A Survey of Maintenance Management Systems in Indonesian Convenience Stores

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Abstract

The importance of facility maintenance management in the retail sector industry has increased rapidly. This research is useful to expand global competition by trying to increase productivity, maximize equipment in total effectiveness and streamline effective and efficient maintenance. by One of the market leaders in the industry retail sector in Indonesia is Alfamart. PT. Sumber Alfaria Trijaya, Tbk has a vision of leading a retail distribution network owned by the wider community, meeting consumer needs, and expectations. To deliver the consumer needs and expectations, PT. Sumber Alfaria Trijaya, Tbk do repairs and maintenance that taken to the profit or loss when the fault is incurred. The purpose of this paper is to analyze maintenance systems at several branches of PT. Sumber Alfaria Trijaya, Tbk and to provide an insight of activities maintenance practice in the retail store. In this paper, the first part is based on the literature, it reviews the characteristics of preventive maintenance. The second part results from a survey about preventive maintenance in the retail sector industry. The questionnaire included a final list of 6 characteristics of preventive maintenance. Store managers were requested to rate the characteristics. The store manager as a respondent on the criteria of preventive maintenance was measured based on their response to a five-point Likert scale. The mean ratings for all the characteristics are 4 or higher (out of 5). The highest mean rating of 4.44 for Preventive Maintenance Planning & Scheduling. The lowest mean rating of 4.02 is Preventive Maintenance Performance. Based on the correlation test using Minitab Software, showing that the correlation is statistically significant.

Keywords
Survey maintenance, maintenance management, convenience stores, retail industry sector

1. Introduction
Supermarket owners must understand the importance of regular maintenance over the life of the equipment. They should allow maintenance staff sufficient time and freedom of access to inspect systems and to provide planned preventive maintenance and repairs if necessary. End users have a key role in the operational efficiency of their cooling systems. Providing opportunities for training employees to expand their skills and knowledge can be important in ensuring that equipment is operated properly and that problems are identified at an early stage (Ciconkov, Samoil, 2016). Recent research on supermarket repair or maintenance systems has mostly focused on refrigeration, compressor rack and fluid line leaks, fan motors, and floating head pressure control. Koronaki et al.

(2012) reviewed the status of refrigerant leaks in refrigeration systems in several Europe and a survey of 81 refrigerant systems that pointed to several crucial factors contributing to refrigerant leakage problems, including poor service and maintenance and lack of technician skills. Francis et al. (2017) used 1464 leak maintenance records in the UK (United Kingdom) to analyze the causes and locations of leaks in stores and found that the most common causes of refrigerant leaks were pipe or joint failures and seal/glands/core leaks in compressor racks and fluid lines. Information on the use of advanced supermarket technologies, such as variable capacity compressors, high efficiency fan motors, floating head pressure control, and demand defrosting was collected in Klemick et al. (2015) from representatives of 44 supermarket companies in the United States.

The total number of supermarkets in Indonesia during 2017 was around 43,826 units. Due to the number of stores, the minimarket industry is extremely competitive. There are big players who are market leaders such as Alfamart and Indomaret. Alfamart are one of PT Sumber Alfaria Trijaya, Tbk minimarket outlets brand that engaged in the retail industry, especially for fast-moving consumer goods. (FMCG) through minimarket format. The products sold are basic household necessities household items, including rice, cooking oil, granulated sugar, milk, food/beverages, candy, and cigarettes. To keep the quality of the products, PT Sumber Alfaria Trijaya, Tbk have some facilities that point to several important maintenance factors that contribute to the quality of the products. Repairs and maintenance are taken to the profit or loss when these are incurred. The cost of major renovation and restoration is included in the carrying amount of the related fixed asset when it is probable that future economic benefits more than the originally assessed standard of performance of the existing asset will flow to the Group and is depreciated over the remaining useful life of the related asset (Alfamart 2017).

In 2018, Indonesia is proven to be a good market for mobile payment and estimated to continue to grow in 2020. This will make competition between mobile payment tougher in Indonesia. Mobile payment companies need to maintain the quality of services and applications to meet customer satisfaction (Dewi et al 2020). Grid-type online questionnaire and multiple-choice questions developed and distributed to professionals in the supermarket industry, including department store engineers, supermarket technicians, refrigeration trainers, and facility managers. The questionnaire includes questions about the type of heating, ventilation, air conditioning (HVAC) and refrigeration system, general malfunctions, and the most expensive repair to the system (Behfar, Alireza 2018). Although the types of fixed assets have been identified, it is also necessary to know the maintenance activities that have been carried out by PT Sumber Alfaria Trijaya, Tbk.

1.1 Objectives

PT. Sumber Alfaria Trijaya, Tbk has a vision in running a business by becoming a leading retail distribution network owned by the wider community, oriented to empowering small entrepreneurs, meeting consumer needs and expectations, and being able to compete globally. To deliver the consumer needs and expectations, and compete globally, PT. Sumber Alfaria Trijaya, Tbk do repairs and maintenance that is taken to the profit or loss when the fault is incurred. This research aims to analyze maintenance systems at several branches of PT. Sumber Alfaria Trijaya, Tbk and to provide an insight of activities maintenance practice in the retail store.

2. Literature Review

2.1 Maintenance

According to Al-Turki et al. (2014), maintenance can be described as the set of activities, technical, administrative, and managerial, carried out during the life cycle of an item, workplace, work equipment, or means of transport, to conserve the value of an asset. Companies and governments invested most of their budget to conduct maintenance activities for reliable, safe, and cost-effective operations and services. An example of a sector that necessary to do the maintenance is the aviation sector, hence the aircraft can be completely used when required by airlines with an estimated cost that is affordable and reasonable but still in excellent quality (Anham et al. 2019).

Maintenance activities are multidisciplinary with a substantial number of inputs and outputs; hence the performance of maintenance productivity requires to be measured and contemplated aggregately with an integrated approach. Along with a rising consciousness of maintenance produces added value to the business process, organizations are managing maintenance as an essential part of their business (Ben-Daya et al. 2009).

Usually, maintenance involves large amount of workforce, spare parts, tools, and equipment, and financial resources. Planning for these resources to be available at the correct time in the right quantity with the lowest cost while maintaining a safe, healthy, and clean environment is a challenging job. This required a prominent level of interrelation among multiple stakeholders internal and external to the organization. Several maintenances plans were developed over time, like preventive maintenance, condition-based maintenance, reliability-based maintenance, and so on. These plans bring a substantial amount of success in banishing unexpected failures and unplanned unavailability's which usually cause excessive costs of operations and restoration (Al-Turki et al. 2014).

2.2 Preventive Maintenance

Preventive maintenance (PM) is a schedule of planned maintenance activity focused on the prevention of breakdowns and failures. PM carries out tasks to prevent failure, to identify the onset of failure, and to find invisible failures. It involves activities such as cleaning, lubricating, adjustment, and replacement of minor parts. PM should be planned and carried out in a highly delicate manner to keep away from damage of the equipment or nearby equipment during inspection, repair, adjustment or installing and reinstalling of parts Al-Turki et al. (2014). Preventive maintenance is a crucial role factor to enhance the system performance in multi-state declining systems. Preventive maintenance activities could also be used to lower the warranty servicing costs. The main goal of PM is to prevent the failure of equipment before it happens. It is planned to maintain and increase equipment reliability by restoring worn components before they break down (Tsang, 1995).

Effective PM planning is crucial for cost-cutting in manufacturing environments. Apart from the objective of sustaining production without interruptions, the planned PM strategies are also anticipated to bring lower equipment failures and increased equipment lifetimes. PM strategies are normally highly labor-intensive in nature and the work has a need of high skills, generating high labor costs. Moreover, the opportunity cost of production losses during the PM activities, and the direct costs and the overhead of the PM activity should be examined when considering PM costs. A further consideration stems as the operating costs of any system can slowly expand among the two activities, because of worn and degeneration of the components. All these cost components need to be considered in the analysis when formulating PM plans Eliiyi and Gürler, (2010). The frequency of PM is determined by the type of equipment, age, condition, and the consequences of failure (Al-Turki et al. 2014).

2.3 Summary of Maintenance Characteristics Formulated from Literature

Many researchers have mentioned that the key measures used should be the characteristic that relate to the successful implementation of a maintenance. Table 1 shows a Summary of Maintenance Characteristics Formulated from Literature.

Table 1. Maintenance characteristics formulated from literature

Characteristics	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
Preventive Maintenance Approach	v	v	v	v	v	v	v	v	v	v	v	v	v	v
Preventive Maintenance Planning & Scheduling	v	v	v	v	v	x	x	x	v	x	v	v	v	v
Preventive Maintenance Performance	v	v	v	v	x	x	v	v	v	v	v	v	v	v
Preventive Maintenance Policy	v	x	v	v	v	v	v	v	v	v	v	x	x	x
Preventive Maintenance Social, Financial, Environmental Impact	v	v	x	x	x	x	x	x	v	x	x	v	x	x

Preventive Maintenance Information Management	v	v	v	x	x	x	x	x	v	x	v	x	x	x

According to Wu et al. (2010), Preventive Maintenance Approach is a maintenance program with activities initiated at predetermined intervals, or according to prescribed criteria, and intended to reduce the probability of failure, or the degradation of the functioning of an item, includes monitoring and inspection.

According to Wu et al. (2010) Preventive Maintenance Planning and Schedulling help in scheduling maintenance work and allocating the resources for each work. The lack of planning and scheduling can significantly restrict a maintenance operation from meeting its objective of servicing the organization's needs. (Cholasuke et al. 2004).

Preventive Maintenance Performance is mportant indicators in defining PM performance are availability and cost. Wang et al. (2020) Steady-state availability is one of the most important performance measures for repairable systems. In addition, Maintenance activity can improve the reliability, availability, and performance of companies. When one of the system components does not operate optimally, it will affect the final quality. (Rahayu et al. 2019).

Preventive Maintenance Policies that implemented are in accordance with the PM model considering the actual operating conditions. Hu et al (2017) present a PM policy for a single machine working under a piecewise-constant OC with short-term production plans. The accelerated failure time model (AFTM) has been widely used to model the failure time of machine operating under different OC.

According to Cholasuke et al (2004), Preventive Maintenance Social, Financial, Environmental Impact means considering the financial, social, environmental impacts and budget allocations of the current PM model, and the main objective of maintenance is to achieve the agreed plant performance at the minimum maintenance cost.

According to Cholasuke et al. (2004) Preventive Maintenance Information Management is the information to provide the report and feedback to the appropriate maintenance management systems. Maintenance of the key performance measurements is also a necessary component of the information management system that provides the link between the status of maintenance function in relation to the maintenance objectives

3. Methods

An empirical quantitative study has been performed and data is collected by questionnaires. Fourteen questions were developed based on characteristics of preventive maintenance in literature. The research was conducted at Indonesian convenience store, PT. Sumber Alfaria Trijaya, Tbk. Most questionnaire responders are store managers. Store managers were requested to rate these characteristics. The questionnaire included a final list of six characteristics of preventive maintenance. Six characteristics of preventive maintenance were determined:

1. Preventive Maintenance Approach
2. Preventive Maintenance Planning & Scheduling
3. Preventive Maintenance Performance
4. Preventive Maintenance Policy
5. Preventive Maintenance Social, Financial, Environmental Impact
6. Preventive Maintenance Information Management

The perceptions of the store manager as respondent on the criteria of preventive maintenance were measured based on their response to a five-point Likert scale. Likert scale was used to transform some qualitative responses into quantitative data analysis (Ugwu et al. 2018). The five points were scaled as: 1= Very Disagree, 2=Disagree, 3= Neutral, 4=Agree, 5=Strongly Agree. Thereafter, basic descriptive statistics such as mean, and correlation analysis were used in the data analysis. Figure 1 below shows branch companies participating in the survey

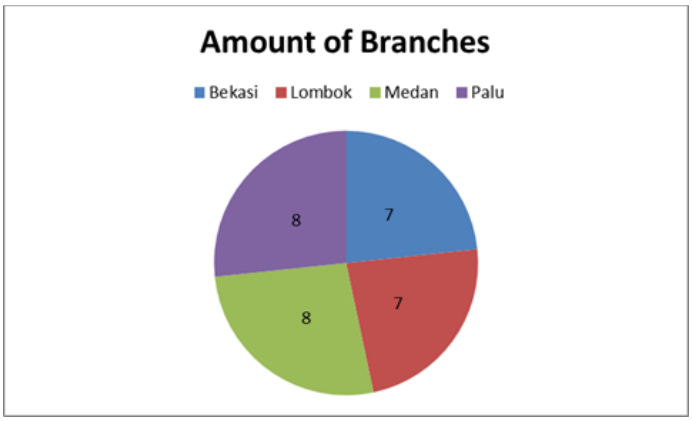

Figure 1. Branch companies

In this research, 30 questionnaires were distributed among store managers of PT. Sumber Alfaria Trijaya, Tbk. and 30 questionnaires were returned for analysis. This represents a response rate of 100%.

4. Data Collection

As many 30 respondents were involved to assess the preventive maintenance in PT. Sumber Alfaria Trijaya. preventive maintenance was measured based on their response to a five-point Likert scale. The assessment was obtained to find out the opinions and perceptions of employees on preventive maintenance in PT. Sumber Alfaria Trijaya. Table 2 shows Likert-scale of respondent's questionnaire assessment and table 3 shows list of questionnaires.

Table 2. Respondents' questionnaire assessment

Respondent	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14
R1	5	5	5	5	5	5	5	5	5	5	5	5	5	5
R2	4	5	5	5	5	5	5	5	5	5	5	4	4	4
R3	4	5	4	4	4	4	4	4	4	4	4	4	4	4
R4	4	5	4	4	4	4	4	4	4	4	4	4	4	4
R5	3	4	3	4	4	3	3	4	3	4	4	3	4	4
R6	3	3	5	4	4	4	4	4	4	4	4	3	4	4
R7	5	4	5	3	4	4	2	3	3	4	4	1	3	4
R8	3	3	5	5	4	4	3	4	4	4	5	4	4	4
R9	4	5	5	4	5	5	4	5	5	5	5	4	5	5
R10	3	4	4	4	4	5	3	4	4	4	4	4	4	4
R11	4	4	4	4	4	4	4	4	4	4	4	3	4	4
R12	4	3	5	5	5	4	3	3	4	3	4	4	4	4
R13	4	4	5	5	4	5	4	4	4	5	5	3	5	4
R14	3	4	4	5	4	4	4	3	4	4	5	4	4	3
R15	4	4	4	4	4	4	4	5	5	5	5	5	4	4
R16	4	4	4	4	4	4	4	4	4	5	4	4	4	4
R17	5	5	5	5	4	3	3	5	4	5	4	5	4	3
R18	5	4	5	5	4	3	3	4	5	5	3	5	2	3
R19	5	4	5	5	5	4	3	5	5	5	5	5	5	3
R20	5	5	5	5	4	4	3	4	4	5	4	4	3	2
R21	5	5	5	5	5	5	5	3	4	5	5	5	4	5
R22	4	4	4	4	4	4	4	4	4	5	4	4	4	4
R23	4	4	4	4	4	4	4	4	4	4	4	4	4	4
R24	5	5	5	5	4	4	4	4	5	4	3	2	4	4
R25	5	5	5	5	5	5	3	5	5	5	4	3	4	4
R26	4	4	4	4	4	4	4	4	4	4	4	4	4	4

R27	5	5	5	5	5	5	5	5	4	5	5	5	5	5
R28	4	4	4	4	4	4	4	4	4	5	4	4	4	5
R29	5	5	5	5	5	4	4	4	4	5	5	5	5	5
R30	4	4	4	4	5	4	4	4	4	5	4	5	5	4

This section aims to illustrate the assesment to find out the opinions and perceptions of employees on preventive maintenance in PT. Sumber Alfaria Trijaya. preventive maintenance was measured based on their response to a five-point Likert scale. Table 2 shows Likert-scale of respondent's questionnaire assessment and table 3 shows list of questionnaires. within table 3, the questionnnaire of characterictics preventive maintenance were classified into four. The employment of good maintenance practice and the benefits gained from maintenance are used as criteria to classify the list questionnaires.

Table 3. Questionnaire of characteristics preventive maintenance

Code	List of Questionnaire
P1	Maintenance of tools/machines is carried out before damage failure
P2	Maintenance of tools/machines is carried out regularly
P3	Maintenance reports are made accurately, on time, and can be accounted for to the parties concerned
P4	Implementation of maintenance activities in accordance with the company's maintenance SOP (Standard Operating Procedure)
P5	The company has a written, accurate, and detailed maintenance schedule
P6	Always available tools/machines during the operational process
P7	There is availability of spare parts for tools/machines
P8	Maintenance costs according to company budget standards
P9	The company has a maintenance policy in accordance with the company's actual operational conditions
P10	The company conducts regular monitoring and control related to safety issues in the work area
P11	Use of chemicals/cleaners in maintenance activities in accordance with SOPs (Standard Operating Procedure) and under the supervision of related parties
P12	There are losses (material and time) due to equipment/machines that cannot operate
P13	The management obtains adequate information regarding the performance of tools/machines and labor in the company's operations
P14	Data storage related to maintenance has been done computerized

5. Results and Discussion

5.1 Numerical Results

Table 4. Characteristics of preventive maintenance

Number	Characteristics	Mean Rating
1	Preventive Maintenance Approach	4.25
2	Preventive Maintenance Planning & Scheduling	4.44
3	Preventive Maintenance Performance	4.02
4	Preventive Maintenance Policy	4.20
5	Preventive Maintenance Social, Financial, Environmental Impact	4.27
6	Preventive Maintenance Information Management	4.05

According to Table 4, the mean ratings for all the characteristics are 4 or higher (out of 5). The highest mean rating of 4.44 for Preventive Maintenance Planning & Scheduling indicates the respondents strongly agree that PT. Sumber Alfaria Trijaya, Tbk has implemented preventive maintenance for a specific period, which included descriptions of tools/machines, maintenance activities, maintenance frequency, and time allocated to carry out preventive maintenance processes. The lowest mean rating of 4.02 is Preventive Maintenance Performance indicates the respondents agree that PT. Sumber Alfaria Trijaya, Tbk ensure the availability of tools/machines during the operational process, availability of spare parts for tools/machines and maintenance costs in accordance with company budget standards.

5.2 Graphical Results

The role of the graphical result is to detect average rating the component statements from the maintenance activities carried out by the branch stores of PT. Sumber Alfaria Trijaya, Tbk. According to the component characteristics average rating in Figure 2, two of fourteen component statements have the lowest average rating is P7 and P12, which represent characteristic of preventive maintenance performance (mean rating is 4.02) and preventive maintenance social, financial, and environmental impact (mean rating is 4.27).

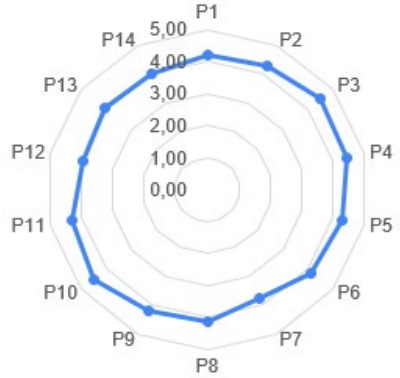

Figure 2. Average rating component characteristics

Maintenance activities with the lowest rating are the availability of spare parts for tools/machines (average rating is 3.77), and there are losses for material and time due to equipment/machines that cannot operate (average rating is 3.97). The average rating shows that the characteristic activities of P7 and P12 do not fully describe the maintenance activities carried out by the branch stores of PT. Sumber Alfaria Trijaya, Tbk. Two of fourteen component

statements have the highest rating is P3 and P10, which represent characteristic of preventive maintenance planning & scheduling (mean rating is 4.44), and preventive maintenance social, financial, environmental impact ((mean rating is 4.27). Maintenance activities with the highest rating are Maintenance reports are made accurately, on time, and can be accounted for to the parties concerned (average rating is 4.53) and the company conducts regular monitoring and control related to safety issues in the work area (average rating is 4.53). The average rating shows that the characteristic activities of P3 and P10 fully describe the maintenance activities carried out by the branch stores of PT. Sumber Alfaria Trijaya, Tbk.

Correlation: C1; C2; C3; C4; C5; C6

	C1	C2	C3	C4	C5
C2	0,490				
	0,006				
C3	0,353	0,387			
	0,056	0,034			
C4	0,358	0,521	0,549		
	0,052	0,003	0,002		
C5	0,361	0,536	0,641	0,611	
	0,050	0,002	0,000	0,000	
C6	0,083	0,198	0,644	0,074	0,329
	0,662	0,294	0,000	0,698	0,076

Cell Contents: Pearson correlation
P-Value

Figure 3. Correlation between preventive maintenance characteristics

To study the relationship between preventive maintenance characteristics, the Pearson-correlation test was adopted using Minitab Software. Figure 3 exhibits the result of the correlation study. According to Crammer (1998), a correlation value in the range of 0.4-0.6 is examined moderate, a higher value (greater than 0.6) is examined to suggest a strong correlation.

Based on the figure above, there is a three strong correlation between PM characteristics. The first is between C5 (Preventive Maintenance Social, Financial, Environmental Impact) & C3 (Preventive Maintenance Performance). This means that PM social, financial, and environmental strategy impacts directly to PM performance. This correlation could appear because one of the performance measurements in PM is related to financial aspect, that is the cost that is issued for PM strategies is still in the company budget standards.

The second is among C5 (Preventive Maintenance Social, Financial, Environmental Impact) & C4 (Preventive Maintenance Policy). This denotes that PM social, financial, and environmental strategy directly influences the PM policy. Correlation between these characteristics emerges as the formulation of the policy is continuously updated based on the actual maintenance situation with consideration of social, financial, and environmental impacts.

The third is between C6 (Preventive Maintenance Information Management) & C3 (Preventive Maintenance Performance). This implies that PM information management impacts directly on PM performance. It seems that correlation among these characteristics develops because PM information management provides a data about historical breakdown and performance of the machine and labor and based on the data, conclusions can be drawn related to the PM performance.

Based on the p-value for the correlation between C5 & C3, C5 & C4, C6 & C3 indicating the correlation is statistically significant. The conclusion is supported by p-value (0.000) lower than the alpha level (0.05). There is

also a moderate correlation between C1 (Preventive Maintenance Approach) & C2 (Preventive Maintenance Planning & Scheduling). The p-value (0.006) is lower than the alpha level (0.05), indicating the linear correlation is statistically significant.

This discovery is different from Naji et al. (2016) findings. They found that top management policy has a strong correlation with maintenance approach, whereas in our research PM approach and PM policy do not have a strong correlation or even a moderate correlation. This new finding is our main contribution to the previous research. In the future, other researchers could find another correlation among the other characteristics.

6. Conclusion

The purpose of this paper is to analyze maintenance systems at several branches of PT. Sumber Alfaria Trijaya, Tbk and to provide an insight of activity maintenance practice in the retail store. The survey with 30 store managers was analyzed with 6 Characteristics of Preventive Maintenance. The mean ratings for all the characteristics are 4 or higher (out of 5). The highest average score for preventive maintenance planning and scheduling was 4.44, indicating that respondents strongly agree with PT. Sumber Alfaria Trijaya, Tbk has implemented preventive maintenance for a specific period, which included descriptions of tools/machines, maintenance activities, maintenance frequency, and time allocated to perform preventive maintenance procedures. The lowest average rating of 4.02 is Preventive maintenance performance indicates that respondents agree with PT. Sumber Alfaria Trijaya, Tbk ensures the availability of tools/machines during operation, the availability of tools/machine spare parts, and maintenance costs that meet the company's budget standards.

There are two of fourteen component statements have the lowest average rating, the analyze shows that the availability of spare parts for tools/machines, and there are losses for material and time due to equipment/machines that cannot operate do not fully describe the maintenance activities carried out by the branch stores of PT. Sumber Alfaria Trijaya, Tbk. In addition, there are two of the fourteen component statements have the highest that analyzed that Maintenance reports are made accurately, on time, and can accounting to the parties concerned, and the company conducts regular monitoring and control related to safety issues in the work area fully describe the maintenance activities carried out by the branch stores of PT. Sumber Alfaria Trijaya, Tbk.

In order to study the relationship between preventive maintenance features, Pearson correlation test was used using Minitab software. There are three strong correlations between PM characteristics, The first is between Preventive Maintenance Social, Financial, Environmental Impact & Preventive Maintenance Performance, the second is among Preventive Maintenance Social, Financial, Environmental Impact & Preventive Maintenance Policy, and the third is between Preventive Maintenance Information Management & Preventive Maintenance Performance. Based on the correlation test, it shows that the correlation is statistically significant. There is also a moderate correlation between preventive maintenance methods and preventive maintenance plans and scheduling, indicating that the linear correlation is statistically significant. Since this paper has analyzed the correlation between preventive maintenance characteristics, future researchers may be able to find other correlations between other characteristics.

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Biographies

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