

DEVELOPMENT OF AN EFFECTIVE MAINTENANCE STRATEGIES FOR PRESSURIZED EQUIPMENT ACCORDING TO RISK BASED INSPECTION (RBI) IN PRIVATE HOSPITAL

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Abstract

The RBI methodology is commonly used in the oil industry through the API 581 standard. Since no such standard exists in the healthcare industry, the authors have developed one Pilot RBI Table from pressurize medical machine Anesthesia Gas Supply System (AGSS); in private hospital at Johor. The author objective was to determine the current and improper scheduled issues of maintenance method used in the hospital. Therefore, a questionnaire of survey was created, and interview session was conducted to find out what maintenance strategies that hospital used and the issues. It can be concluded that they were aware the present of RBI method. The author develops Pilot RBI Table maintenance strategies for reference propose module of identifying risk and priority equipment. The efficiency of the table by survey was concluded that it easy to understand and complete with information. To validate the outcome from the theoretical research of RBI in the private hospital, the author evaluates the research with expertise in the field of research. However, the Pilot RBI Table still have lacked content that required specific document on the targeted machine. Lastly the strategies of maintenance might be well implemented in the industry

Keywords: Risk Based Inspection (RBI); Anesthesia Gas Supply System (AGSS); Preventive Maintenance (PM)

1.0 INTRODUCTION

Risk-Based Inspection is a methodology intended to settle on choice for inspection planning depend on risk by joining two separate factors: the probability of failure (PoF) and the consequences of failure (CoF). This strategy is utilizing a 5x5 matrix to give the basic assessment. RBI value are utilized to upgrade inspection program and suggest observing testing plans for each bit of equipment (Bollinger et al., 2015). By combining the probability of failure and the consequence of failure, the risk associated with a failure is estimated to illustrate the risk picture, a 5x5 square matrix table is mostly used. Easy way to communicate risk in RBI and Risk Management is:

$$\text{Risk} = \text{Consequence of Failure (COF)} \times \text{Probability of Failure (POF)}.$$

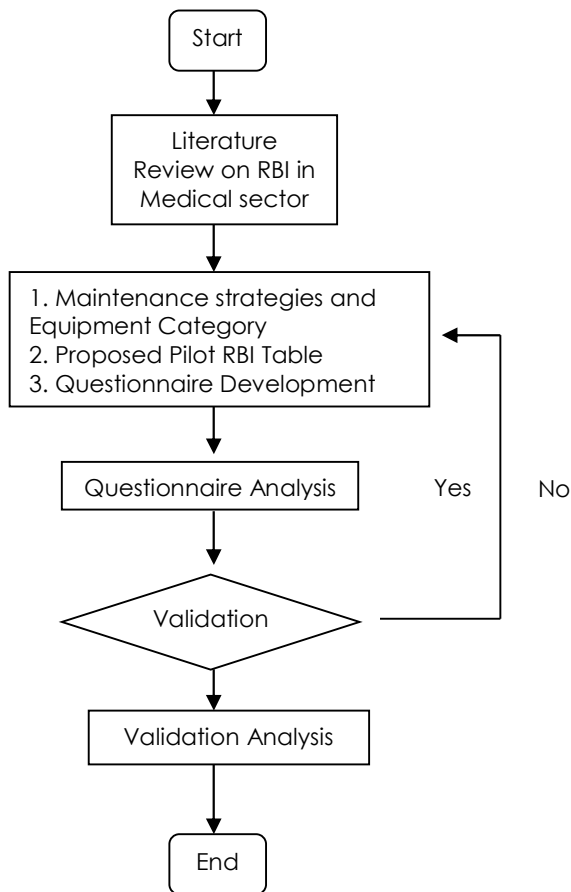
The risk matrix shows three danger levels, recognized through colour.

- **Green** - Low danger - Risk is worthy. For the most part, activity should be taken to guarantee that danger stays inside this district;
- **Yellow** - Medium danger - Risk is satisfactory. Activity, with the goal that move can be made to guarantee hazards don't rise into the red high-hazard locale.
- **Red** - High danger - Risk level is unsatisfactory. Activity must be taken to lessen possibility,

outcome or both, so that danger exists in the
2.0 EXPERIMENTAL

- Research Objective.** The objectives are as follows:
 RO1: To determine the current and improper scheduled issues maintenance method used in the hospital
 RO2: To develop Pilot RBI Table form of maintenance strategies and analyze effectiveness using questionnaire in the hospital.
 RO 3: To validate the outcome from the theoretical research of RB techniques in the private hospital).

Research Flowchart. The flowchart below shows the procedure of research.



Research Scope

The focus of this study was on identifying existing risk assessment maintenance strategies as well as determining the percentage of understanding RBI methodology in hospitals. Only the medical firms Hospital Columbia Asia, Tebrau, Johor are included in the study.

There were fifteen individual responses, all of them were employees from the company's maintenance facilities department and other departments. The

locale

totals of the questions that have been prepared and distributed are thirty. The surveys include four key sections that will be analyzed for respondent responses, including: Demographic Profile, Pilot RBI Table Attributes, Pilot RBI Table Organization, Pilot RBI Table.

Research Material. The figure below shows the proposed Pilot RBI Table of maintenance strategies.

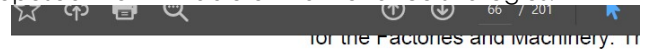


Table 3.2: Risk Based Inspection Pilot Table

No	Part	Function	Degradation Mode/ Mechanism	Causes
1.	Compressor	Electrical machine that convert electrical energy into mechanical	Intermittent	External factor: Temperature Internal

Figure 1: Pilot RBI Table

e) **Matrix table for Pilot R Malaysia)**

Table 3.3: Proba

PoF	PoF Ranking	PoF Description
Very Likely/ Frequent	5	(1) Expected to occur regular normal circumstances (2) Failure has occurred sever year in the location
Likely/ Occasional	4	(1) Expected to occur at some (2) Failure has occurred sever year in the operating company

Figure 2: PoF and CoF Matrix Table



CoF	1	
Safety	Minor injuries or discomfort. No medical treatment or measurable physical effects.	Inj illn req me tre: Ter

Figure 3: CoF description of scale



Probability of Failure (PoF)	(1) Expected

Figure 4: PoF description scale

3.0 RESULTS AND DISCUSSION

Questionnaire Result Tables. Tables below show the result of the survey of questionnaire that has been gathered and analyses.

Section A: Demographic Section

Table 1: Tabulate Data of Respondent Position

	Position			
	Frequency	Percent (%)	Valid Percent (%)	Cumulative Percent (%)
Manager	2	13.32	13.32	13.32
Bio-Engineer	4	26.67	26.67	26.67
Technician	6	40	40	40
Housekeeping	1	6.69	6.69	6.69
Charge man	2	13.32	13.32	13.32
Total	15	100	100	100

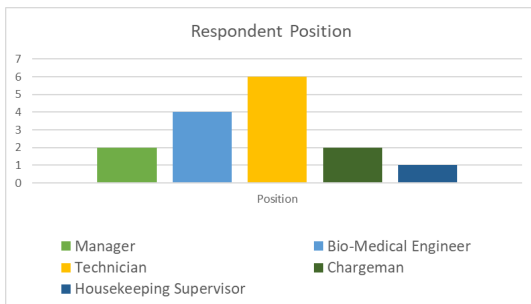


Figure. The bar chart above depicts the frequency of each respondent's role in the company. Figure 4.5 shows that Technician has the largest frequency of respondents, with 6 respondents. Following that, 4 responses from Bio-Medical Engineers, led by both chargeman and Manager with total of 2 respondents. In the respondents from the housekeeping department, have the least frequency, with just 1 responding.

Section B: Pilot RBI Table Attributes

Table 2: Tabulate Data of Respondent Work Experience

Paragraph	



Figures. Based on the figure and table, it shows that the question understandable of relevant staff on Pilot RBI Table. Most respondents choose strongly agree level on this statement. 5 respondents choose agree on the statement of understandable of relevant staff on Pilot RBI Table. There are also 3 respondents who moderate with the statement and no respondent that strongly disagree and disagree the statement which shows the Pilot RBI table is understandable

Section C : Pilot RBI Table Organization

Table 3: Tabulate Data on all departments in the operational hierarchy must be involved in RBI program and training

	Frequency	Percentage (%)	Valid Percentage (%)	Cumulative Percentage (%)
Strongly Disagree	0	0	0	0
Disagree	0	0	0	0
Moderat	3	20	20	20
Agree	6	40	40	40
Strongly Agree	6	40	40	40
Total	15	100	100	100

	Frequency	Percentage (%)	Valid Percentage (%)	Cumulative Percentage (%)
Strongly Disagree	0	0	0	0
Disagree	0	0	0	0
Moderat	3	20	20	20
Agree	6	40	40	40
Strongly Agree	6	40	40	40
Total	15	100	100	100

Figure. Based on the figure, it shows that the question on all departments in the operational hierarchy must be involved in RBI program and

training. Most respondents choose strongly agree and agree level on this statement. 6 respondents choose agree on the statement and another 6 respondents choose strongly agree. There are also 3 respondents who moderate with the statement and no respondent that strongly disagree and disagree the statement which shows the training of Pilot RBI table need to be involved in all department.

Section D: Pilot RBI Table

Table 4: Tabulate Data on implementation of consequences analyses and risk assessment for RBI

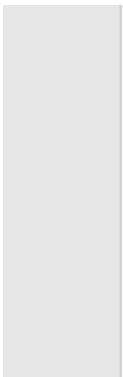
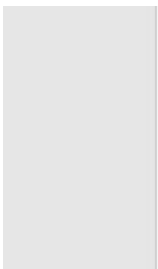
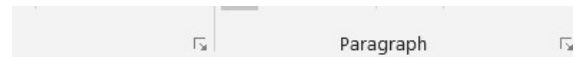


Figure. Based on the figure, it shows that the question on implementation of consequences analyses and risk assessment for RBI. The most of all respondents choose is agree level with total of 8 respondents. Follow by strongly agree level which have 7 respondents. All of the level like moderate, disagree and strongly disagree with total of 0.

Validation Result Tables. Tables below show the result of the survey of validation that has been gathered and analyses from the research field expertise.

Section A: Demographic Section

Table 5: Tabulate data of respondent position



4

Figure. The bar chart above depicts the frequency of each respondent's role in the organization. Figure 4.47 shows that senior lecture has the largest frequency of respondents, with 2 respondents. Following that, 1 response from Senior Mechanical Engineers, led by General Maintenance manager with 1 respondent.

Section B: Pilot RBI Table Attribution

Table 6: Tabulate Data of the content of the framework is appropriate and practical for implementation

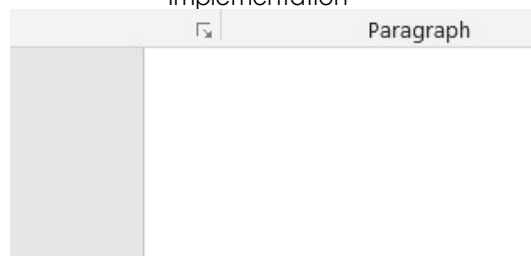




Figure. Based on the figure, it shows that the question content of the framework is appropriate and practical for implementation. Most respondents choose Agree level on this statement with 2 respondents. 2 respondents choose strongly agree and remaining is 0.

Section C: RBI Table Content

Table 7: Tabulate Data on the Pilot RBI Table evaluates failure scenarios, damage mechanisms, and uncertainties

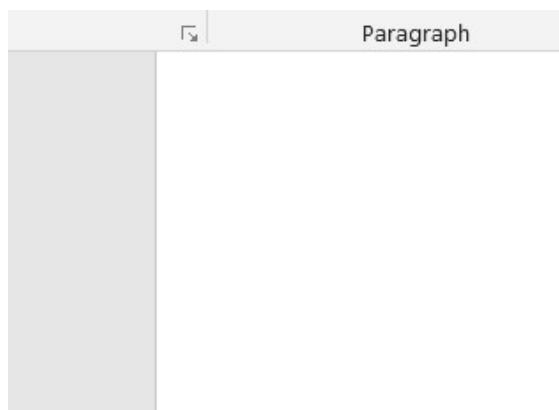
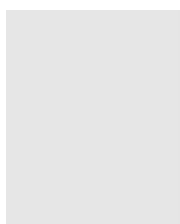


Figure. Based on the figure, above shows that there are 2 of the respondents choose to agree on the statement. Followed by 1 respondent for agree and another on 1 respondent for moderate on the Pilot RBI Table evaluates failure scenarios, damage mechanisms, and uncertainties. Other respondents choose, strongly disagree and disagree has 0 respondent.

4.0 CONCLUSION

Literature References

To summarize, this study was about a pilot RBI table model for machine and medical equipment service and maintenance for management in the hospital. The researchers looked at how medical equipment and machinery are now risk assessed, as well as how they prepare for maintenance and unforeseen equipment failure in the hospital. A survey of maintenance department employees was also conducted to determine their perception of RBI's methodology in risk management for machines and equipment. The thesis was written using a method time research review and observation by interviews conducted with the department over a one-day tour, as well as a survey distributed prior to the site visit. The data was then analyzed and interpreted. And illustrated through transcript and Microsoft excel.

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