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Effects of Good Maintenance Management System on Workers Safety and Environment

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ABSTRACT
This work presents a study of the effects of good maintenance management system on the workers safety and the work environment. The study focuses on the efficient management policies used in maintenance systems in industrial firms that reduces risks and hazardous conditions affect the safety of workers. Also the effects of such management systems on work environment are studied and analyzed. The cost of maintenance on such firms is affected by the maintenance management policy followed by the firm. The effects of such management system on cost is also studied and analyzed. Data and information will be collected from many firms or factories using some questioners directed to workers and then some statistical tools will be used here to analyze these effects.

I. INTRODUCTION

There are many maintenance management systems' polices and strategies followed in Jordanian companies and firms. Such types and polices of maintenance affects the safety of workers and work environment and then the cost.

Misdirected maintenance

In this type of maintenance too much of the work done by maintenance teams is unnecessary, unproductive, or even counterproductive. Over half of typical maintenance activities are unnecessary. This includes routine equipment checks as well as preventive maintenance on equipment that doesn't need it.

- One analysis showed that 63% of all instrument work orders did not result in corrective action, because there was nothing wrong with the equipment.
- A study of 230 valves scheduled for rebuilding during a shutdown found than only 31% needed such extensive service.
- Many plants re-calibrate transmitters before installation and then once or twice a year after that, even when the original factory calibration is more accurate and (for some transmitters) stable for 5-10 years.

Unproductive work

In a typical plant, the maintenance department averages about 30% .wrench time. The rest of the time they're doing data entry and retrieval, work-order reporting, and other paperwork. Best practices plants use automated tools to manage this information more efficiently increasing wrench time to 50% or more.

Counter productive work. Some maintenance actually reduces equipment reliability. Problems can result from incorrect re-assembly, incorrect tightening, misalignment, or other errors. In fact, as many as 70% of equipment failures happen shortly after initial installation or major preventive maintenance.

Inefficient maintenance strategies

Many of these problems could be reduced by adjusting the mix of reactive, preventive, predictive, and proactive maintenance strategies so workers can focus on doing the right things at the right time.

1. Reactive maintenance. Also described as fix it when it breaks. This is the most basic maintenance strategy. Its major drawback is obvious: the cost to repair (or replace) equipment that's run to failure is typically much higher than if the problem were detected and fixed earlier not to mention the cost of lost production during extended downtime.

2. Preventive maintenance. A preventive strategy assumes equipment is relatively reliable until, after some period of time, it enters a wear-out zone where failures increase. To postpone this wear-out, equipment is serviced on a calendar- or run-time basis − whether it needs it or not. On average, this: fix it just in case approach is about 30% less expensive than reactive maintenance.

However, determining when the wear-out zone might begin has traditionally been an inexact science, relying on estimates and averages rather than actual equipment condition. Because of this uncertainty, preventive maintenance schedules are usually very conservative.

As a result, maintenance often takes place too soon, when there's nothing wrong and service can actually create new problems. In fact, about

30% of preventive maintenance effort is wasted, and another 30% is actually harmful.1 But there's an even bigger problem: only about 6% of equipment follows a time-based “wear-out” pattern. For most other equipment over 90% − failures typically result from the cumulative effects of events or conditions that can occur at any time. That means schedule-based preventive maintenance can also come too late, after the damage has begun.

3. Predictive maintenance. The third strategy overcomes these drawbacks by constantly monitoring actual equipment condition and using the information to predict when a problem is likely to occur. With that insight, you can schedule maintenance for the equipment that needs it and only what needs it − before the problem affects process or equipment performance. That's a great way to improve maintenance productivity, as well as reduce costs for repairs and unexpected downtime.

A best-practices plant uses predictive maintenance for most equipment where condition-monitoring is practical, limiting reactive and preventive strategies to equipment that's not process-critical and will cause little or no collateral damage if run to failure.

4. Proactive maintenance. which analyzes why performance is degrading and then corrects the source of problems. The goal is not just to avoid a .hard failure, but to restore or even improve equipment performance.

For example, a valve failure might be caused by excess packing wear, which in turn was caused by poor loop tuning that caused the valve to cycle continuously. Retuning the loop will prevent further failures while also improving process performance.

The best-practices plant of the future will actually spend more on maintenance to include this proactive approach in their arsenal and more than regain the investment in increased plant efficiency.

Operators typically have extensive .real-world knowledge of the plant and the process. But instead of using this know-how to improve operations, they spend much of their time and talent reacting to unexpected situations a productivity drain that limits the number of loops they can manage effectively.

This productivity problem often begins with instruments, valves, and process equipment or entire loops − that don't perform as they should, requiring intense operator intervention to maintain control.

When something does go wrong, the flood of data and alarms that operators have to deal with can make it harder for them to find and fix the problem, or even obscure other process conditions and events that need their attention. Better alarm and alert management is needed to ensure that the right people get the right information at the right time to guide their actions.

Some plants rely on abnormal situation management programs to provide this guidance. But greater productivity gains are possible by focusing on abnormal situation prevention. Using predictive maintenance and similar strategies to correct or avoid potential problems before they require operator intervention.

Workplace accidents in Jordan-Statistics

There is no database for work-related accidents in Jordan, except for statistics issued by the Social Security Corporation (SSC).

However, institutions registered with the SSC employ only 62 per cent of the total workforce in Jordan, the Phenix Centre for Economic and Informatics Studies said in a statement released on the occasion of World Day for Safety and Health at Work, annually observed on April 28.

The weak implementation of safety standards in some workplaces is related to “ineffective inspection campaigns by authorities”.

SSC statistics showed that there were 11,789 workplace-related accidents among subscribers in 2014. Of those, 19 per cent were among migrant workers and 6.3 per cent among working women.

Injuries in the transformative industries sector topped the list with 38.2 per cent, followed by retail (14 per cent), while the hospitability sector came third with 13 per cent among hotel employees and 12 per cent among restaurant workers.

Since the establishment of the SSC in 1978 and until last year, total work related injuries stood at 447,000 with 2,400 deaths. Phenix Centre called on the government to ratify the International Labour Organizations’ resolutions related to work safety to ensure a better and safer work environment.

The UN said every year some 2 million men and women lose their lives through accidents and diseases linked to their work.

In addition, there are 270 million occupational accidents and 160 million occupational diseases each year, costing $2.8 trillion in lost working time and expenses for treatment, compensation and rehabilitation.

To predict the effects of good maintenance system on workers' safety and work environment the questioners are used here depending on the following assumptions: first, the good maintenance system has a strong positive effect on workers' safety by decreasing number of works accidents and also machines downtimes. Also as such parameters are improved the productivity of the firms is increased. Second, as last parameters are improved the work environment is enhanced.

II. LITERATURE REVIEW

The maintenance activity isn't a purpose in itself, it's a necessity of which "the production suffers" and the financial agent "considers too expensive". There are many researches discussed this issue but little of them investigate and make experimental investigation. Vasile D. et al. (2010) discussed the conflict between the production units and the maintenance department, not only for a short term, but, sometimes, for a long term, imposing a rigorous definition of each person's responsibilities. Considering the mutations in the industrial equipments' technical complexity and the accidental failures' catastrophic consequences from the economic and/or social point of view, it should be assigned a new dimension to the maintenance activity. Nicolae U. et al. (2010) presented some aspects of the most used maintenance systems like Preventive maintenance, Corrective maintenance, Predictive maintenance, and Current functional maintenance and a combination of such systems to get the most optimal maintenance system.

III. RESULTS AND DISCUSSION

Questioners are used here to prove the study assumptions. The study is performed on two companies in Jordan, the contents of the questioners is shown below. Table 1 below shows such contents and results. The samples included about 200 workers from two companies.

Table 1. Questioner used in the study and results

Question	Agree (Yes)	Not agree (No)	sometimes
1.Have you ever gotten a workplace accidents	**35%**	**65%**	**-**
2. In different places you have worked did you read or listen to safety regulations.	**20%**	**50%**	**30%**
3. In your company do you have a safety department or maintenance manager	**35%**	**65%**	
4. Do you note that there is an effect on workplace safety or accidents for different maint. management policy.	**60%**	**20%**	**20%**
5. Do you think that preventive maint. policy is better.	**70%**	**30%**	
6. Do you think that periodic maint. policy is better.	**45%**	**55%**	**-**
7. (For mangers) does the maintenance policy has a positive effects on decreasing downtimes and increasing productivity.	**80%**	**10%**	**10%**
8.When a new safety and maintenance policies are applied: does work environment enhanced.	**90%**	**5%**	**5%**

Fig. 1 below shows the effect of using better safety and maintenance management policy on workers safety and work environment depending on the questioner results.

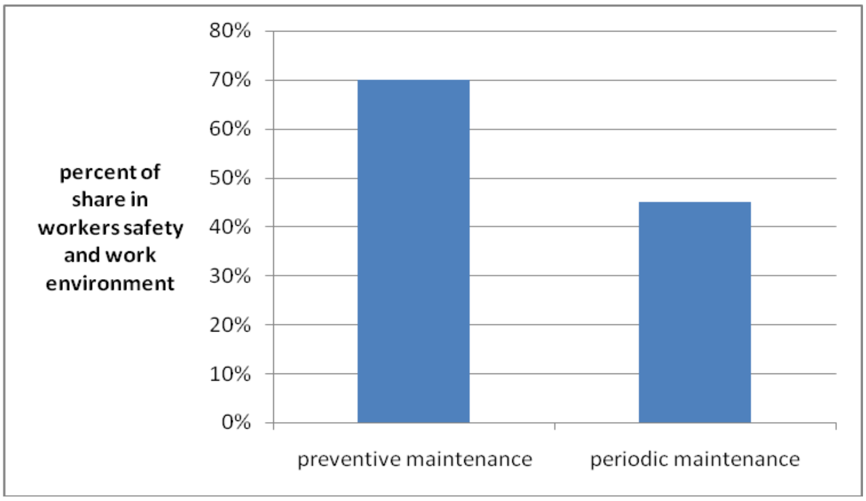

Fig.1. The effect of two different maintenance management polices on workers safety and work environment in the studied firms

IV. CONCLUSIONS

The maintenance management system is very important in any company, this department responsible for selecting the type or policy of maintenance should be followed in the factory to decrease the hazardous or risks in work processes, if so the safety of workers is increased and so the work environment is enhanced. In the case study of this work the preventive maintenance policy is better than periodic maintenance policy as it is predicted from the results of the questioner analysis.

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