

# Implementation of Maintenance Management in Educational Institutions in Indonesia

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## Abstract

The purpose of the paper is to present the implementation of maintenance management in educational institutions in Indonesia. It is important for every school to have an effective facilities maintenance management plan. Therefore, we analyze how facilities maintenance is planned and managed by educational institutions (primary, secondary, and vocational schools) in Indonesia. The survey questionnaires were sent to 37 schools through google form. The result shows that within some maintenance success indicators such as maintenance planning and policy; data collection and management; facility condition; human resource management; maintenance funding and cost; continuous improvement, most of the schools (97,3%) are already implementing maintenance programs. However, some of the schools (46%) never conduct training to improve the skills and competencies of human resources related to maintenance.

## Keywords

Maintenance Management, Facility, Infrastructure, Schools, and Maintenance Planning.

## 1. Introduction

Indonesia has many educational institutions throughout its territory, both public and private schools. In achieving successful educational goals, educational institutions, in this case primary and secondary schools, need to have supporting facilities and infrastructure. This is in accordance with the mandate of law number 20 of 2003 concerning the national education system, in which article 45 act 1 states that each formal and non-formal education unit provides facilities and infrastructure that meet educational needs in accordance with the growth and development of physical potential, intellectual intelligence, social, emotional, and psychological students.

Since facilities and infrastructures are the national standard for education in Indonesia, they need to be managed properly and the existence of these facilities and infrastructure is also an integral part of education management. Therefore, in order for the facilities and infrastructure to be managed properly, it is necessary to carry out the maintenance of facilities and infrastructure by the school management. However, based on national data from the 2018 Ministry of Education and Culture Performance Overview Report as quoted by [kompasiana.com](http://kompasiana.com), among the elementary school buildings, which number 1 million schools, were damaged around 74% of elementary school classrooms, around 10% of them were heavily damaged. Furthermore, for junior high school classrooms, which amounted to 358,000 schools, 70% were damaged while around 11% of them were heavily damaged. For high school classrooms, there are 160 thousand, 55% are damaged, while about 4% are heavily damaged. Among the

approximately 162,000 SMK buildings, it was noted that 53% were damaged, and about 3% of them were heavily damaged. And for special schools (SLB), among 22,000 schools, 64% of them were damaged and 4% of them were severely damaged.

The amount of damage to school facilities and infrastructure can be anticipated by carrying out maintenance activities, where effective maintenance activities cannot be separated from positive contributions of maintenance planning. Planning will guarantee all necessary assets are accessible in planned time, exact amount and quality, and sensible expense (Nurchahyo et al., 2019). Many studies have conducted research related to the maintenance of school facilities and infrastructure. Facilities maintenance becomes one of object research that researchers focus on (Leung et al., 2005; Szuba & Young, 2003; Xaba, 2012). Facilities maintenance comprises emergency, routine, preventive, predictive, corrective and deferred maintenance(Szuba & Young, 2003).

Based on the above data, we conducted a study of 37 schools, both public and private schools in Indonesia, regarding whether there is a school infrastructure maintenance planning and how the implementation of the maintenance management is carried out by these schools. In this study, we used the maintenance success factor attributes from previous studies, those are maintenance planning and policy (Cholasuke et al., 2004; Lavy & Bilbo, 2009; Xaba, 2012), data collection and management(Lavy & Bilbo, 2009), facility condition (Duyar, 2010; Lavy & Bilbo, 2009), human resource management (Cholasuke et al., 2004; Duyar, 2010), maintenance funding and cost (Asiyai, 2012; Cholasuke et al., 2004; Jin et al., 2016; Xaba, 2012), and continuous improvement (Cholasuke et al., 2004). The mapping of previous researches can be seen as the following table 1.

Table 1. Previous researches about maintenance management

No	Success Factor	R1	R2	R3	R4	R5
1	Maintenance Planning and Policy	v	v	v	v	v
2	Data Collection and Management	v	x	x	x	v
3	Facility Condition	v	v	x	x	x
4	Human Resource Management	x	x	v	v	v
5	Maintenance Funding and Cost	x	v	v	v	v
6	Continuous improvement	x	x	v	v	x

Notes: **R1:**(Lavy & Bilbo, 2009); **R2:** (Xaba, 2012); **R3:** (Cholasuke et al., 2004); **R4:**(Jin et al., 2016); **R5:** (Ahuja & Khamba, 2008)

## 1.1 Objectives

Facilities and infrastructure management in public and private schools is mandatory as mandated by law number 20 of 2003, but in reality there are still many schools that have poor facilities and infrastructure that are not managed properly. Therefore, this study aims to:

- Identify school facilities maintenance planning (long-term and short-term)
- Identify facility conditions assessment
- Identify the existence of facility and infrastructure maintenance budget
- Identify the intensity of training for mechanical and electrical staff's skill and competencies

- Identify the commitment to conduct maintenance activities continually

## **2. Literature Review**

### **2.1 Maintenance Management and Planning**

Maintenance definition based on Akasah (2009), states that maintenance is related work that is undertaken in order to keep or restore all facilities, for example are every part of a site; building and contents to an acceptable standard (Mohammad Ropi & Tabassi, 2014). Another statement from Ahmad & Kamaruddin (2012), Maintenance is defined as a set of activities or tasks used to restore an item to a state in which it can perform its designated functions (Fatoni & Nurcahyo, 2018).

Effective maintenance activities cannot be separated from positive contributions of maintenance planning. Planning will guarantee all necessary assets are accessible in planned time, exact amount and quality, and sensible expense. Moreover, maintenance planning also contributes to health, safety and environment (Nurcahyo et al., 2019).

### **2.2 Building and Facilities Maintenance**

Building performance, based on some researchers, is focused on examining the quality of the environmental performance of the building and its services, and assessing the quality of the building fabric to determine the level to which the building fulfills the requirements of its users. There are several benefits that building performance provides based on (Douglas, 1996), including reviewing the property condition for the purposes of acquisition, or disposal; identification of the building services that lack in performance; and prioritizing maintenance, or remodeling activities. (Hassanain & Iftikhar, 2015).

Some researchers also pointed out that building and facility maintenance in educational institution, like (Szuba & Young, 2003) who stated that maintenance is concerned with ensuring safe conditions for facility users, be they learners, educators, staff, parents or guests, and is also concerned with creating a physical setting that is appropriate and adequate for learning. Leung et al. (2005) state in this regard that facilities maintenance relates to resource integration with the emphasis on the provision of an enabling working environment. To this end, espouse facilities maintenance as aiming to provide end-users with a comfortable, effective and quality environment with minimum resources to enhance organizational effectiveness. Facilities maintenance comprises emergency, routine, preventive, predictive, corrective and deferred maintenance (Xaba, 2012).

### **2.3 Maintenance Success Factor**

Many authors have provided some factor for facilities maintenance to be carried out effectively, some of the important success factor that is used in this paper are:

#### **1. Maintenance Planning and Policy**

A well-conceived, formulated and written school facilities maintenance plan is an essential component of an effective school program. This also reflects a school's degree of systematic maintenance planning. In addition, facilities maintenance planning should be one component of a greater organizational management plan (Lavy & Bilbo, 2009). There's also another aspect to support maintenance planning and policy making, like maintenance organization which relates to creating an organizational structure for facilities maintenance, which should clearly define duties and responsibilities, and should vary with the complexity of the school community (Xaba, 2012). Other factors are the availability of written policy or short/long term policy planning.

Maintenance plans and schedules help in scheduling maintenance work and allocating the resource for each work and the maintenance performance is highly impact from lack of linkage between maintenance policy and the overall corporate strategy of manufacturing organization (Cholasuke et al., 2004).

## 2. Data Collection and Management

Proper data collection and management can significantly enhance the effectiveness of a maintenance organization. Deciding how to systematically store and manage the data during inspection is also important in the planning stage. Failure to do this may make it difficult for the staff to use the inspection information and thus, they will derive little value from it (Lavy & Bilbo, 2009). The key aspects are Inventory Data; Historical Data and current needs (staff and space requirements); Physical space resource; Fixed assets inventory (furniture and equipment); Cost and schedule information

## 3. Facility Condition

Some of previous researchers indicated that school's facility conditions might affect student performance more readily than many social and economic variables. Even though the methodological rigor of the studies differed significantly, the majority of correlation studies showed a strong, positive relationship between overall building conditions and student achievement (Duyar, 2010). The data collected by a Facility Condition Assessment (FCA) should be used for short- and long-range planning, routine operation and maintenance, establishing benchmarks for measuring equipment and component's service life, and preventive maintenance. When the organization knows the condition of their facility, the need for maintenance or repair becomes much clearer (Lavy & Bilbo, 2009). Some of the aspects are: condition assessment and survey inspection; how to record the maintenance activities (recorded using standard checklists and forms or recorded by writing assessment on blank papers)

## 4. Human Resource Management

The human factor has long been the primary focus of educational research (Duyar, 2010). Many authors agreed that effective maintenance of human resource management is one of the factors of a successful maintenance management program. The important factors related to successful maintenance resource planning include: skill and training, job motivation and sufficient maintenance human resources (Cholasuke et al., 2004). Other aspects are job understanding and perception and the balance of staff and workload.

## 5. Maintenance Funding and Cost

Maintenance Funding was found to be the basis of facilities maintenance challenges at most schools. Although the Department of Education allocates money to schools, participants indicated that it was not enough (Xaba, 2012). The financial control of maintenance includes the control over the maintenance budget, contractor cost monitoring and, overall labour and material cost control. Factors that include in this aspect are maintenance spend; the variation between maintenance budget and actual spend; and costs of lost production (Cholasuke et al., 2004). Beside the funding, the proper maintenance strategy can optimize the cost. Significant cost saving due to failure reduction and life extension (Jin et al., 2016). Educational planners and policymakers should ensure that enough provision is made in the budget for facilities maintenance and management, including costs of technology (Asiyai, 2012).

## 6. Continuous Improvement

The factors that lead to the continuous improvement of maintenance are the effective use of performance measurement, management commitment and the adoption of proactive maintenance. Factors that consider part of continuous improvement are performance measurement used and TPM and RCM employment if there's any (Cholasuke et al., 2004).

## 3. Methods

In this research, we use a qualitative approach with questionnaires as a data collection technique to obtain the data. The questionnaire consists of 20 questions in regards to some variables such as maintenance planning and policy, data

collection and management, facility condition, human resource management, maintenance funding and cost, and continuous improvement. We distributed the questionnaire to some schools in several cities through google form. Prior to the research, we did a literature review to identify what variables are needed to formulate the questions in the questionnaire. Figure 1 shows the methodology of this study.

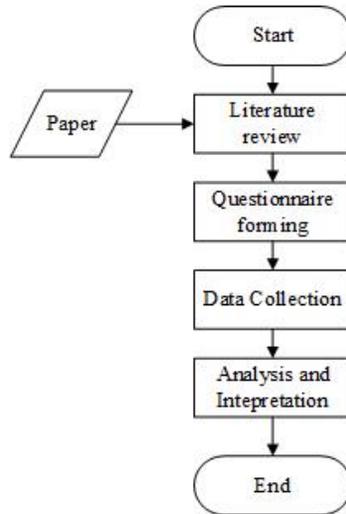


Figure 1. Research methodology

#### 4. Data Collection

Data collection activity yielded 37 respondents who are professionals in various educational institutions such as elementary school, high school, and vocational school covering both public and private schools. The respondents also come from different regions, ranging from Jakarta, Bekasi, Bogor, Tangerang, Bandung, and other cities. Table 2 presents demographic data on the respondent responses used in the analysis.

Table 2. Sample demographics

Category	Frequency
Educational level	
Elementary school	12
Junior high school	14
Senior high school	9
Vocational high school	2
City	
Jakarta	13
Bekasi	6
Tangerang	3
Depok	1
Bogor	1
Cimahi	1
Karawang	1
Bandung	11
Public school	20
Private school	17

## 5. Results and Discussion

According to (Lavy & Bilbo, 2009) a well formulated and written school facilities maintenance plan is an essential to develop an effective school program. Facilities maintenance planning should be one of the components that include in school management plans. The analysis data collected revealed a number of important factors regarding facilities maintenance management at educational institutions in Indonesia. As seen in Figure 2 mostly the educational institutions in Indonesia (97.3%) are aware to have a written plan to improve the facility management. Furthermore, 86.5% of the school acknowledge the importance of facilities maintenance planning as a part of their overall organizational plan.

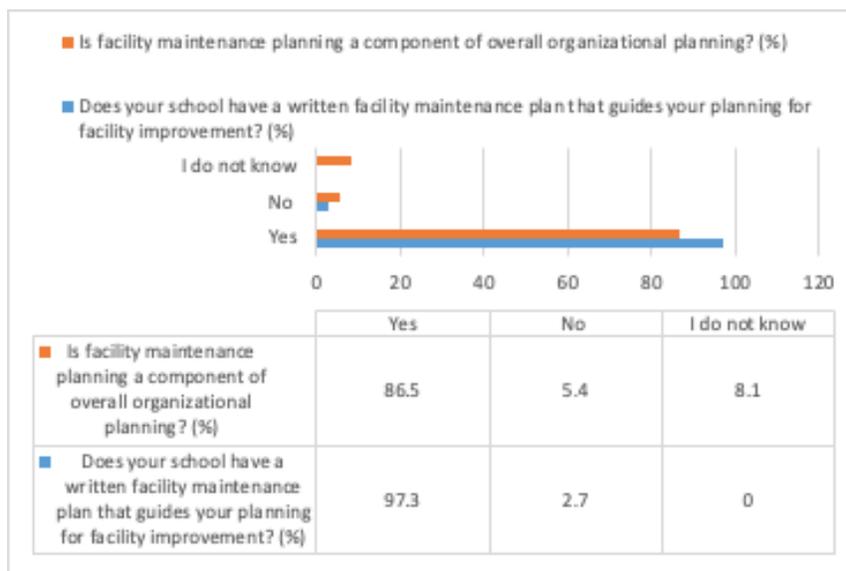


Figure 2. Participant's responses to questions about facilities maintenance planning

It is also essential to include school administrators, facilities/maintenance/custodial representatives, teachers, parents, students, and the school committee in the maintenance planning process (Lavy & Bilbo, 2009). Figure 3 shows that mostly school administrators and facilities/maintenance/custodial representatives are involved with long-range planning and short-range planning. Parents are very seldom included in the process of both long-range and short-range planning.

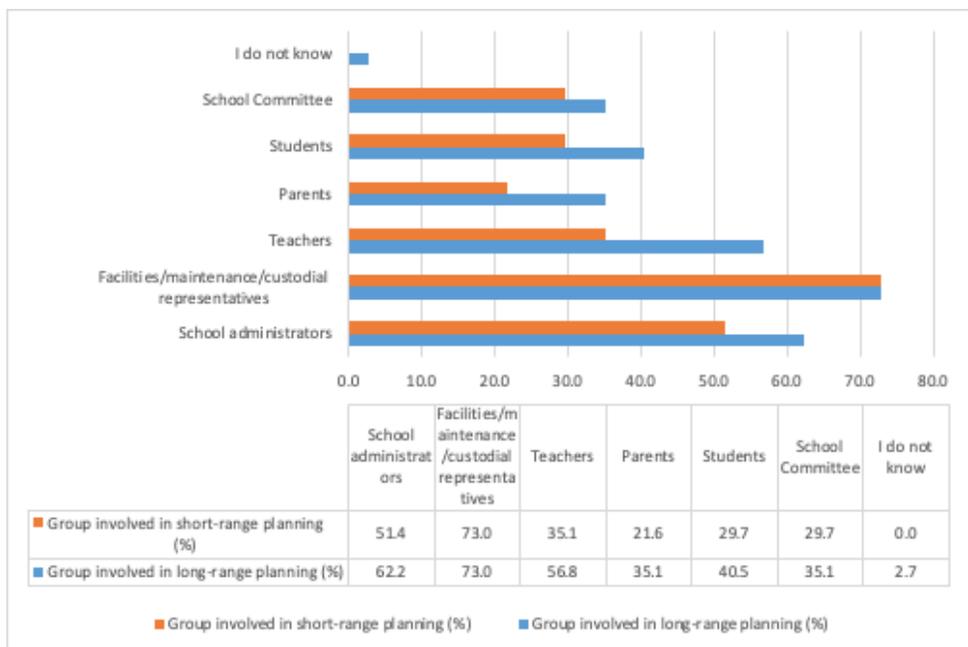


Figure 3. Groups involved in short and long-range planning

As seen from table 3, the long-range planning for most of the school typically spans between 2 years (27.8%) and 5 years (55.5%). The long-term planning needs to be updated periodically to adjust its condition and changing state. Mostly, about 48.7% of the schools updated the long-range plan every year while there are 2.7% of the schools that do not update their long-range plans. For short-term planning Lavy & Bilbo (2009) indicates that a plan should be updated on a quarterly basis for routine operation and maintenance, manpower distribution, etc. This is practiced by 35.1% of the school whereas for 64.9% of the schools, short-range planning spans between six months until 2 years.

Table 3. Span of facilities maintenance plans and updated

Response	Span of long-range plan (%)	How often is the long-range plan updated? (%)	Span of short-range plan (%)
1 month	-	-	21.6
3 months	-	-	13.5
6 months	-	21.6	18.9
1 year	-	48.7	40.6
2 years	27.8	16.2	5.4
3 years	8.3	10.8	-
5 years	55.5	-	-
7 years	5.6	-	-
Never	2.8	2.7	-

Lavy & Bilbo (2009) suggest that the data of facility condition assessments should be used for short and long-range planning, routine operation and maintenance, establishing benchmarks for measuring equipment and component's service life, and preventive maintenance. From figure 4 we can see that 64.8% of the schools typically assess the facility condition by visual inspection and use of building assessment and inspection software then 78.4% of the schools use the data or information for routine operations & maintenance and 70.3% for short term facility planning (from figure 5).

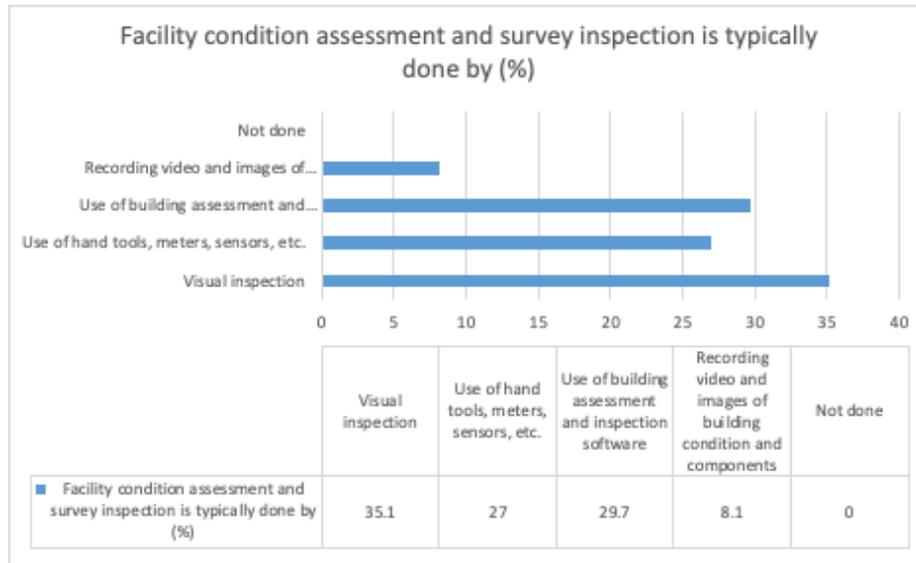


Figure 4. Inspection for facility condition assessment

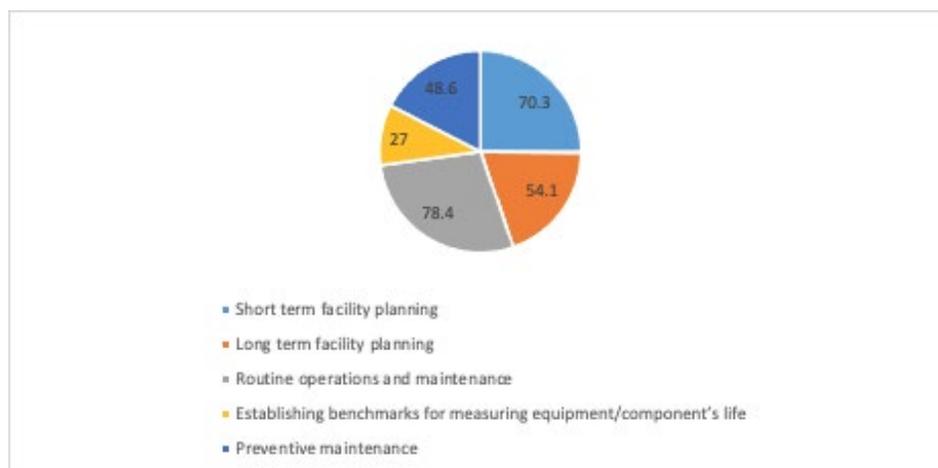


Figure 5. Uses of facility condition assessment

Recording and storing the data of facility conditions is important since this information will help policymakers make decisions about school building which will provide a better environment for students to learn. Hence, incomplete or inaccurate information will only discourage effective decision making for facilities planning and improvement. To record the data accurately, it's important to use standard checklists and forms. The information and data should be stored systematically and managed in a computer database that is strong and flexible enough for data import, export, and updates (Lavy & Bilbo, 2009). 78.4% of the school record data using standard checklists and forms and 21.6% of the schools still record by writing assessment on the blank papers. Recording the assessment on the blank papers is not the best way since the data can be inaccurate as it is not directed by standard checklists. Furthermore, 70.3% of the schools store the data in computers but there are still 21.6% of the schools that store the data in paper file which is not the best practice because it is not organized, then retrieving particular information in a timely manner becomes almost impossible.

As mentioned earlier, it is very important to have complete information on a building's condition and its component to maintain the maintenance planning. The database should contain information about physical space resources, historical data, current and projected needs, staff, equipment and space requirements, fixed assets inventory (furniture inventory), and cost and schedule information (Lavy & Bilbo, 2009). The survey found that most of the schools have

detailed information on Historical data and current needs (staff, equipment and space requirements) (54.10%), Fixed assets inventory (furniture and equipment) (51.4%), Physical space resources (space/occupancy inventory) (48.6%), projected needs (29.7%). Nevertheless, what many schools lack of information in their database is cost and schedule information (16.2%). The last but not least regarding data collection and management is we want to know how much inventory data on the school facility's condition, and its components, they think they have available. 40.5% of the schools have inventory databases of 76% - 90% and only 10.8% of the schools have an inventory database of 91% or more.

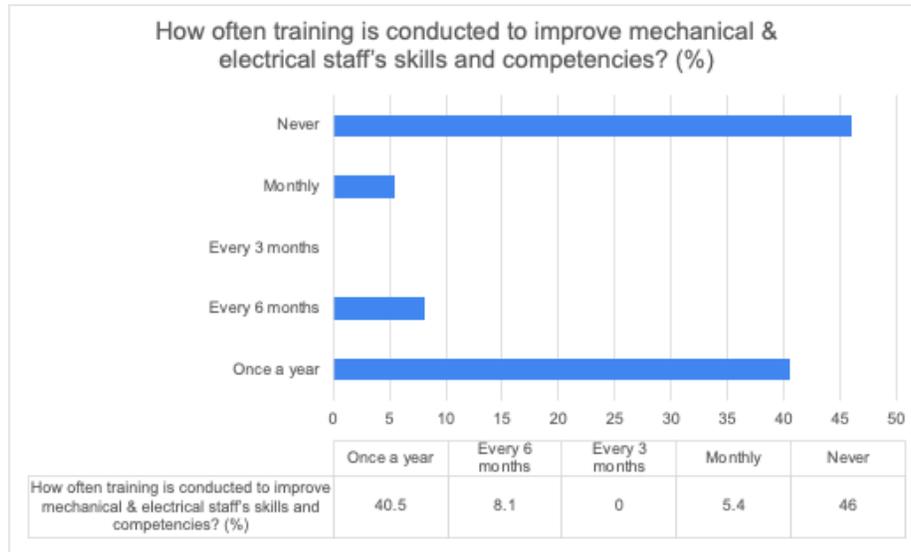


Figure 6. How often the training is conducted

According to Cholasuke et al. (2004), one of the factors of a successful maintenance management is effective maintenance of human resource management. The important factors related to successful maintenance resource planning include: skill and training, job motivation and sufficient maintenance human resources. Based on the survey that shows in the figure 6, it is sadly that 46% of the schools never conduct a training and 40.5% of the schools conduct a training once in a year. Then, mostly the schools have specific divisions to do the maintenance planning activities (83.8%) as shown in table 4.

The basis facilities maintenance challenges are maintenance funding (Xaba, 2012). It is very important for school to have a yearly budget for maintenance and mostly 94.6% of the schools in Indonesia have yearly budget for maintenance and 40.6% of them realize that there is any significant cost saving while they are implementing the maintenance management planning due to failure reduction for the past year and 29.7% of them not sure if there is any significant cost saving.

Table 4. Response from school regarding human capital management, maintenance budgeting, and continuous improvement

Response	Is there any specific division to do the maintenance planning activities? (%)	Does the school have a yearly budget for maintenance? (%)	Any significant cost saving due to failure reduction in the past year? (%)	Is there any commitment to continuously conducting maintenance activity at school? (%)	Is there an evaluation for maintenance activity/planning periodically? (%)
Yes	83.8	94.6	40.6	100	91.7

No	16.2	5.4	29.7	0	5.5
Maybe	-	-	29.7	-	-
I do not know	-	0	-	-	2.8

Regarding continuous improvement of planning maintenance management, all of the schools have commitment to continuously conducting maintenance activity and 91.7% of the schools always evaluate their maintenance activity or planning periodically as seen in the table 4.

### 5.1 Proposed Improvements

The domicile of the schools only in the java island especially in the Jabodetabek and Bandung which will not represent educational institutions in remote areas. Based on the findings of this study, we suggest exploring the impact of the school type (primary, secondary and vocational) on facilities maintenance and also the impact of the facility condition on the performance of the students.

## 6. Conclusion

Based on this study, most of the schools are already implementing maintenance management program. Mostly school administrators and facilities/maintenance/custodial representatives are involved with long-range planning and short-range planning. About half of the schools surveyed updated the long-range plan every year and only few that do not update their long-range plans. Most of the schools have short-range plan that spans between six months to two years.

In the aspect of how the schools assess the infrastructure condition, there are three mainstream methods that schools use almost equally. Visual inspection, which is the easiest and the most conventional of the three are slightly above the others with 35% of respondents. A more modern approaches which utilize technology are by using hand tools/sensors and maintenance software are probably done by a more modern school.

In terms of budget for infrastructure maintenance, almost all schools already have budgeted their maintenance activities and all schools are committed to continue conducting maintenance activity for their facilities and infrastructures. However, it seems that the financial benefit of continuous maintenance in reduce cost is still unclear or difficult to measure by schools. It is indicated by the fact that only 40.6% of respondents who stated that the continuous maintenance results in cost savings. We can also deduct that the budget is not allocated to improve competencies of the technicians. Looking at the data about the training intensity for technical staffs, almost all of the schools only conduct maintenance training once a year or even not done at all.

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