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Preview of Preventive Maintenance Practices and Teamwork Initiative in Workplace

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Abstract: The aim of this research is to present the findings from a case study conducted on the role of teamwork towards maintenance performance in a Malaysian manufacturing plant. However, the company lack of strategy in implementing maintenance initiatives affected its performance in terms of quality problems and escalating cost. Preventive maintenance helps to reduce the rate of equipment failure and to enhance equipment life.Preventive maintenance impacts on quality, safety, cost, capacity and environment. The study was conducted to identify role of teamwork toward maintenance performance in a manufacturing company. The data was gathered from interviews conducted on a few key personnel of the company. The role of teamwork influenced the maintenance performance of the company.The main contribution of the study is an understanding of the role of teamwork toward maintenance performance.

Key words: Preventive maintenance, role of teamwork, maintenance performance, implementing maintenance, contribution

INTRODUCTION

Maintenance has been recognized as a strategic tool to improve competitiveness. It was prevent the trouble trough the routine action in fixing, retaining or restoring in order to maintain quality, safety, cost, capacity and environment (Qingfeng *et al*., 2011). Maintenance is activities required or undertaken to conserve as nearly, and as long, as possible the original condition of an asset or resource while compensating for normal wear and tear.It should be started by outlining a broad perspective including all aspects of teamwork through focused on a model that identifies three team dimensions which are technical dimension, governance dimension and normative dimension (Rolfsen and Langeland, 2012). Cannon-Bowers and Bowers state that teamwork is an important strategy that leads to success anyorganization. This because teamwork is dynamic process which involve two or more professional that help to maintain the competitive advantage in assuring quality and safety in the delivery of services. On other hand, Knights and McCabe (2000) pointed that teamwork is ableto adapt to changing conditions and to cope with new situations successfully, because they are conceptualised to function as autonomous units. In addition Baker *et al*. (2006) found that team make few errors however the teamwork is to be more creative, productive, and adaptable than an individual person.

There were three dimensions, namely technical, normative and governance which cover most of the possible aspects of teamwork. Technical dimension is emphasizing on continuous improvement and job rotation within the team. Normative dimension strengthen employee identification with organizational goals. The ability of a employee to understand well the maintenance goals for instance can contribute significant effect to the organization (Rolfsen and Langeland, 2012). The changes in behavior and attitudes perhaps can cause teamwork effectiveness (Rolfsen and Langeland, 2012).Organization should look into the changes of behavior accordingly. Governance is about the delegated power to the team and selection of team leaders (Rolfsen and Langeland, 2012). Teamwork moves away from the hierarchical command and control workplace which means that empowering the employee. Maintenance performance increases the reliability and lower operational risks. Maintenance performance can be enhanced by making it more efficient and more effective. Effective maintenance means choosing a proper maintenance technique to increase reliability and lower operational risks whereas efficient maintenance is doing maintenance correctly so that reliability and risk reduction can be achieved through least resources and time. The role of maintenance team and organization can be a vital role to reduce cost and increase organization performance.

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Literature review

Maintenance: According to Byggtjanst, maintenance can be divided into three categories where are corrective maintenance, predictive maintenance and preventive maintenance. Corrective maintenance is a maintenance task performed to identify, isolate and rectify a fault so that the failed equipment, machine or system can be restored to an operational condition within the tolerances or limits established for in-service operations. Preventive maintenance refers to the care and servicing by personnel for the purpose of maintaining equipment and facilities in satisfactory operating condition by providing for systematic inspection, detection and correctionof incipient failures either before they occur or before they develop into major defects. However, Tsang found both types of maintenances spending constitutes a large part of the operating budget in organizations with heavy investments in machinery and equipment, and tracking the performance of maintenance operations in such organizations should therefore be a key management issue. On other hand, Fitouhi and Nourelfath (2012) declare that preventive and corrective maintenance save the organization costs in terms of setup costs, holding costs, backorder costs and production costs, while satisfying the demand for all products over the entire horizon and also reduce the total maintenance and production cost. When referring to recent studies regarding preventive maintenance, many researchers found that preventive maintenance was performed well in many organizations and able to increase the lifecycle of the equipment with minor breakdown or repair (Duffuaa and Raouf, 2015;Tlili *et al*., 2015).

Maintenance performance: Top management requires information of maintenance performance for planning and controlling the maintenance process (Parida and Kumar, 2009). The maintenance performance is the effectiveness and efficiency of the maintenance process. Sondalini (2009) defines maintenance performance as increase the reliability and lower operational risks. Maintenance performance can be enhanced by making it more efficient and more effective. Effective maintenance is choosing of a proper way for maintenance to increase reliability and lower operational risks whereas efficient maintenance is doing maintenance correctly so that reliability and risk reduction can be achieved through least resources and time.

Parida and Kumar (2009) stated that there are various factors and issues needed for measurement of the maintenance performance. The factors that are needed for measurement of maintenance performance are:

- The value created by the maintenance. The most important factor in the measurement of maintenance performance is to measure the value created by maintenance process. Business must know that what is being done, what is required by business process and does the maintenance create any value for the business. The main focusis on doing the right things to meet objectives of the company.
- Health safety and environmental. Business should understand that maintenance can contribute toward health safety and environmental issues. An inefficient maintenance performance can cause incidents and accidents at workplace and other health hazards. It also causes environmental issues and an unhealthy working area.
- New trends in operation and maintenance strategy. Business today needs to use new operating and maintenance strategy in order to response to market demand by reduce the production loss and process waste. This strategy has to be continuously reviewed and improve.

Vaisnys stated 3 key performance indicators which are system and equipment availability, reliability of systems and components and preventive maintenance effectiveness. There are some specific indicators for system and equipment availability. The first key indicator is component and system unavailability. This indicator is defined as the component unable to perform when it is required to be available for service. This indicator can be separated into three more specific indicators which are total downtime, scheduled downtime and unscheduled downtime (Reed and Mendes, 2006). Total downtime is the number of time that a system is unable to running the machine. It is the total of schedule downtime and unscheduled downtime. Schedule downtime is the equipment unable to work due to scheduled work whereas unscheduled downtime is the time that equipment are not able of running due to unscheduled repairs (Jardine and Tsang, 2013).

Another key performance indicator is reliability of systems and components. The first key indicator is number of corrective work orders issued. High number of corrective work order issued may influence overall plant performance and unit capability factor. Another key indicator is number of failures in safety related systems. This indicator measures of the reliability of safety related systems. The third indicator is mean time between failures. Mean time between failures is the average time that a component works without failure. Besides mean time between failures, that is another indicator which is mean time to repair. It is different with mean time between failures because it measures the time between the service interruption and service restoration (Smith, 2011).

The last key performance indicator is preventive maintenance effectiveness. This indicator helps business to understand the effectiveness of the preventive maintenance program. The first indicator for this is preventive maintenance compliance (Duffuaa and Raouf, 2015). This indicator is to review on the preventive maintenance work orders. The second indicator is ratio of corrective work resulted from PM activities. Preventive maintenance effectiveness can be shown as the number of corrective work that is identified when performing preventive work compared to the number of preventive work being done. This is a measurement of how the preventive maintenance is identifying potential failures before they occur. Another indicator is overdue of preventive maintenance activities. High number of overdue preventive maintenance work shows the poor planning of plant management in a company.

Three dimensions model: There are three team dimensions that cover most of the possible aspect of teamwork. The first teamwork dimension is technical dimension. Technical dimension is the basis of teamwork (Hagermann *et al*., 2012). It concerns on the integration through various forms of functional flexibility, self-regulation through delegated responsibilities for resourcing, scheduling and discipline and a collective framework for the development of expanded competences (Thompson and Wallace, 1996). Rolfsen and Langeland (2012) stated that technical dimension deals with functional flexibility, continuous improvement and learning capacity.

Besides that, governance dimension is another team dimension. Hagermann *et al*. (2012) stated that "The governance dimension is center on three main concerns". Teamwork is move out from hierarchical command and control workplace which mean empowering the employee (Thompson and Wallace, 1996). Thompson and Wallace (1996) also listed the three main governance issues. The three main governance issues are the extent of delegated powers to the team, the selection of team leaders and the relationship between the eam and the wider organizational governance.

Thompson and Wallace study (as cited in Rolfsen and Langeland, 2012) stated that normative dimension concern on employee identification with organization goals, attitudes and behavior. The normative dimension also encompasses managing and preventing errors and continuously learning from errors to develop a low error culture (Hagermann *et al*., 2012).

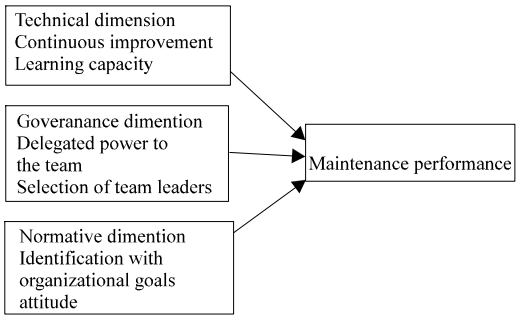

Fig. 1: Research framework (Rolfsen and Langeland, 2012)

MATERIALS AND METHODS

Research methodology is a way that researcher identify the problem and seek the answer. The following will describe the subject of the study and the methods to gather the information. It is a set of procedures or methods use to conduct research. Qualitative methodologies will be used during the research of the role of teamwork toward maintenance performance. Qualitative method is a method of collecting data which is concerned with describing meaning rather than use statistic to analyze. Qualitative method includes interview, observations and collect data from other resources.

In this study, three dimensions model will be used to evaluate the role of teamwork toward maintenance performance as shown on Fig. 1. These three dimensions include technical dimension, governance dimension and normative dimension. The first dimension consist technical dimension, the elements include continuous improvement and learning capacity. Meanwhile the second dimension is governance and these include delegated power of the team and selection of team leaders. Finally for normative dimension, the elements include is identification with organizational goals, attitudes and behaviors

Before starting the study, the researchers have conducted thorough literature review on previous studies. The method that use in this study is case study design. Interview will be conducted to someone that is expertise in this area. Therefore, site visit was done in manufacturing company in Malaysia for the purpose of interview and observation. After the interview and observation, all the data collected are analyzed for full report.

RESULTS AND DISCUSSION

Maintenance practices at Indah paper industries Sdn. Bhd: The company outsources preventive maintenance activities to third party. However, the company has

implemented the routine preventive maintenance and schedule refurbishing preventive maintenance as highlited by Mr. Jamri (the manager). According to Wireman (1990), routine maintenance is taken care of small problem before they cause equipment failures such as cleaning, inspection, lubricant and so on. Scheduled refurbishing preventive maintenance is replacing all suspected defective components during shutdown. At Indah Paper Industries Sdn. Bhd (IPISB) apply the lubricant liquids on machine to clean the machine every day. Besides that, they have change the vacuum oil, oil filter, exhaust filter and so on in some machine. For the replacement of other component than the vacuum oil, oil filter and exhaust filter of machines, the company outsource to their supplier since the machine is imported.

Three dimensions model: This study uses three dimensions model to evaluate the role of teamwork towards maintenance performance. These three dimensions model nclude technical dimension, governance dimension and normative dimension. These three dimensions model covers most of the possible aspect of teamwork and it is widely used in case study analysis (Rolfsen and Langeland, 2012). Therefore, it is suitable for this study to evaluate the role of teamwork towards maintenance performance. The elements inside the technical dimension are continuous improvement and learning capacity. Governance dimension focuses on delegated power and selection of team leader. For the normative dimension, it concerns on identification with organizational goals, attitudes and behaviors.

Technical dimension: One of the elements inside the technical dimension is continuous improvements. (IPISB) did not have any improvement program in preventive maintenance because most of the preventive activities are outsources to their supplier. They do not have a specific person to in charge the maintenance activities in the company. Therefore, maintenance activities in the company are based on their supplier. According to Mr Jamri (the manager), most of the machines in the company are imported so the supplier is responsible for the maintenance procedures than the company such as what kind of components have to be replaced. The company is just doing the routine preventive maintenance and scheduled refurbishing preventive maintenance.

The second element in the technical dimension is the learning capacity. (IPISB) implemented job rotation in their company. All the job rotations are decided by the manager and team leaders. Jobs like preparing the raw materials to produce products, lubrication etc., are done by different people every time as highlighted by Mr. Jamri the manager. All workers are expected to know every processes in the production line in order to tackle of absenteeism issue and avoid production line unnecessary stoppages.

Governance dimension: The first element in governance dimension is delegation of power. Delegation of power is the extent of the workers free to take responsibilities in their job. The delegation of power to the team in Indah Paper Industries Sdn. Bhd. is quite low. Every preventive maintenance activity is based on schedule. Workers are not given the opportunity to choose the schedule they need to do the preventive maintenance. They have to follow the schedule for every preventive maintenance activity as scheduled. This is to avoid someone get injured when doing preventive maintenance. Mr Jamri (the manager) asserts that preventive maintenance will be conducted during raw materials preparation.

The second element is selection of team leaders. Operators in Indah Paper Industries Sdn. Bhd. do not have freedom to decide who should take care of the team leadership. The management team will select the leader for them. Moreover, Mr Jamri (the manager) emphasizes that the leader is chosen by management team, everybody in the team have chance to become leader because the leader will be changed by management team every 2 month.

Normative dimension: Mr Jamri (the manager) further highlights that the organizational goal is to produce superior quality, excellent service and competitive price. Every worker in the company is aware of the organizational goals in this company. This means that all the workers in the company have to work together to achieve the goal. However, since there is no specific preventive maintenance given to the operators therefore some routine activities such as daily cleaning and checking of equipments and machines can be done effectively. Abnormality production processes detection training also not been structurally done and it is more to an ad hoc basis.

The second element in normative dimension is behavior of team. The workers in Indah Paper Industries Sdn. Bhd. always show their enthusiasm when doing their work. When they saw some problems occur in the workplace, they will immediately report it to the management team. For example, last year two workers managed to detect the lighting failure and burst parts in the workplace during long public holiday. Both of them immediately fix the problems to avoid the problems become more serious.

The third element in normative dimension is attitude of the team. There are some punishments given to those who did not give 100% commitment in the maintenance

activities. Previously, there is a worker who did not do the maintenance according the schedule given. Warning letter was given to the worker for penalty. Workers will be given chance maximum two times to improve their working attitude. If they are still repeating the same mistakes, some actions will be taken such as no opportunity for overtime.

Maintenance performance: Preventive maintenance helped the company to reducing the machine breakdown and also help to reach goal of production target in organize job rotation, enthusiasm of team, attitude of team effectively. In addition state preventive maintenance also helps to preserve the quality of the products. In addition he found that after the preventive maintenance was employed the reject rates equipment's was reduced it significantly show there is improvement in term of cost savings due to reduced equipment failures.

Based from the interview session for this study, there are some improvements have to be done by the companies' in implement the preventive maintenance in their organization. This study supports Mr. Jamri (the manager) argument that the success of preventive maintenance will be assured only if organization set a team for specific maintenance activities. On other hand, this study also suggest that each preventive maintenance activity can ensure the equipment to be cleaned daily. The components of equipments can be observed easily for any abnormalities when the equipment is in clean condition. Thus this study urge the company to redesign daily cleaning and checking procedures in the production processes in order to help to protect equipment from dust and other minor problem such as machine cracks, leaks, loose and thick layer of dust.

Another tips that must be followed by companies in applying preventive maintenance strategy is to follow a systematic preventive maintenance programs. These can be conducted by a good record of documentation. A logbook, for instance, which records on inspection activity of; what has been checked; what was found; and any corrective action that was taken needed some improvement though.

Meanwhile, the researchers of this study found that some of the suppliers were not coming to inspect the equipment periodically. The regular inspection can be made either weekly or monthly these action help the organization to reduce the problem that will ensure sensor accuracy and reduce production costs. Inspection of equipment is not just minimize the shutdown time but also to detect vibration, leaks and anything that cannot be assessed on stationary equipment. Besides by assigning the right people for conducting a preventive maintenance task will lead to better and promising results. Finally by giving the right and well structured training to the employees on proper way of operation of equipments could reduce the injuries and major accident in organization.

CONCLUSSION

The purpose of this study is to evaluate how teamwork helps in maintenance performance in manufacturing company in Malaysia. There are three dimension models using in this study to evaluate teamwork include technical dimension, governance dimension and normative dimension. The findings of this study show that the teamwork in the company toward preventive maintenance is at moderate level because workers are not free to decide when they should conducted preventive maintenance and select who should lead them. Besides that, Indah Paper Industries Sdn. Bhd. did not have any improvement programs that are related to the preventive maintenance. Mr. Jamri has suggested that preventive maintenance in their company has to be improved and the company should organize a team that has specific focus on maintenance activities in the company.

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