Fundamental Study of Energy Control System Lockout and Tagout (LOTO) Implementation in Manufacturing Industry at Pasir Gudang, Johor

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Abstract

Lockout and Tagout (LOTO) has been used by industries in order to ensure the process will run smoothly and continuously without any sudden accident or breakdown which is vital to industries especially Manufacturing industries. Nevertheless, this research was present about a LOTO system to improve energy control system in Manufacturing industries on maintenance and servicing framework for downstream industries. An online survey has been done in order to collect data from all respective companies. This research covered the whole development of the framework from variables identifications, questionnaire development, correlation coefficient and finally an initial conceptual sustainable maintenance framework model.

1. Introduction

Lockout tagout is an important safety component to your workplace. In fact, it's critical to safeguarding workers and employees around the machinery and equipment they operate, service and maintain from the unexpected energization or the release of hazardous energy during service or maintenance activities. [1] Hazardous energy is defined as any electrical, mechanical, hydraulic, pneumatic, chemical, nuclear, thermal, gravitational, or other energy that can harm personnel in maintaining or servicing. The main concept of LOTO is to overcome the optimal control energy problem for persons working in, around equipment or machinery when it is maintained, operated, repaired or serviced. Based on Chinniah Y. (2013), the study more realistic by implementation LOTO system in manufacturing industries, it can overcome the optimal control energy

problem. Containing accident prevention techniques such as LOTO to service and repair equipment have proven to improve occupational safety. [2]

2. Methodology

In identifying variables, several journals on Lockout and Tagout (LOTO) system which covered in maintenance activities. Interview was done in order to get the expert view in variables chosen from the journals and the validity of it. Then questionnaire for survey study also was verified during this session.

After survey questionnaire has been verified and validated, an online survey questionnaire has been sent via e-mail to choose manufacturing companies in Pasir Gudang. A statistical analysis was run after all

questionnaire responses collected. Statistical Package for the Social Science (SPSS) software have been used for several statistical analyses. These analyses identified crosstabulation between variables and other finding. Crosstabulation analysis has been done to verify the data, the variables and the relationship. Finally, the sustainability maintenance framework of the initial concept has been developed based on statistical results.
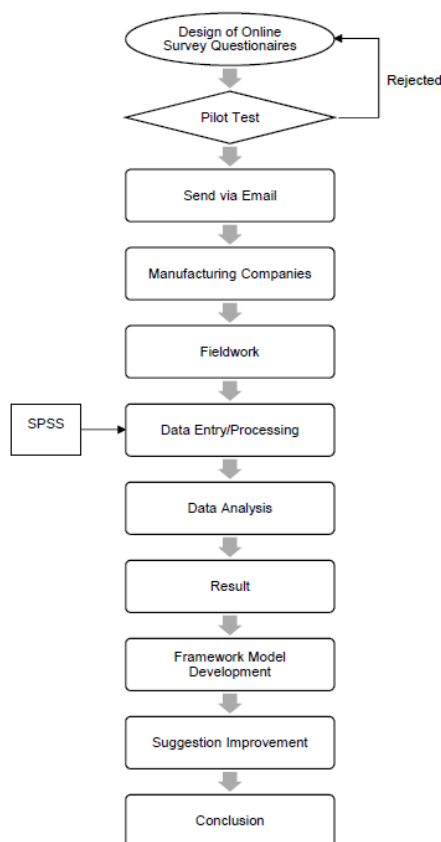
Flowchart 1: Flow Process of Online Survey Questionaires

3. Results and Discussion

Data was collected through an extensive survey process and included various kinds of questionnaires. The analysis of questionnaire feedbacks was carried out using the Statistical Package for Social Science (SPSS) and Microsoft Excel. In this research, 20 over 25 manufacturing companies have response to the online questionnaire. This make the response rate is 80%. Due to larger number of manufacturing companies in Pasir Gudang, Johor, the response rates are medium level.

Descriptive statistic was used to describe the characteristic of the variable of interest in a situation. Descriptive study presented data in a meaningful form. The form of data can be organized in table which using frequency of the data, and also by graphs.

Table 1: Descriptive Statistics of Demographic Question

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Company_Type	70	1	2	1.46	.502
Department	70	1	6	2.47	1.604
Position	70	1	4	2.99	.789
Working_Experience	70	1	5	2.34	.915
Valid N (listwise)	70				

Table 1 above shows the descriptive analysis for Part A - Demographic Question. The mean level and standard deviation for each variable is shown as above. From the table above, we can see that the Standard Deviation value for Department variable is more than 1.0 which means majority of the respondent are from difference department.

Table 2: Descriptive Statistics of General Knowledge of LOTO

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
B01	70	1	2	1.01	.120
B02	70	1	2	1.01	.120
B04	70	1	2	1.30	.462
B05	70	1	2	1.30	.462
B06	70	1	2	1.39	.490
B08	70	3	5	4.43	.734
B09	70	1	5	2.86	1.671
Valid N (listwise)	70				

Table 2 above shows the descriptive analysis for Part B – General Knowledge of Lockout Tagout (LOTO). From the table above, we can see that the Standard Deviation value for B09 variable is more than 1.0 which contributed 1.671. For B09 variable is refer to critical success of LOTO implementation, majority of the respondents are chosen different answered from each other.

Table 3: Descriptive Statistics of Implementation of LOTO

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
C01	70	1	1	1.00	.000
C02	70	1	3	2.77	.594
C03	70	1	2	1.03	.168
C04	70	1	2	1.61	.490
C05	70	1	2	1.03	.168
C06	70	1	3	2.70	.598
C07	70	1	2	1.53	.503
C08	70	1	4	3.44	1.099
C09	70	1	2	1.07	.259
Valid N (listwise)	70				

In table 3 above shows the descriptive analysis for Part C – Lockout Tagout (LOTO) Implementation. From this section, the standard deviation value must be below 1.0 because it relates to the Lockout Tagout implementation procedure which is safe or not to run. But from the table above, C08 variable contributes more standard deviation values which refers to question of the procedure before removing the lock. The rest of variable is considered acceptable because the value is lower than 1.0.

Next, study about the comparison between variables and set the mean as the indicator of level in every study. From this study, it can give a brief view on what was happening at the organization based on some demographic factor. Statistical Package for the Social Science (SPSS) has been used for Crosstab Analysis to analyse the finding and to make a table.

Table 4: Comparison Company Type and Awareness of LOTO

Company_Type * B05 Crosstabulation

			B05		Total
			Yes	No	
Company_Type	Multinational Corporation (MNC)	Count	36	2	38
		% within Company_Type	94.7%	5.3%	100.0%
	Small and Medium Enterprises (SME)	Count	13	19	32
		% within Company_Type	40.6%	59.4%	100.0%
Total		Count	49	21	70
		% within Company_Type	70.0%	30.0%	100.0%

Table 4 above shows the comparison between company type and those company that providing awareness and implementation of LOTO system. The result shows that 36 out of 38 respondents from the MNC company stated that their company provided awareness and implementation of LOTO. In contrast to the SME company, the result shows only 13 out of 32 respondents. Therefore, it able to determine that SME company less exposed to awareness and implementation about the Lockout Tagout system.

Table 5: Comparison Company Type and Critical Success of Loto

Company_Type * B09 Crosstabulation

		B09					Total
		Employment Involvement	Education and Training	Management Commitment	Time Allocation	All of the Above	
Company_Type	Multinational Corporation (MNC)	15 / 39.5%	3 / 7.9%	1 / 2.6%	6 / 15.8%	13 / 34.2%	38 / 100%
	Small and Medium Enterprises (SME)	7 / 21.9%	12 / 37.5%	4 / 12.5%	1 / 3.1%	8 / 25.0%	32 / 100%
Total		22 / 31.4%	15 / 21.4%	5 / 7.1%	7 / 10.0%	21 / 30.0%	70 / 100.0%

Table 5 above shows the comparison between company type and the critical success of LOTO implementation in organization. In MNC companies, the highest selected variables were Employment Involvement which contributed 15 of 38 respondents. Although SME companies, Education and Training are the highest selected variables.

Finally, based on the findings from data analysis, an initial framework model of Lockout Tagout has been developed. Based on Kumar & Tauseef, there have 6 framework model of LOTO system. [3] Based on result, the framework have been improvise by add up two step, which in yellow box in flowchart 2.
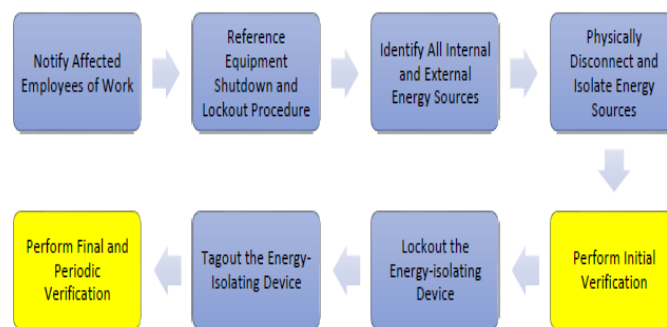
Flowchart 2: Framework Model of Lockout Tagout

This framework explained that how to used the lockout tagout system properly by following step. For verification, the lockout tagout procedure have been developed to ensure identify all isolating energy in equipment or machine and label with specific letter and colour

Figure 1: Lockout Tagout Procedure [4]

In order to enhance the LOTO practices, framework for Lockout Tagout (LOTO) implementation procedure is suggested. In addition, an important purpose of procedures is to ensure consistency. Procedures are designed to help reduce variation within a given process. From the framework above, employees can refer or work as training material before doing a servicing or maintenance work.

4. Conclusion

The focused of this research is on development of a best practice LOTO guideline for manufacturing industries. Three objectives have been developed earlier. First objective is to determine the implementation of Lockout and Tagout (LOTO) in Manufacturing industries in Pasir Gudang, to analyse the status of Lockout and Tagout (LOTO) implementation and to propose the best practice LOTO guideline to the manufacturing industry. These three objectives have been achieved by implementation of methodologies in this research. In the future, the framework model could be tested in Malaysia for further improvement and globally for Manufacturing industries to achieve and benefit their sustainability maintenance.

References

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