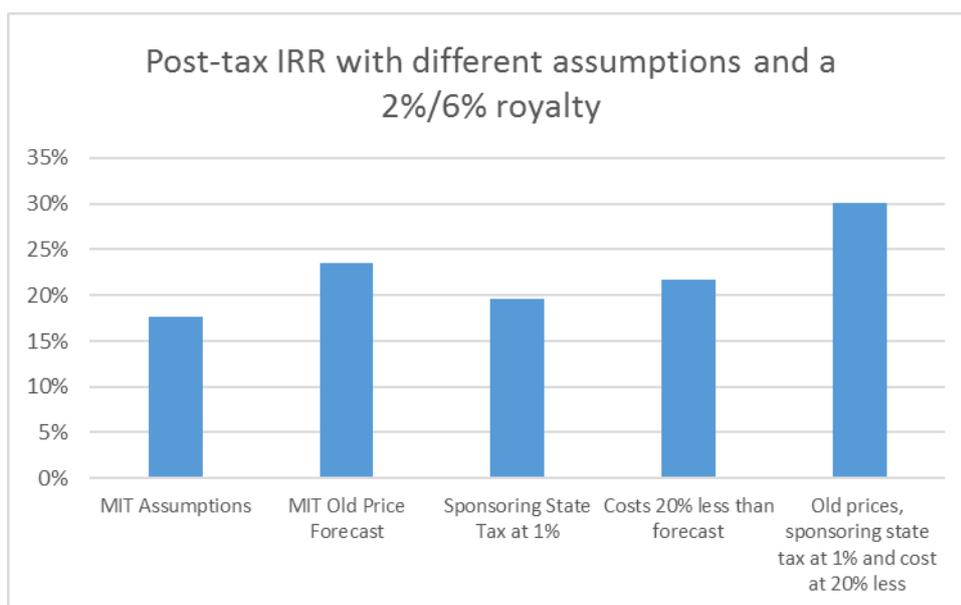
The difficulty in forecasting metal prices can also be seen from the work undertaken by MIT for the ISA. The original price forecast based on a statistical analysis of past prices and the updated price forecasts are consistent with nodule values per dry tonne of \$1,199 and \$870 respectively.

Table 1: MIT price forecasts

	MIT Price Forecast from July 2018 Presentation ^{xvi}	MIT Price Forecast from paper comparing four economic models ^{xvii}
Cobalt	46,500	55,535
Copper	5,000	6,965
Manganese (EMM)	3,500	1,640
Nickel	14,000	22,962
Nodule Value*	1,199	869

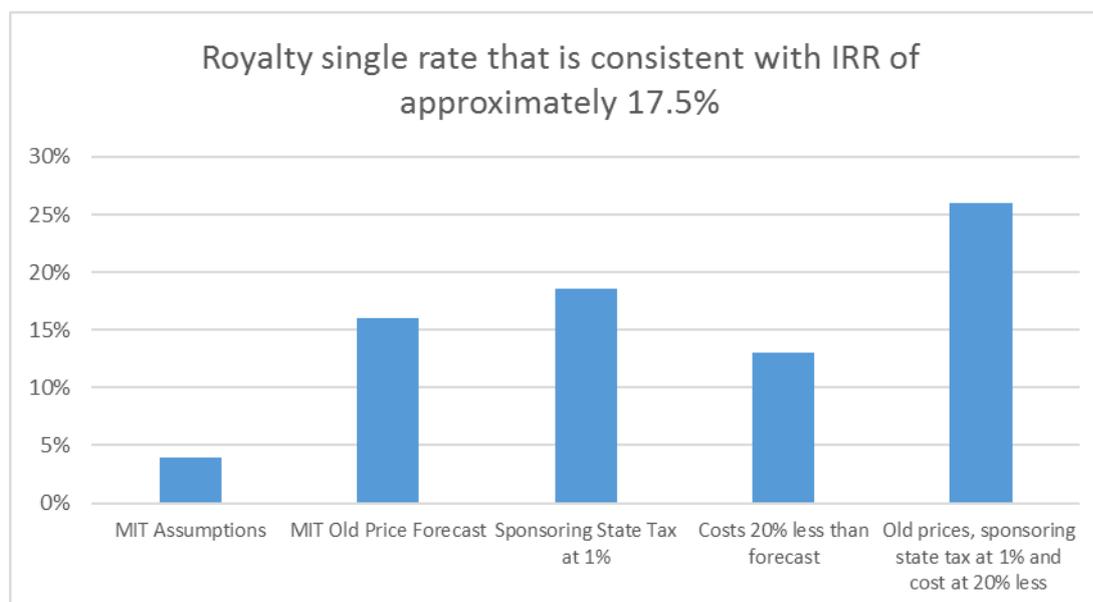
The IRR and fine-tuned royalty rate are also extremely sensitive to the underlying assumptions. For example, as shown in the next graph that reports results based on a replication of MIT’s economic model^{xviii}, the conclusion that a contractor’s IRR will be 17.5% is not robust to reasonable changes in the underlying assumptions. Indeed, including the realistic assumption that the sponsoring State tax/fee is 1% of profits then a 2%/6% royalty is consistent with a contractor IRR of 20%. While including MIT’s old price forecasts, sponsoring State taxes at 1% and costs at 20% less than forecasted results in an IRR of 30% for a 2%/6% royalty.

Graph 1: Replication of MIT Model, IRR with 2%/6% royalty and different assumptions



We can also use the MIT replicated model to examine whether the conclusions regarding a particular royalty being the most that is affordable are robust to changes in the underlying assumptions. As shown in the next graph, MIT concluded that a single royalty rate of 4% was consistent with a 17.4% IRR. But this conclusion is not robust. With reasonable changes to the underlying assumptions the replicated model shows that contractors may be able to afford a single royalty rate of 26%.

Graph 2: Replication of MIT Model, Royalty Rate Consistent with IRR of approximately 17.5%



These graphs illustrate a simple intuition: we do not know what the future will hold. Nobody has a crystal ball. Accurately forecasting metal prices for the next thirty plus years is a fool's errand. Nobody has undertaken commercial deep-sea mining before, so we don't know exactly what it will cost. Many contracts between sponsoring States and contractors are not publically available, so we don't know what taxes contractors are liable to pay to sponsoring States. The logic of fine-tuning a royalty rate to a particular forecast of profits thus makes little sense.

The conclusion that it is unwise to fine-tune royalty rates to inherently uncertain forecasts of profits has been recognized in the tax literature for decades. It is partly for this reason that land-based mining payment regimes do not rely exclusively on ad-valorem royalties and that most countries have significant taxes on ex-post profits.

In summary, if the rate of the royalty is fine-tuned to a forecast of profits over the next 37 years and then the forecast of profits turns out to be incorrect (which is very likely given the uncertainty concerning future prices and costs), then the ISA would be legally bound to a royalty rate that results in mankind receiving a low share of profits while contractors make excess profits. The African Group regards this as completely unacceptable.

Conclusion

The African Group has developed six criteria that any proposed payment regime should pass in order for it to be consistent with deep-sea mining only occurring if it is demonstrably beneficial to mankind. As shown in the next table, a payment regime with a 2%/6% royalty would not pass any of the criteria and thus it would be very difficult for the African Group to support such a payment regime.

Table 2: Criteria for evaluation of deep-sea mining payment regimes

<i>Criteria</i>	<i>Evaluation of 2%/6% payment regime</i>
Does the payment regime result in significant and fair compensation to mankind whenever deep-sea mining occurs?	No. Neither 2% or 6% of the value of the nodule is significant and fair compensation to mankind for the loss of nodules to common ownership.
Is the payment regime consistent with deep-sea mining only occur if it is an efficient and low cost way of producing minerals?	No. The payment regime is explicitly designed based on the assumption that the royalty rate should be fine-tune to a level that results in a contractor having a higher IRR than required for land-based miners because deep-sea mining is riskier than land-based mining.
The rates of payment for deep-sea should be within the range of those prevailing for land-based mining, in practice this means the ISA should receive at least a 40% share of the contractor's profits.	No. MIT report that the ISA's share of profits is 21%
The payment regime should be progressive with regards to profits and/or metal prices (as these often drive profits).	No. The ISA's percentage share of profits does not increase as prices increase or costs decrease.
Does the payment regime fairly tax profits from the transfer of rights?	No. There is no tax on the transfer of rights.
Has it been convincingly demonstrated that the payment regime results in the ISA receiving enough revenue to fully compensate land-based miners for any economic losses (including lost revenue from exports) due to a decline in mineral prices caused by deep-sea mining?	No. MIT convincingly demonstrate that deep-sea mining will cause manganese prices to fall. It seems unlikely that 2% or 6% of the value of nodules will be enough (after the ISA's costs and benefit sharing) to fully compensate land-based mining States for the lost revenue from this fall in manganese prices.

Going forward, the African Group intends to propose two new payment regimes. These payment regimes will not be based on the philosophy that because deep-sea mining is 'risky' it should face a lower rates of payment than land-based mining. Rather, it will be based around the philosophy that deep-sea mining should only occur if it is demonstrably beneficial to mankind.

ⁱThe Regulations also outlined various fees. However, these fees are likely, at least compared to the royalty, to result in relatively minor revenues to the ISA and are thus not discussed in detail in this Proposal. Fees are however accounted for in the economic models presented in this Proposal.

ⁱⁱ The term MIT is used throughout this Proposal to refer to the work undertaken by: Randolph Kirchain and Richard Roth, Material Systems Laboratory, Massachusetts Institute of Technology.

ⁱⁱⁱ The MIT presentation (full title 'Financial Payment System Working Group Meeting').

^{iv} Full title 'Report to the International Seabed Authority on the Development of an Economic Model and System of Payments for the Exploitation of Polymetallic Nodules in the Area June 2019'.

^v For the remainder of this report the term '2%/6%' is used to refer to an ad-valorem royalty with a rate of 2% for the first five years of commercial production and then 6% for the remaining years of commercial production.

^{vi} The full title of the presentation is 'Financial Payment System Working Group Meeting, February 2019'

^{vii} This is the simple average of the 'total effective tax rate %' figures presented for different mining jurisdictions presented in table 2.4 of Otto et al (2006). The data presented by Otto et al (2006) is itself based on data from Otto (2004) and Otto et al (2000).

Otto, J. M., and M. L. Batarseh. "Cordes:'Global Mining Taxation Comparative Study'." *Colorado School of Mines* (2000): 101.

Otto, James. "Comparative International Tax Regimes, vol. 50." Rocky Mountain Mineral Law Foundation (2004)

Otto, James, et al. Mining royalties: A global study of their impact on investors, government, and civil society. The World Bank, 2006.

^{viii} The MIT Report refers to 'Report1 to the International Seabed Authority on the Development of an Economic Model and System of Payments for the Exploitation of Polymetallic Nodules in the Area' 3rd June 2019.

^{ix} Request for consideration by the Council of the African Group's proposal on the Economic Model/Payment Regime and Other Financial Matters in the Draft Exploitation Regulations under review, July 2018

^x Unless otherwise stated the term 'IRR' is used in this Report to refer to the post-tax internal economic rate of return.

^{xi} The workshop report is available at: <https://www.resolve.ngo/site-dsm/dsm-payment-regime-workshop-3.htm>

^{xii} See: Corporate income taxes, mining royalties and other mining taxes, a summary of rates and rules in selected countries, June 2012, PWC. Available at: <https://www.pwc.com/gx/en/energy-utilities-mining/publications/pdf/pwc-gx-miining-taxes-and-royalties.pdf>.

^{xiii} See: Update on Financial Payment Systems: Seabed Mining for Polymetallic Nodules International Seabed Authority, LTC Meeting – Kingston, Jamaica July 8, 2018 Dr. Randolph Kirchain Research Team: Drs. Richard Roth, Frank Field and Thomas Peacock and Carlos Royo.

^{xiv} See MIT Report page 33.

^{xv} See: <https://comtrade.un.org/Data/>

^{xvi} See slide 11 of presentation entitled 'Update on Financial Payment Systems: Seabed Mining for Polymetallic Nodules

International Seabed Authority LTC Meeting – Kingston, Jamaica July 8, 2018'

^{xvii} See page Financial Regimes for Polymetallic Nodule Mining: A Comparison of Four Economic Models Randolph Kirchain, Frank R Field, and Richard Roth

Materials Systems Laboratory, Massachusetts Institute of Technology January 2019.

^{xviii} In order to test the robustness of the payment regime the African Group replicated MIT's economic model. The replicated economic model is based on the data and assumption outlined by MIT in their 'Financial Regimes for Polymetallic Nodule Mining: A Comparison of Four Economic Models' report. The African Group notes that MIT have updated their model on many occasions and as such the replicated model will not give identical results to the latest version of MIT's economic model. In addition, the African Group were sent a version of the MIT model on the 20th of June 2019, but this version of the model did not appear to give the same results as either the MIT June 2019 Report or earlier MIT reports. As such the African Group concluded that it would be unwise to use the June version of the model before further discussions were held with MIT.