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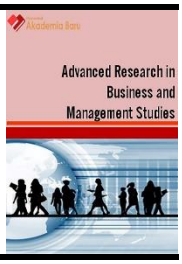

Establishment Upstream Brownfield targeted Maintenance Strategy in Driving Collaboration between Offshore and Onshore

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ABSTRACT

Most of the Malaysian brownfield facilities have in production for almost 40 years. To date, these facilities already matured and aging including their subsurface equipment and machinery. It has been observed that these brownfield facilities facing issues in high maintenance costs which higher than the agreed target sets by the business. Feedback from internal benchmarking exercises surface that high maintenance cost is due to facilities adopted the same maintenances strategies which introduce during early-stage facilities been operated until today. By adopting the same maintenance strategies, it contributes to the uptrend of overall maintenance cost but also individual facilities facing issue in changing their way of working in maintenance program due to less support from offshore and onshore working functions. Targeted maintenance strategies are the journey for brownfield facilities adopted individual maintenance strategies that reflect their current production profile and their production outlook minimum of for the next 5 years. With this strategy, all brownfields would focus their daily operation and maintenance activity as 1 team which required high collaboration between offshore and onshore key functions to work transparently with common goal-achieving daily production targets with fewer facilities interruption/unplanned shutdown. By adopting targeted maintenance strategy these brownfield facilities would able to reduce their overall maintenance cost and achieving production targets through work collaboration in terms of people (offshore and onshore working functions), daily work process and improvement in the current working system to support overall productions.

Keywords:
Upstream Brownfield, Targeted Maintenance Strategy & Collaboration

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1. Introduction

Petroleum exploration in Malaysia started at the beginning of the 20th century in Sarawak, where oil was first discovered in 1909 and the first time been produced in 1910. Based on history before 1975, petroleum concessions were granted by state governments, where oil companies have exclusive rights to explore and produce resources. In return, these companies required to paid taxes & royalties to the government. On 1st April 1975, the government has introduced the Petroleum Development Act and PETRONAS been established as the custodian of hydrocarbon/petroleum resources with rights to explore and produce resources on behalf of Malaysian.

PETRONAS is a Malaysian national oil company that retains ownership and management control in the exploration, development, and production of oil resources. Expenditure and profits are managed under instruments called Production Sharing Contracts (PSCs). The Production Sharing

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Contractor assumes all risks and sources all funds for all petroleum operations. Malaysia has 494,183km^2 of acreage available for oil and gas exploration, with 337,167km^2 in the offshore continental shelf area, and 63,968km2 in Deepwater.

Regarding facilities in Miri and Bintulu area, most of these brownfield facilities have been in operation for more than 25 years. These brownfield facilities required a targeted maintenance strategy to ensure their maintenance costs always below their operating cost and align with [1] PETRONAS business targets. By having a targeted maintenance strategy, the facilities would continue to achieve production reliability and achieve the agreed production targets and generate positive value creations.

Targeted maintenance strategy means the maintenance activities which are specific to individual facilities depending on their actual equipment performance based on their maintenance strategy such as to time base, risk base, fit for purpose or runs to failed [2]. To operationalize this strategy, good collaboration between onshore and offshore personnel are for key success [3]. The better collaboration between these two-working groups, the better their qualities of maintenance execution which lead to better production reliabilities at low maintenance costs. This aspiration was not easy to operationalize effectively because the collaboration between offshore and onshore is hard to achieve. From day one both working groups always having differences in terms of priorities, goals, and targets due to the nature of work and logistic locations. Targeted maintenance strategies would able to address this pain point and make both working groups align towards 1 common goal which specific to their facilities' requirements and achievable.

2. Methodology

As described on the above, brownfield requires establishing its targeted maintenance strategy individually and enable them to achieve collaboration between onshore and offshore work functions. To achieve this aspiration, we have identified the 1 brownfield in Sarawak basin as our case study.

At this brownfield we need to evaluate the following:

a. Analysis of "As Is" brownfield maintenance strategies
b. To evaluate their brownfield past 3 years of operation and maintenance (O&M) performance in comparison with other brownfields.
c. To recommend the targeted maintenance strategies that would enhance collaboration between offshore and onshore personnel

Before establishing a targeted maintenance strategy, we need to understand the definition of targeted maintenance strategies. Targeted maintenance strategies can be described based on the following equation:

Targeted Maintenance Strategy = (Brownfield facilities Availability and Brown filed equipment Reliability) which mean:

1. Facilities Availability means: Brown filed facilities availabilities within 365 working days and the proposed target is based on analysis on Asset life studies, Maintenance Reference Plan and Risk-Based Inspection programs [6].
2. Equipment Reliability means [7]: The proposed target recommended based on analysis of Equipment Maintenance Plans, Equipment Basic Care and Bad Actor Management

With the above definition and we merge the actual facilities finding with the above result. Once the target finalized then the agreed target needs to be properly communicated with offshore and onshore personnel for their understanding, feedback and agreement. Before implementing the proposed target maintenance strategies, there is a need to evaluate this brownfield offshore and

onshore personnel on their understanding about the new maintenance strategies based on the following element:

1. Ongoing maintenance strategy [4] adopted by current brownfield based on their respective maintenance References Plan, Risk-Based Inspection programs, Equipment Reliability Strategy, etc.
2. The effectiveness of current maintenance Performance management [6] for ensuring good quality of maintenance execution through good collaboration between offshore and onshore.
3. Quality of alignment and collaboration between 2 working group towards achieving production target and production reliabilities through adopting Targeted Maintenance Strategy

To evaluate the understanding of a set of data gathering activities required to capture the actual input either analysis of brownfield past 3 years performance [8] with targeted interview sessions for critical key offshore and onshore personnel. To interview the identified staff the focus more on evaluating their daily activities being carried out during normal operation only with more focus toward staff daily interaction between 2 focus groups on how they able to achieve production target and production reliabilities through adopting targeted maintenance strategy.

	Data acquisition	Modelling & analysis	Opportunity ident. & mgmt.	Proposals	Execution planning	Execution	Performance monitoring
Key activities	***Surveillance, monitoring well tests, metering***	***End-to-end view on production system potential, hydrocarbon allocation***	***Opportunity registers and reviews, short term production forecast***	***Effective budgeting and spending***	***Integrated activity planning***	***KPIs and performance dialogs***	***Planned vs. Actual results***
Key Interfaces	**Onshore** • PS • Ptech • Process tech **Offshore** • Production supervisor • Maintenance supervisor • Operations (incl. external vendors)	**Onshore** • PS • Ptech • RE • ME • Process tech • FA • Discipline engineers	**Onshore** • FM • PS • OE • Ptech • RE • ME • Process tech • Discipline engineers **Offshore** • OIM • Production supervisor	**Onshore** • FM • PS • OE • Ptech • ME • Discipline engineers **Offshore** • OIM • Production supervisor • Maintenance supervisor	**Onshore** • FM • PS • OE • Ptech • ME • Process tech • Discipline engineers **Offshore** • OIM • Production supervisor • Maintenance supervisor • Site planner	**Onshore** • FM • OE • ME • Discipline engineers **Offshore** • OIM • Production supervisor • Maintenance supervisor • Site planner • Operations (incl. external vendors)	**Onshore** • FM • PS • OE • Ptech • ME • Process tech **Offshore** • OIM

Fig. 1. Daily operation and maintenance work process for normal operation activities

The above is a daily operation and maintenance work process for normal operation activities which also highlighted the involvement of offshore and onshore personnel at every work process. This work process has already been the benchmark with other International Oil Companies (IOC) for ensuring this facility work process are standardized with other oil production companies and input from this analysis would allow us to benchmark with others IOC on how these companies execute their activities which similar to us but able to produce a better result.

Based on the above work process also, we could see the number of work function involves, the level of work complexity which demands good collaboration between onshore and offshore [8] from the beginning of data acquisition until the final process of producing daily performance monitoring report by the end on of the day [12]. This would ensure oil production continuously produces as per the agreed business target. From the above work process also, we could always observe that the

output of their daily production activities not about the work process been adopted but also about the competency of all respective work functions delivering their activities to the agreed performance standard. The challenge is how this brownfield able to sustain the practices in the long run.

Based on data gathering there is a lot of result of non-compliance to performance standards which bee set by the business and one of the examples is non-compliance with facilities Well data acquisition and their gap is Well test not properly conducted & analyses which contribute to the wrong prediction of good behaviour. When this happened, the Reservoir working team would recommend a deferent daily production target and this would contribute towards poor production performance which shown in a high gap in actual production versus purpose targets through-out the years. If this continues, in the long run, these brownfield facilities have been not performing and subject to the abandonment of oil production.

For ensuring these facilities showing good performance it's recommended focusing the improvement at their daily operation activities which in managing good collaboration between offshore and onshore working groups. These efforts have been recognized as managing trade-off which we required to focus on the following activities:

1. Identifying on what activities that required a trade-off I order to achieve a better outcome
2. Understanding the impact of the trade-off between these 2 groups not only for the business element but also intern of work behaviours and the capital investment required for ensuring the business target achieve
3. Process improvement requires for ensuring the all work functions well understood their role & responsibilities towards the assigned task and visible to others

To further analyze the trade-off element an interview session been conducted between offshore and onshore key working functions. As a result of the interview sessions, below are the evidence of the trade-off issue not properly been managed which surface on evident of collaboration issues between onshore and offshore.

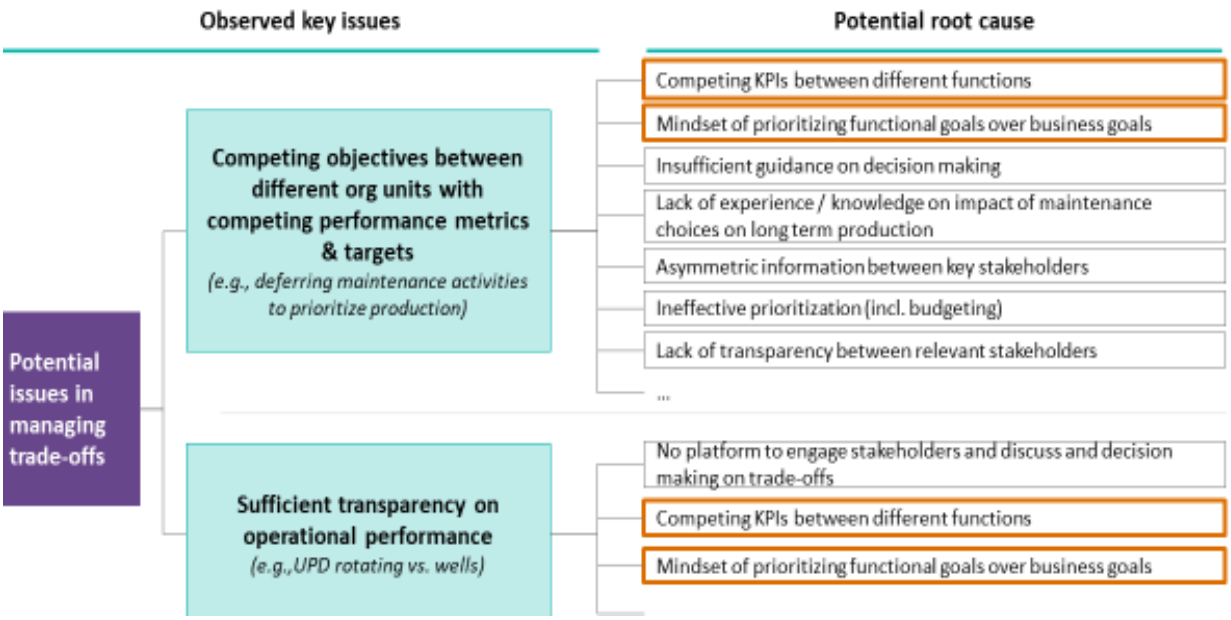

Fig. 2. Evident of collaboration issues between onshore and offshore

Based on the above analysis, it clearly has shown there is any evidence of competing objectives between onshore and offshore [9] working functions, which create competition KPI's between mong them. Feedback from the interview highlighted that this scenario becomes worst when individual working function not transparent on their individual KPI's and crated silo mentality among the team.

Through consolidated findings from other best practices brownfield facilities, this study able to surface visibly the evidence good quality of interface collaboration [13] which driven by targeted maintenance strategy in achieving production target with high-value creation. Most important input from other best practices brownfield facilities able to demonstrate consistency work behavior with an open conversation on daily performance standards including their work process involves and transparency of role and responsibilities at all levels. With good quality of work process, effective management of trade-off, it contributes toward good working collaboration between offshore and onshore working functions. This would achieve through the implementation of targeted maintenance strategy at respective brownfield facilities.

3. Result and discussion

Targeted maintenance strategy for the brownfield was a strategy that emphasis on the following element:

1. Getting the right Key Performance Indicator [11], the (KPI) been adopted at facilities level based on asset ranking and tearing. To date, the organization adopted a uniformed maintenance strategy at all facilities despite its performance-based business portfolio. By adopting a targeted maintenance strategy based on facilities value creation organization able to reduce overall maintenance cost.
2. Simplified and standardize all operation and maintenance key activities for better collaboration between offshore and onshore personnel. This is the key result area that facilities would achieve once the collaboration between onshore and offshore are seamless [10]. This happened once all activities become transparent to both parties. Once standardization is happening facilities would benefit through a reduction in unit production cost and finally achieve the agreed business targets.
3. Capitalize on operating discipline in achieving maintenance target delivery via the Integrated Operations dashboard between offshore and onshore personnel. To achieve this, real-time discussion [14] and daily feedback session is required for ensuring transparent of info between all working functions. As an example, our current modus operandi would result in facilities facing issues on high logistics cost due to maintenance staff required to travel daily to offshore for executing the agreed maintenance activities. For Malaysia, we are having monsoon seasons towards every end of the year which limits maintenance resources to mobilized offshore. Internally to offshore their living quarters only allowed for a limited number of resources to be on-board due to safety reasons. This challenge would able to address when brownfield adopting targeted maintenance strategy as a new way of working.
4. All activities very depended on data-driven and targeted maintenances strategy would focus more resources on predictive maintenance rather than reactive maintenances. All maintenance activities based on predictive require the equipment having a facility for 24-hours monitoring capacity by offshore and onshore functions. Any deviation from the norm would demand immediate discussion between both parties to understand the issues and immediate action required to address their facilities deviation. With this good collaboration by both parties would able to address all equipment breakdown real-time, more effort on prevention and seamless maintenance action

4. Conclusions

Referring to the above approach we would like to reiterate that targeted maintenance strategies are the new way of working for brownfield facilities toward achieving production targets with a positive business value despite the facilities already aging and operate beyond design life. Embarkation on targeted maintenance strategies at the facility level, would not only achieving the business result but more important good working behavior between offshore and onshore working functions These strategize offer significant value improvement for brown filed facilities without involvement significant capital investment in the long run.

In summary, targeted maintenance strategies would provide with the following advantages:

1. A culture of Maintenance Excellence through interface collaborations between onshore and offshore to achieve brown filed production targets.
2. A well-orchestrated facilities improvement activity through effective working collaboration between offshore and onshore functions

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