DEVELOPMENT OF PLANT MAINTENANCE MANAGEMENT SYSTEM (PMMS): A CASE STUDY

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ABSTRACT

In large plant industry, it is not easy to maintain the machine performance without using any method such as checklist system. Manual checklist is one of common maintenance checklist used in industry. All machine, equipment and part of machine that needs to be check will be written down for the employee to do maintenance checks. Convert manual checklist to the Plant Maintenance Management System (PMMS) can improve the way of employees work and make employer easy to manage the plant. Therefore, a new system was design to maintain the equipment so that the activities are more efficient and cost effective. The system consists of three frames that connect to each other. The frames divide to section, equipment and checklist. This system also builds to prevent data from arbitrarily changed. Only certain officers or staffs allowed making modifications to data. This system developed for convenience of staff and officers in carrying out their duties. Using this system, a company can make the office environment a paperless environment.

Keyword: Plant Maintenance Management System; Manual checklist; Electronic checklist.

INTRODUCTION

In today's environment, Maintenance Management System (MMS) is wide expands for process plants to increase profitability by improving reliability and achieving maintenance excellence. Maintenance is accepted as a means of gaining additional control of operational budgets and significantly increasing a company's bottom line. When we consider that maintenance costs can make up 40 to 50% of operational budgets in capital-intensive industries, the effect of a reduction in maintenance costs is both obvious and impressive (Mather, 2002). In addition, maintenance is generally the largest controllable operating cost of a capital investment industry.

Maintenance can be clarify as 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. In the engineering world, the word maintenance can be simplifies as actions necessary for retaining or restoring a piece of equipment, machine, or system to the specified operable condition to achieve its maximum useful life. It includes corrective maintenance and preventive maintenance. The objective of maintenance is to try to maximise the performance of equipment by ensuring that, items of equipment function regularly and efficiently, by attempting to prevent breakdowns or failures, and by minimising the losses incurred by breakdowns or failures (O'Donoghue et al., 2004). In fact, to maintain or increase the reliability of the operating system taken as a whole is the objective of maintenance. Properly implemented of an integrated maintenance management can lessen emergencies by 75%, cut the purchasing by 25%, increase warehouse accuracy by 95% and improve preventative maintenance by 200%.

Then, in the short and long term the potential saving is high if the maintenance cost rising from 9% to 11% per Annum and if maintenance can minimise the costs by as much as 35% it can count as good management (Sivaligam, 1997).

Profitability and competitiveness are the overall goal that a company need. The overall goal can be defined in different level of control using the term of efficiency, effectiveness and cost-effectiveness.) The word of efficiency is defined as the ratio of output to inputs of a system and a measure of how well the system's output contributes to the business goals and objectives is defined for term effectiveness (Anthony, 1998. Collecting all the cost information incurred during equipment life can be determined as Life Cycle Costing (LCC). The measure of a system in terms of mission fulfilment and total LCC is defined as cost-effectiveness. The operational maintenance goals and is a combination of technical and organisational aspects can be relate to high resource efficiency (Al-Najjar, 1997).

New technologies bring us improvement toward job and live. Electronic checklist nowadays can provide an external memory of pending, completed, and skipped steps. There is no debating it anymore with a solid foundation in place; electronic checklist processing is growing because it virtually ensures substantial benefits for any organization that implements it. Computerized maintenance management systems (CMMS) are one of the ways to improve manual checklist. The goal of a maintenance manager is to employ a management system that optimizes the use of scarce resources such as manpower, equipment, material, and funds to maintain the facilities and equipment that are the responsibility of the maintenance organization. The system should provide for integrated processes giving the manager control over the maintenance of all facilities and maintainable equipment from acquisition to disposal.

The facilities maintenance manager with work reception, planning, control, performance, evaluation and reporting was requirement and assists in modern CMMS nowadays. Besides that, this system will also maintain historical information for management use. The manager should evaluate management data requirements and establish electronic data needs prior to acquiring a system or additions to, or replacement of, an existing system. The evaluation should include a return on investment (ROI) analysis before investing in additional or new CMMS capabilities. To accomplish the maintenance organization's goals, manager should only acquire what is necessary for company.

CONVERT MANUAL CHECKLIST TO ELECTRONIC CHECKLIST

The development of a system, the main thing that should be implemented is phases of creating new Plant Maintenance Management System (PMMS). The system design will be develop trough out many stage before can be running up. The stages of this phase have been planned in developing this system such as system planning stage, the stage of systems analysis, systems design stage, implementation stage and the stage of the operation and support system. Things that need to be addressed in this stage are to understand the problem, determine the existing constraints and finally identify the benefits derived from the system that will be developed. The problems that have been detected and gathered will be analyzed and then a plan to solve the problems be created.

The main stage is system design stage. In this stage, the display screen, files and procedures manual is designed. Then, the design for input data need to be choose for each of available data whether use button or need to be write. To ensure accurate system, controlled, reliable and easy maintained this system need to be planned

according to the needed of company. When start creates the system, LAMP (Linux, Apache, MySQL and PHP) will be best software use to complete the PMMS. Figure 1 at the following page show the step of build up the system.



Figure 1. System development flow.

PMMS was created for one of the largest cement industry in Malaysia. This plant has 7 main sections consist of crusher, raw mill, core line, coal mill, cement mill, cement silo and packing plant. This plant also consists of the other section such as blower, palletizer, air and water service and fire fighting. All of these sections contain 17 to 37 equipments and machines. Each of the equipments and machines consists 2 to11 parts that need to check every week. Using PMMS can help maintenance management maintain this plant so that they can run this plant 24 hour per day without having any problem.

RESULT

Figure 2 at the following page illustrates the main page of the system. Users that want to enter this system must key in the user data first. The user must enter the staff id, password and section from the screen. Section consists of mechanical, electrical or production where user must select one of the sections. User needs to click the 'login' button to go to the next screen. User can change their new password by click 'change password' button. The 'admin' button design for administration to modified system such as to update or remove data by a specific person.

MAINTENANCE CHECKLIST
STAFF ID : PASSWORD : SECTION : V Log In Change Password
Admin Manager

Figure 2. Main page.

Figure 3 below shows the front view of the system has been developed. At the top of the screen display there are several main sections of crusher, raw mill, core line, coal mill, cement mill, cement silo, packing plant, blower, air & water service, fire fighting and log out. User must click one of the sections, and then the equipment listed will be reflected at the left side of the web page. By clicking one of the equipment lists, the checklist list will be reflected to the right side of the web page. Users just need to click or type the requirement information. All the data collected will store at the data based then it can be review by the manager as illustrated in Figure 4 at the following page.

mechanical department			
Home Crusher raw	mill core line coal mill cement mill cement silo pac	ting plant blower air & water service fire fighting	
L/s spron conveyor Clay apron conveyor Spillage conveyor Easmer crusher (Friday lunch time only) Easmer crusher(during operation) Dust plant (hasmer crusher) Discharge belt conveyor	1. Check hydraulic oil level/condition 2. Check any hydraulic oil leakage 3. Hydraulic working pressure - A (120 - 150 bar) 4. Hydraulic working pressure - SP (10 - 15 bar) 5. Hydraulic working pressure - B (0 bar) 6. Hydraulic working temp T1 (50 - 800 C) 7. Hydraulic working temp T2	□ Yes □ No □ bar □ bar □ bar □ bar C C	
Discharge belt conveyor spillage conveyor Magnetic separator CRA belt conveyor Dust plant (transfer tower)	 Check drive and tail bearing condition Check chain and sprocket condition Check cent. grease pressure 	Good Not Good	

Figure 3. Maintenance checklist menu.





DISCUSSION AND CONCLUSION

PMMS is convenient, reliable and advantageous to the organization as a whole. Significant time saved in every level of an organisation which can be utilized for other project, which can bring greater benefit and productivity. With the implementation of PMMS, need for sorting and filling is fully eliminated thus saving time and space, which indirectly creates a more conclusive working environment. Abnormal operating conditions of plant equipment is quickly detected since the data obtained is immediately and easily uploaded into the database that does not rely on manually data entry which is time consuming and usually not immediate. Although the initial cost of implementation might be somewhat higher compared to traditional methods, return of investment (ROI) can be seen as early as within 1 year to 2 years. The bulk of returns will come from time saved and spent on more productive projects, significant reduction in the use of paper which in turn result in less cost and significant reduction in environment impact.

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REFERENCES

Mather, D. 2002. CMMS: Journal of a timesaving implementation process.

- O'Donoghue, C.D. and Prendergast, J.G. 2004. Manufacturing maintenance objectives. Journal of implementation and benefits of introducing a computerised maintenance management system into a textile manufacturing company.
- Sivaligam, R. 1997. A12 step programme for moving down the road to recovery, Plant Engineering. Journal of applying best practices to maintenance, 51(6): 120.
- Anthony, R.N. 1998. Management Control Systems, ninth edition, Irwin/McGrawHill, USA
- Al-Najjar, B. 1997. Condition-based maintenance selection and improvement of a costeffective vibration-based policy for rolling element bearings, PhD thesis, Lund University, Department of Industrial Engineering.