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QUALITY METRIC DESIGN USING INTERNAL CONTROL METHOD TO CONTROL THE QUALITY OF FIBER OPTIC INSTALLATION PROJECT

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Abstract—To provide internet network, one of public Telecommunication provider in Indonesia conduct several project related to fiber optic cable installation such as the STO Modernization Feeder project. In every project implementation, the company is concerned with quality in order to remain competitive with competitors. Deliverable which meets the project quality will produce the product in accordance with the requirements. STO Garut Feeder Modernization Project was experiencing delays which is caused by the non-conformity project deliverable to project specification during monitoring & controlling phase. At project planning, the quality metric was not designed, which can be used as a guideline for vendor in carrying out the project task and to assist the process of quality control. Quality metric design is carried out using internal control methods that can identify possible errors in each project activity and critical success criteria that define a successful activity that will be performed. Result shows that only 67.1% statement (critical success criteria) form critical activity is implemented. This result can answer why the project delay because the activity on critical path is mostly re-worked due to non-conformity issues.

Keywords—*Quality, quality metric, internal control, control quality, telecommunication project*

I. INTRODUCTION

Internet or interconnection-networking is one of the most popular and commonly used applications of information technology. One of public Telecommunication provider in Indonesia strives to optimize projects that support quick time-to market internet networks for customers. Due to high demand of high speed data access, the company perform the installation and replacement of copper cables to fiber optic cables. To achieve customer expectation, company is required to ensure that every project activity that will be carried out should be in accordance with agreed quality standards.

This telecommunication provider now acts as project owner hired vendor or project executor from modernization project of STO Garut Feeder. This vendor started the project preparation on May 24, 2014. He received the order letter after the Design Review Meeting (DRM) was conducted and released on June 13, 2014. After the order letter is issued then the project will take 120 calendar days. This project attaches great importance to the quality of project implementation so that it is expected to produce quality products that meet specifications. Project owner is also required to ensure that the output of the project implemented by vendor, complies with agreed specifications.

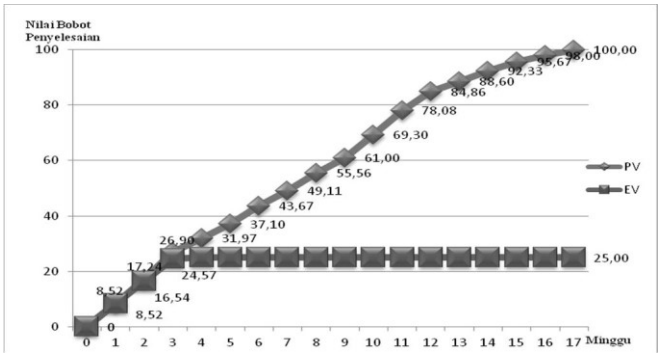

Fig. 1 S Curve Feeder STO Garut Modernization Project

As the project start to work, the S curve of the project indicates the delay in project execution. The work is targeted to be completed within 17 weeks. However, the implementation of the project takes more than 17 weeks. From Figure 1, it can be inferred that there is such a big gap between planned value (PV) within the actual performance (earn value). The value of EV is under PV, it means the implementation of the project did not reach the target since week 3. Earn value at 5th week shows a constant value because of no-work performed. The main reason why the project delay is non-conformance deliverables that already produced and required to be repaired or reworked as soon as possible. This is non value added activity that will lead to schedule overrun.

This problem was found during the project monitoring & controlling phase especially in acceptance test. Acceptance test is carried out for

checking the deliverables are met with standard specifications. Form the test, it also showed that some installed-project components, executed by project owner is not matched with several item test. Vendor is required to repair many parts that do not pass the test. Thus, the re-work activity caused vendor's performance is extremely poor. The schedule expands up to 3 years left behind the original schedule.

Form the fact, vendor did not follow some quality standards that project owner has requested, but vendor itself does not have a guidance on the quality standard specification. There are also no quality control resources to control and monitor the project.

Based on these problems, this researched aims to create quality standard specification that can be used to both parties in carry out the project. The quality standards help the vendor and project owner to check whether the deliverables are met with the desired specification. Quality metric is one of the example quality standard in the project. it is useful to help both parties during monitoring and controlling phase.

Quality metric can be used to anticipate the work gap performance between planning and the actual one. To create the quality metric, an internal control method is applied to this research which tell about several possible errors in each project activity. Developing quality metric helps new workers to avoid the mistakes.

II. LITERATURE REVIEW

Quality is the condition when the product or services meet the stakeholder expectation or requirement [3,7]. According to Schröder, Schmitt, and Schmitt's research in 2015, in order to meet the challenge of innovative and technologically demanding products, companies should have quick and flexible capabilities against internal and external threats. One of the possible solution is implementing quality control [2].

Quality control also mentioned in PMBOK as a part of project quality management process. Project quality management involves the process of developing an organization's quality policy on project planning, management, and control as well as product quality requirements to meet stakeholder objectives [6]. There are three process in project quality management including plan quality management, manage quality, and control quality [3].

One of the output of quality management plan is quality metrics. Quality metric is the important input for controlling project quality which most of project managers rarely used. Control quality is the implementation of quality management activities to assess the project deliverable correctness, ensuring complete project output, and checking whether they meet the agreed specifications. The advantage of control quality is to verify project results and work activities meet the requirements agreed upon by key stakeholders in the project for final acceptance [3].

Quality metrics is specifically described as the project or product attributes to meet the accuracy. Some examples of Quality Metrics include the percentage of tasks completed on time, cost performance measured by the CPI, failure rate, number of defects identified per day, total stopping time per month, errors found per line of code, customer satisfaction scores, and percentage requirements covered by the test plan as a test coverage measure [3].

There are many ways to create a quality metric one of the best approach is applying Internal Control Method. Internal control ensures accuracy and reliability at the key points in business processes. It may also reduce the number of possible errors in the process, as well as helping new trainee to carry out the task more easily. Quality metric also show the condition whether the proses are in line with the initial plans. To establish internal control method, a designer must identify all possible error in the activity as well as their preventive action [1]. The description of internal control method can be seen in Table 1.

Activity Number	Activity Description	Possible Issue(s)	Internal Control(s)
Numbering activities that can distinguish each work package, but that does not represent the order/predecessor	Description of each project activity	Identify errors that may arise in each activity	Requirements for each activity

TABLE 1
INTERNAL CONTROL

By having an internal control system company can also manage risk effectively. An effective internal control will provide assurance that the company performs its operations efficiently and in accordance with its mission statement [4]. Performing internal controls can improve the

effectiveness, efficiency, and adaptability of business processes (metrics) [1]. Internal control can be illustrated in a questionnaire form that will assist an auditor to check the correctness of project deliverable more effective than narrative form one [1].

III. METHODOLOGY

There are several research steps to design quality metrics using the internal control methods and best illustrated in Fig. 2

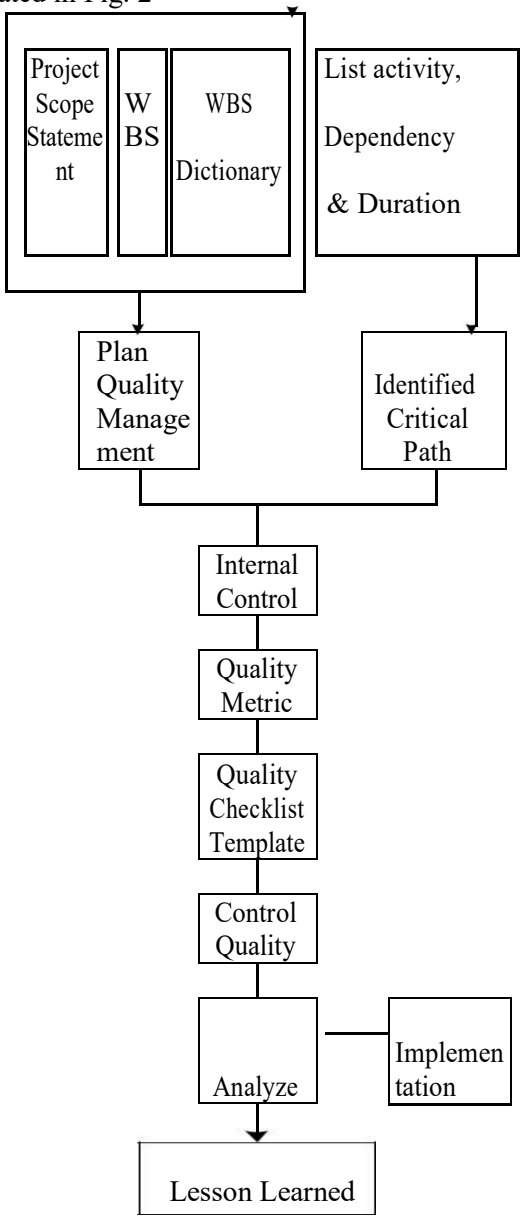

Fig. 2 Research Step

As mentioned earlier, quality metric is a valuable output of plan quality management process. Plan quality management requires project scope statement, WBS (work break down structure) and WBS dictionary. At the same time, critical path is also applied to identify critical activity. This is also important to get deep understanding between the correctness of deliverable and project schedule. If activity attribute in critical activity is jeopardized, then it is logical the project duration delayed.

At this stage, all possible errors are identified and all the preventive action is also elaborated. The critical success criteria in each activity is also developed as a tool for further analysis.

The design of quality metrics is completed by all possible resources attached to a certain activity. The resources include material components, tools / documents, man, method and specification / function of each project.

The development of quality checklist templates is also made as an additional tool in controlling the quality of project. The quality checklist comprises quality item statement that must be checked during monitoring and controlling phase in the project.

After quality metric and quality checklist are generated, all the quality item is being audited during the project. If the item quality items are not implemented during the project, then it will be findings for quality audit. We correlate the quality finding audit to project schedule. After analyzing the results of quality audit, the findings can be used as lessons learned for further research and as a guidance for similar projects in the future.

IV. RESULTS AND DISCUSSION

Critical path consists of activities undertaken on a project that has no waiting time between successor and predecessor activity or called no-float. This critical activity is obtained by using software Microsoft Office Project 2016. The result of critical path identification can be seen in Table 2. There are 9 work packages that belong to non-critical activity and 13 work packages that belong to critical activity.

TABLE 2
ACTIVITIES IN CRITICAL PATH

WBS Number	Task Tittle	Total Float	Critical
1	Preparation	0	Yes
1.1	Survey	0	Yes
1.2	Design Review Meeting (DRM)	0	Yes
1.3	Permission	14	No
1.4	SITAC	15	No
2	Material Delivery	81	No
2.1	Material Delivery Fiber Optic (Feeder)	82	No
2.2	Material Delivery FTTx (ODC)	81	No
3	Installation	0	Yes
3.1	Track Excavation	0	Yes
3.2	Installation Cable and Sub duct	0	Yes
3.2.1	Pulling Sub duct/HDPE	0	Yes
3.2.2	Pulling Fiber Optic Cable	0	Yes
3.3	Installing Outdoor Device	14	No
3.3.1	ODC Foundation	14	No
3.3.2	ODC Device Installation	14	No
3.3.3	ODC labeling	24	No
3.4	Cable Termination	0	Yes
3.5	Commissioning Test	0	Yes
4	Closing	0	Yes
4.1	Test Receipt	0	Yes
4.2	BAST-1	0	Yes

4.1 Quality Metric Design

As seen on Table 3 and 4, the quality metric design comprises WBS number, task tittle, possible error, critical success criteria, and resources which are equipped with tools / doc, man, material, method, and specification / function.

TABLE 3
QUALITY METRIC TEMPLATE

WBS Number	Task Tittle	Possible Error	Critical Succes Criteria
indicates the number of WBS on each project activity	shows the title of each project activity	the possibility of predictable failure that can be avoided by the worker on each project activity	standards / success requirements that must be met for each project activity

TABLE 4

QUALITY METRIC TEMPLATE - RESOURCES

Resources				
Tools/Doc	Man	Material	Method	Spec/Func
equipment used as well as documents attached in any project activity	the required workers and the estimated number of workers to undertake related project activities	materials used in each stage of project activity	specific methods used in related project activities	specifications and / or functions of tools / documents, man, materials, and methods in each related project activity

4.2 Quality Checklist Template

Quality checklist in the project is a tool that can be used to evaluate the project deliverables. It also ensures that all activities within the project meets the stakeholder expectation. Quality. checklist is also useful to achieve company consistency in standardizing project deliverable during planning, execution, and monitoring & controlling phases

TABLE 5
QUALITY CHECKLIST TEMPLATE

Quality Checklist						
			PIC:			
Project:						
			Date :			
			Verification			
No	Quality Item	OK	NOK	N/A	Note	Evidence

In the quality checklist template there are some information that needs to be filled by auditor in accordance with the project facts items as follows:

1. PIC (Person in Charge shows the person responsible for filling the quality checklist template and performing the quality control process
2. Date: shows the date of quality control
3. OK: information that shows quality item has been implemented during the project
4. NOK: information that shows quality item has not been implemented during the project
5. N/A: neither of quality item has been implemented or not
6. Note: an important note used as a reference for improvement

Evidence: facts that support OK, NOK, or N/A every quality item statements.

During control quality audit, the auditor met the project manager and quality project manager to check whether all deliverables meets the quality items. Every quality item has their own weight to be calculated. 1 indicates that the statement has been implemented and supported by relevant evidence while 0 shows the statement has not been implemented and not yet supported by relevant evidence. After the audit is finish, the statement is summed up. The bigger score indicates the better condition of the project deliverables.

From Table 6 to 7, there are 65 item in quality metric and 73 items in quality checklist item. Form quality metric table, only 36 items out of 65 items are implemented and supported by relevant documents. In other hand, only 49 items out of 65 items are implemented in quality checklist and supported by relevant documents. Those items in quality metric and quality checklist are lied on critical activates in the project. Thus, it was found that not 100% statement about the quality is implemented in Garut STO Modernization Feedback project which can be one of the reason why the project is delay. This finding also support the rework activities and project extension since the project deliverable almost didn't reach the fully project quality.

TABLE 6
IMPLEMENTATION RESULT OF CRITICAL SUCCES CRITERIA

Value	Number of Statements	Percentage
0	29	44,6%
1	36	55,4%
Total	65	100%

TABLE 7
IMPLEMENTATION RESULT OF QUALITY ITEM

Value	Number of Statements	Percentage
0	24	32,9%
1	49	67,1%
Total	73	100%

V. CONCLUSION

Control quality is one of the process of ensuring project output meet the agreed specification supported by right evidence and right measurement criteria. This activity aims to support quality control process. Using internal control method can ease the development of quality metric and quality checklist design. We also suggest to investigate the quality audit finding toward the critical activity generated by critical path method to give more comprehensive result the project performance. The design of quality metric and quality checklist templates is expected to help project owner and project executor to plan project quality in the project planning phase as well as to ensure quality in the monitoring and controlling phase of the project. For further researched we suggest all the quality metric of this project can be formally used as the project requirement for similar project and equipped with real time information system.

REFERENCES

[1] S. Page, Business Process Improvement. New York: AMACOM, 2010.

[2] M. Schröder, S. Schmitt, and R. Schmitt, "Design and implementation of quality control loops," TQM J., vol. 27, no. 3, pp. 294–302, 2015.

[3] Project Management Institute, A Guide To The Project Management Body Of Knowledge, 6th ed. Pennsylvania: Project Management Institute, 2017.

[4] Länsiluoto, A. Jokipii, and T. Eklund, "Internal control effectiveness – a clustering approach," Manag. Audit. J., vol. 31, no. 1, pp. 5–34, 2016.

[5] J. Lloyd Bierstaker and J. C. Thibodeau, "The effect of format and experience on internal control evaluation," Manag. Audit. J., vol. 21, no. 9, pp. 877–891, 2006.

[6] Pratami, D., Puspitasari, N., & Haryono, I. (2017). Designing Project Stakeholder Management Plan at Coffee Plant Construction Project for Successful Initiating Phase in Ciwidey. International Journal Of Innovation In Enterprise System, 1(01), 19-28. doi:10.25124/ijies.v1i01.28

[7] Putri, N., & Elsera, A. (2017). Designing Quality Management Systems For Thresher Production Using ISO 9001-2015. International Journal Of Innovation In Enterprise System, 1(02), 26-33. doi:10.25124/ijies.v1i02.3