Integrated Monitoring of Schedule and Cost Control for Investment Project in Energy Industry

Fatkhur Rahman[1,2]

[1]Imperial College London
[2]Mata Garuda Jawa Barat
Email: fatkhur.rahman.0909@gmail.com

Abstract. In Indonesia, state-owned enterprises (BUMN) manage the fulfillment of energy needs. To execute that responsibility, BUMN carries out integrated business through management of energy in Indonesia. Since energy needs will continue to grow, BUMN are mandated by government to implement accelerated programs and initiatives. Hence, BUMN will face several challenges in managing investment projects. The problems experienced usually include the need for an accurate project progress. As a solution, BUMN needs to develop Program Management Office (PMO) for investment projects, that can serve as a centralized platform for key project functions at high-level. Then, for more detail, PMO solution needs to be complemented by integrated monitoring of schedule and cost control. The solution includes systems and capabilities for various types of projects. Besides technology, maturity of people and working processes are also important. The key success in adapting the process lies on the standardization of project structure and piloting. Besides that, culture of transparency through project review cadence is needed for effective problem resolution. This study is documented using qualitative research method, by understanding the experiences of some organizations through case studies. To conclude, integrated monitoring significantly improves project transparency. The solution provides granular insight to enable interactive problem resolution.

Keywords: *investment; integrated; monitoring; energy; technology; process; people*.

1 Introduction

State-owned enterprises (BUMN) such as PLN, Pertamina and MIND ID; is an institution that manages the supply and fulfillment of energy needs in Indonesia. BUMN also carries out integrated business through ownership of all distribution assets, as well as management of the energy and mineral resources in Indonesia.

Energy needs in Indonesia will continue to grow. One of the reasons is because the current condition has entered the recovery stage after the COVID-19 pandemic, where human activities have begun to increase again so that energy needs will also increase. In terms of electricity, based on PLN's projections in the electricity supply plan for the period 2021 – 2030 [1], electricity consumption growth in Indonesia is estimated to be around 4.9% per year on average. In the

Copyright © 2022 Published by ITB

same period, electrification ratio is also projected to increase to 100% by 2022. In oil and gas industry, upstream business actors are encouraged by SKK Migas in [2] to improve operational efficiency and innovation, to achieve the long-term target of 1 million barrels of oil per day (mmbopd) and 12 billion standard cubic feet per day (bscfd) of gas by 2030.

To achieve this target, BUMN are mandated by the government to implement accelerated programs and initiatives. Therefore, BUMN face several challenges in managing investment projects. The problems experienced usually include the need for an accurate and consolidated overview of project progress monitoring. In addition, problems can also arise in terms of optimizing project resources.

In response to these problems, BUMN needs to undertake strategic initiatives in the form of a Program Management Office (PMO) for investment projects. PMO solution can serve as a centralized platform for several key project functions at a high level; which includes project governance, project monitoring and control as well as knowledge management. Then, to carry out project monitoring at a lower level or in more detail, the PMO solution needs to be complemented by integrated monitoring of schedule and cost control. The integrated monitoring solution includes systems and capabilities for various types of investment projects with standard framework.

2 Case Studies

2.1 Type of Investment Projects

To maintain consistency of investment projects implementation in BUMN, standard project monitoring templates need to be developed for various types of projects. Examples of projects in the scope of electricity are power plants and transmission networks. Refinery and other surface facilities are examples of projects in the oil and gas industry. The mining industry also does not want to be left behind in launching projects. Recently, several BUMN in the mining sector have been building smelters, hauling roads or other production facilities.

2.2 Organization Challenges Occurred at Site

As mentioned before, a big organization such as BUMN usually face several challenges in managing investment projects, especially at the site. The problems occurred usually related to the lack of transparency, which include progress reconciliation, project performance, knowledge documentation, as well as reporting system. Transparency issue will cause inaccurate overview of project progress monitoring. Further in term of reconciliation of working progress, the

Copyright © 2022 Published by ITB

problems are usually caused by long processing time of volume inspection due to data accuracy issue.

In addition, problems also arise in the continuous improvement culture and capability improvement. The culture of continuous improvement is important in guiding project team to conduct quality management, equipment management, and project resources optimization. To encourage this culture, the organization should continuously improve people capability on several areas, such as contract management, risk planning, forecasting, and business analytics.

2.3 The Implications of Project Monitoring which not Leveraging Updated Digital Technology

The organization challenges that are mentioned above will be worse if the organization do net leverage the updated digital technology. In traditional organization, the work plan was usually made very high level and planners were tracking the schedule manually through spreadsheet.

In the high-level planning, the project activities are usually planned for two (2) weeks duration. Even though, the best practice in the project monitoring is to have at least weekly duration for every project activity. This practice will made slow response in putting corrective action (mitigation or contingency plan) when there is a project delay. As it is known, project delay will cause overall cost-overrun that impact profitability.

In manual planning, planners on the site are usually using spreadsheet (instead of schedule control application) to track progress and to create S-curve. This is not a best practice since spreadsheet has limited capability for resource loading.

Eventually, project monitoring which not leveraging updated digital technology will cause problems on the reporting system. High level and manual planning are usually making people to do too much manual efforts for report generation.

The digital technology is also important to provide warning system for project performance. The inexistence of warning system will lead to problem on the transparency on project health and continuity.

3 Research Methodology

This study is documented using qualitative research method. The method is used to understand the experiences of some organizations through focus groups discussion, case studies, and literature review; especially in the area of project monitoring. The detailed description of each method is as follow:

1. **Focus groups discussion**: Gathering opinions from a group of experts to discuss a lesson learned from their past experience of project monitoring

Copyright © 2022 Published by ITB

2. **Case studies**: An in-depth and comprehensive study of a project monitoring practice in a particular investment project
3. **Literature review**: A survey of published works by some authors and report from some organizations that have some investment projects

4 Supporting Applications for Integrated Monitoring

In managing an investment project, maturity of people and working processes play an important role. Even so, existence of digital technology cannot be separated. This section will explain supporting applications that are commonly applied in the project monitoring. The portion of people (change management) and working processes adaptation will be explained next.

4.1 PMO Dashboard Application

Several BUMN have carried out project monitoring at program level or high level through PMO. Monitoring at this level includes the performance of the physical progress of the project and payment of set of projects from initiation to completion. The main users of PMO solutions are top management.

In some institutions, term for PMO display is quite diverse. A fairly common term to use is dashboard, control tower or remote operations center (ROC).

PMO dashboard app needs to be developed to facilitate monitoring, analysis, and decision making for top level management. The series of activities in managing investment projects usually include initiation, planning, pre-implementation, execution, and completion. PMO dashboard app needs to cover entire series of project activity.

4.2 Scheduling Application

Development towards a more detailed solution in terms of schedule and cost control needs to be continued at the project and activity management level. With this solution, progress monitoring can be carried out to the level of a more detailed project structure. Monitoring up to the activity level of each project also allows critical path analysis to be carried out to avoid project delays.

Commonly used schedule control apps are Ms. Project and Oracle Primavera. This app needs to be implemented to facilitate periodic management of schedules and progress. In a series of investment project activities, schedule control app needs to be deployed during the execution and completion.

In its utilization, the physical progress of the project at the site must be inputted by project engineer or planner into the schedule control app, in order to interface the progress to the cost control and the PMO dashboard app. Generally, the

Copyright © 2022 Published by ITB

implementation of progress input and interfacing can be done at the end of each month.

At the site, the scheduling control app could be also equipped with other technology, depending on the type of project. For project that involved high number of people and vehicles traffic, radio frequency identification (RFID) could be used to help in monitoring the progress based on ritase and/or volume. For project that need aerial progress survey, drone could be used to help in fastening the calculation. For engineering project that produce high number of design and drawing, electronic document management system (EDMS) could be used to help in managing engineering documents toward paperless system.

4.3 Integration of Schedule Control and Cost Control Application

Commonly used cost control app are enterprise resource planning (ERP) apps such as SAP. The cost control process will optimize cost and loan management features to manage financial aspects and record project costs. In a series of project activities, cost control app needs to cover from planning to completion.

In its utilization, monthly physical progress will be interfaced from the schedule control app to the cost control app at the end of each month. The payment activities can then be made based on physical progress. Hence, the cost control app must be configured and integrated with schedule control app. Then, integrity of the data presented from the integration will be interfaced through the PMO dashboard app.

5 Key to Success in terms of Working Process Adaptation

5.1 Upgrades on Standard Operating Procedures (SOP)

Besides developing the digital tool to support the operation monitoring, the project team is needs to improve the working process through reviewing and updating the SOP. The scope on the SOP upgrades should cover the end-to-end project life cycle. In some organizations, SOP is rarely utilized, mainly caused by the accessibility issues, time constraints and the relevancy issues.

SOP for some people is difficult to access due to available only in web based. Reading SOP is also consuming much time. Some SOP in several organization is even founded outdated or obsolete. Therefore, implementing digitalization through integrated monitoring for a BUMN would be a good time to revisit and upgrade the SOP. This could be done first by analyzing overall gap of current SOP against the best practice in the energy industry.

The concise, comprehensive, and complete SOP is important for a project-based organizations. To make the access easy, SOP could be digitized in an app so that

Copyright © 2022 Published by ITB

it is accessible through mobile phone. Additionally, to enhance the socialization process, the gamification could be introduced to ensure the SOP socialization and familiarization.

5.2 Standardization of Project Structure

Before transferring data to supporting apps, standardization of project structure needs to be done first. The standardization includes the structure of the project schedule, project costs, and the definition of critical milestones (key dates) to be achieved by project. This standardization later needs to be realized as templates for managing various types of projects that are relevant for a particular BUMN or industry. Activities that will be carried out during implementation need to be made in the form of a Work Breakdown Structure (WBS). These activities could be manifested in the form of tasks (has duration) as well as milestones (does not have duration).

Edwards in [3] states that critical milestones are important events during the project implementation that need to be known and acknowledged. Critical milestones are important points that contribute to the overall output of the project and indicate important events that must be achieved to ensure the achievement and deliverability of the desired work results. One of the main functions of milestones is to monitor the schedule from a general perspective. Therefore, critical milestones must have a planned date so that stakeholders can compare that date with the actual achievement date and determine the performance and differences between the two dates.

In addition to WBS, cost mapping in each activity also needs to be done in the form of Cost Breakdown Structure (CBS). WBS and CBS must be aligned in such way that CBS level resembles WBS level. This approach is preferred since dashboard, schedule control and cost control app needs to integrate each other.

With this concept, the aspects considered in developing CBS and WBS should adopt the same design principles. This includes inclusiveness, an appropriate level of detail, as well as a mutually exclusive and clear scope of structure.

5.3 Business Process Detailing

Business processes detailing need to be carried out in more detailed project management. Business process detailing can be made up to three (3) levels to show series of activities in investment projects management. Level 1 typically include initiation, planning, pre-implementation, execution, and completion.

5.4 Metrics Definition for PMO Dashboard Application

Defining the metrics during the dashboard development is important. Each metric that is shown on the dashboard are designed to answer the fundamental

Copyright © 2022 Published by ITB

performance questions raised by project manager, other management at headquarter and board of directors or C-level. The topic that is depicted by the metrics should cover at least: overall project performance, right sequence, right work quantity, priority area (selected based on the major issue or upcoming milestone), systems completion (applicable for >50% completed project), as well as social and community engagement (as applicable).

Metrics are defined to enable close monitoring of key project drivers to identify where intervention and support is required. During the metrics definitions, each metric should have detailed description as follow:

1. function related to the metric (procurement, construction, etc.)
2. metric name
3. unit of measure (percentage, days, etc.)
4. dimension (by contractor, by discipline, etc.)
5. frequency (weekly, monthly, etc.)
6. visualization (number, graphic, table, etc.)
7. user (project manager, other management at headquarter and board of directors or C-level)

The metrics should be applied to multiple project scopes and should adapt over time to include critical risks as they develop. The sample metrics list for the dashboard application are shown on the following table.

Table 1 Sample metrics list for the dashboard application.

No	Manpower & equipment productivity	Project scheduling	Delay, risk, and issue	Project costing
1	Manpower histogram (plan VS actual) by category **in number**	Ahead or delay schedule can be transformed into cost **in currency**	Mitigation of delay	Period change (cost VS budget VS revenue) **in currency**
2	Forecast & important milestone **in %**	Schedule and time variance; forecast completion **in weeks**	Potential delay events or slow down activities	Change order and trend register **in currency**
3	Monthly productivity rates **in currency**	S-curve (plan VS actual VS earned) **in %**	Top 10 gain or loss items movements	Approved delay VS EOT; claim VS EOT **in currency**
4	Delivery schedule **in weeks**	Schedule and cost performance index **in number**	Top 5 risks in term of cost and schedule	Variance approved VS not yet approved **in currency**
5	Manpower loading **in %**	Eraned value **in %**	Outstanding issues and PIC	Cost variance **in currency**

5.5 Implementation on Pilot Project

In order to achieve success in the adoption of new solutions, the implementation of PMO solutions and integrated monitoring needs to be piloted first. BUMN that

Copyright © 2022 Published by ITB

planning to adopt this solution can try it out in some pilot projects. There are no specific criteria in selecting the pilot project. However, based on several rules of thumb that are often used, pilot projects should be carried out for projects that are not too complex and have a short to medium duration. The success of pilot project will increase BUMN capability in project monitoring.

5.6 Risk Management

A good project control practices also need good risk management practices. The stage of managing risk is started with risk control self-assessment by forecasting future conditions and identifying risk. Lost event management is performed afterwards by extracting information and lesson learned. The last step is key risk indicator which defined by initiating risk alerts and treatment plans.

Ideally, all risk aspects should be identified and included in the contract. Risk management team should intensively work with project team and utilize 5M+1E rule (Man, Method, Machine, Material, Money and also External) in risk identification. The 'External' factor could act as a contributing factor, such as local and national government regulation as well as force majeure.

6 Key to Success in terms of People (Change Management)

Introducing the tools and new working processes is not enough to adopt integrated monitoring for operational excellence. People are the key in implementing the digitalization. Therefore, change management for the people is essential, which is continuously conducted through several initiatives.

6.1 Project Review Cadence

The culture of transparency through project review cadence needs to be institutionalized to drive quick and effective problem resolution. The cadence will also help site construction team to set targets better. Several actions to drive effective project review is as follow:

1. Introduce cascaded target-setting and project review with feedback loop to key roles (planning, cost control, contract, procurement, logistics)
2. Identify and track actions on project review with a clear person in charge and clear deadline

The recommended structure of project review cadence is as follow:

1. **Daily** plan and target setting performed by project team, subcontractor at site, and supervisor;
2. **Daily** performance review performed by supervisor and project manager

Copyright © 2022 Published by ITB

3. **Weekly** project review performed by project manager and other management at headquarter. Weekly project review could be covering forecasting, payment and invoicing issue, material discrepancy, manpower planning and equipment planning
4. **Monthly** project review performed by project manager, other management at headquarter and board of directors or C-level. Monthly project review could be covering forecasting and risks discussion

6.2 Capability Building

To build the people capability, a series of workshop or training could be conducted, especially for planner and cost controller at both site and headquarter. After the workshop, the site planner should be able to independently drive daily standup planning discussion and weekly forecasting using schedule control app and project planning board. On the other hand, the planner at the headquarter should be able to implement resource loading, analyze schedule variance, and measure the earned value on all projects.

The cost controller capability building program usually consists of building forecast estimate-at-completion (EAC) analysis, forward-looking budget control, risk and contingency as well as planning for cashflow analysis in collaboration with finance team. This capability building is important in ensuring project health and continuity.

7 Benefit of the Implementation

Integrated monitoring significantly improves project progress transparency from operation to financial. The detail benefit of the solution is as follow:

1. Automated access to the project structure to provide full transparency on the project health and continuity. Project team will receive timely warning on the performance
2. Provides granular insight to enable interactive problem resolution
3. Clear visualization of main project metrics and simplified reporting process

Furthermore, such integrated monitoring could be developed as an automated analytic processing. For example, project engineer could conduct the scenario-based forecasting in changing operation parameters.

Additionally, with the new capability that has been introduced into the planner and cost controller, there is a change in the way of working that will provide benefits to overall organization, especially in promoting culture of transparency.

Copyright © 2022 Published by ITB

8 Conclusion

In overall, some lesson learned could be obtained from the success story of implementing the digital tool of integrated monitoring. With a strong capability of monitoring, the project possibly increases the profit of the project by minimizing cost and avoiding loss. The digitalization effort on the other hand also creates easier understanding on working process of project management.

Through digitalization, project control can be implemented better and easier than manual, where project risks or problems can be identified and anticipated earlier. So, it can be reviewed and taken action to reduce potential loss. The project team also can get more accurate information and facilitate analysis. Ultimately, PMO dashboard significantly improves progress transparency from operations to financial through tracking across the full life cycle of project.

References

[1] *Rencana Usaha Penyediaan Tenaga Listrik (RUPTL) 2021-2030*, PLN, Jakarta, Sep. 2021.
[2] *Annual Report 2020*, SKK Migas, Jakarta, Jan. 2021.
[3] Edwards, G., *Guidelines for Successful Project Milestone Planning*, Bright Hub PM, http://www.brighthubpm.com/project-planning/68427-successful-project-milestone-planning/, (9 April 2010).

Copyright © 2022 Published by ITB