Developing a Risk Control Modifying Matrix in Assessing Occupational Stress in Port Terminal

Norwahida Yaakub, Saliza Elias, Huda Zainuddin, Mohd Azhar Mohd Noor, Mohd Rafee Baharuddin

ABSTRACT--- Occupational stress is a universal phenomenon which lead to increase the adverse health effect, performance and general well-being of a worker. These problems need to be assess using a suitable risk assessment matrix. Current method available does not integrate the element of existing risk control measures. In this study, port terminal was chosen as a workplace due to its heavy daily operations.Based on the safety and health data available, a framework of this new proposed matrix was then developed accordingly.Thus, this paper explained the overall process of the development on Occupational Stress Risk Assessment Matrix (OSRAM) which emphasize on a risk control modifying matrix in the port terminal.

Keyword–Occupational Stress, Risk Assessment, Control Modifying Matrix, Port Terminal

I. INTRODUCTION

Port industry is passing through a veryunique phase, continuously evolving and defined as a "*gateway through which goods are transferred between ships and shore*" [1],[2]. Port terminal act as 'hubs' at which transportation system coverage in Malaysia and one of the most complex tasks in the transport industry [3],[4]. Occupational stress has become a worldwide discussion and debate in various forms in workplace including port terminal. While significant advancement has been completed to improve knowledge concerning these issues, there are still gaps in the translation of this knowledge into effective practice [5].[6]–[8]identified occupational stress as a critical factor impacting on human safety behaviour. Several studies have investigated the determinants of occupational stress in port terminals, the reason for such mishaps remain unclear and inconsistency findings. Numerous study has generally supported the proposition that unfavorable working conditions negatively influence psychological and physical health [9]. Factors such as workload [10], excessive work pace (time pressure), lack of meaningfulness, low work autonomy, external disturbances and toxic work system that can pose health damage and disrupt well-being of employees engaged in such poor working conditions [11]. In Malaysia, baseline data or data on measuring occupational stress in all industries including port are limited. In the Western countries, some tools have developed based on annual reports or primary research data. The ways to overcome these issues with to design a simple tool to rank and prioritize the risks and make a decision [12]. The study objective is to develop the occupational stress risk assessment, in directly to calculate the hazard using risk matrix approach in port terminal context.

The limited approaches to understanding the significant risk assessment on occupational stress in port terminal. Risk management is not to reduce at all but to achieve objectives as effectively as possible. An element of uncertainty that relates to an outcome, an exposure, an event or a situation [13], [14]. While a hazard is a potential danger, risk refers to the actual danger. The risk can be identified via direct observation in the whole field process. The previous research revealed that OSH professional lacked systematic risk assessment technique and that they conducted an assessment based on their own experience and knowledge, which limited reliability. The risk of a hazard is determined by the likelihood that it will result in an undesired event and the severity that such an event would have. The equation can describe this relationship:

Risk = Likelihood x Severity ---------- (1)

The occupational stress risk assessment matrix (OSRAM) was developed to solve the problems caused by using unverified tools or a mixture of multiples tools. This matrix is based on the existing occupational model and an enormous amount of literature, thus making it generalized to a number ofoccupational conditions. The purpose of any risk assessment tools is to ensure that the decision process is transparent, based on knowledge and common understanding. This proposed OSRAM was developed to calculate the occupational stress level in a way of semi-quantitative method.

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II. METHODOLOGY

Data Collection

Data was collected from occupational stress questionnaire and perception survey. 304 respondents been selected using simple random sampling. All inclusion and exclusion criteria, for example, a) employees older than 15 years, b) work experience not less than one year, c) employee was not trainee or internship employees d) not under medical treatment or special follow up and supervision from the hospital. The questionnaire been chosen becauseprevious study has stated that this assessment instrument to being one of the comprehensive instruments that suitable to use because it is already tested in Malaysia population [15], [16].

B. *Development of Occupational Stress RiskAssessment Matrix (OSRAM)*

The development of OSRAM consists of two stages involving assessing the occupational stress risk in workplace. First stage, occupational stress risks are referred to Inherent Risk (IR), and the second stage known as Residual Risk (RR). Hazard identification should be carrying out before these two stages started such work activity, hazard involved, cause or effect from hazard and existing control measure. IR is an occupational stress risk that counted the existing control measure, while RR is an occupational stress risk that takes into account the 'modification factor'. In calculating risk matrix, the IR equation should be in 'Likelihood x Severity'. Therefore, risk formula (1) is rewritten as IR in accordance with OSRAM development, as shown in (2). The likelihood and severity values use score as shown Table 1 and Table 2. RR is quantified with (3), which also calculate the 'modification factor' denoted as 'w'. The value of 'w' can be referred in Table 3, where 'w' is computed with (4). IR values can be referred in Table 4 to determine the risk category. Guidelines for the use of Table 1 and 4 are referred to in Appendix A respectively.

IR = Likelihood (L) x Severity (S) ----------(2)

RR = IR – (IR x w) ----------(3)

w = (a + b + t+ e) / 4 ----------(4)

Where:
a = Frequency of OHS audit / inspection,
b = Allocation of OHS prevention budget,
t = Adequacy of OHS training,
e = Effectiveness of OHS control measures.

C. *Field Testing of the OSRAM*

The purpose of field testing is to identify the response and understanding of the process flow use of proposed OSRAM and was tested with the 40 port operation employees who directly involved in operating activities in port terminal. Guidelines for the use answering OSRAM sheet referred to in Appendix B respectively**.** There are few steps stages of the risk assessment conducted in this study are:

1. Decomposition of the task of work and type of activities based on port terminal process;
2. Identification of hazard and the effect of hazard, it can be done by conducting direct observation at the port, the observation made for all activities undertaken at the port;
3. Identification of existing risk control, if any controlled being adopted;
4. Likelihood and severity risk assessment process with attention to obtain Inherent Risk Analysis (IRA).
5. Calculating the amount of risk generated risk formula
6. Modifying factor (w) was calculated on risk value with attention to obtain Residue Risk Analysis (RRA).
7. Risk control or opportunity was proposed after the completion of risk assessment.

D. *Ethical Review and Participant Consent*

Ethical approval for this study was obtained from the Medical Research Ethics Committee of the Faculty of Medical and Health Science, Universiti Putra Malaysia. The purpose, methods, and benefits of the study were explained to all respondents before enrolment. The respondents had a right to decide for against participant in this study and also the right to withdraw from the study at any time without penalty. Written, informed consent of the respondents was taken before enrolment into the study and confidentiality of all personal information was protected.

III. RESULT & DISCUSSION

Based on table 1, the likelihood of the risk assessment matrix consists of 8 contributing factors that lead to occupational stress occurred in the working environment. The factors are: 1) social support, 2) task, 3) recognition, 4) exposure, 5) skilled work, 6) stability, 7) organizational culture and 8) response from customer.

Table 1: OSRAM Likelihood Scoring

Risk Factor		**Social Support**	**Task**	**Recognition**	**Exposure**	**Skilled Work**	**Stability**	**Organizational Culture**	**Response from Customer**
		S	**T**	**R**	**E**	**S**	**S**	**O**	**R**
Almost certain	**5**	>3	>3	>3	>2	>3	>2	>3	>3
Likely	**4**	3	3	3	2	3	2	3	3
Possible	**3**	2	2	2	1	2	1	2	2
Unlikely	**2**	1	1	1	-	1	-	1	1
Rare	**1**	0	0	0	0	0	0	0	0

Note: The marked space (-) for the risk factor means no value is given due to a recorded average value of only oneper weekly or 6 months.

OSRAM is able to capture the contributing element of occupational stress that could be identified in port terminal. In likelihood scoring, two black blank columns because the possible value is 1. There is no lowest number than 1 could put in the table. The value is zero shall place at rare column because it is identified as rarely to occur but the definite potential exists. The discrete likelihood and severity categories can be identified by nominal and textual descriptions such in Table 1 and 2. The categorical should

be placed in order of risk matrix, ie likelihood categories should be ranked from lowest to highest and severity categories from least to most severe [17], [18]. The OSRAM is well defined via three criteria: 1) weak consistency mean each hazard in the red category represent a larger risk than those in green category, 2) betweenness means each positive or lower hazard in the blue category and ends in the red category must pass through a green and yellow risk category, and 3) consistency coloring means that hazards with equal risk level shall have the same colour. The basis of these features of the matrixwas adopted from risk management principle and guideline - ISO 31000: 2009.

Table 2: OSRAM Severity Scoring

Severity Score	Severity Description	Severity Rating
Extreme	Extreme stress-related ill health leading to major permanent incapacity	**5**
Major	Major stress-relatedillness resulting in long term incapacity/ counselling.	**4**
Moderate	Significant stress displayed over a considerable period or ineffectiveness of work	**3**
Minor	Minor concern or worry over a period of time, but responding to local support from manager and colleagues and not requiring time off work.	**2**
Insignificance	Alarm on one-off occasion or short duration having symptom requiring no treatment program	**1**

Table 3: Control Modification Factor

(W)	Value	Description
a1	0.07	Never perform any OHS audits/inspections at the organisation
b1	0.04	Never allocate any OHS prevention budget for the organization
t1	0.05	Never conduct any OHS training for employees at the organisation
e1	0.01	Implementation of existing control measures potentially increases the risk.
a2	0.12	Carrying out OHS audits/inspections once a year
b2	0.14	Allocating occupational health prevention budget between 0.1% and 1% of the total cost of OHS Organization
t2	0.11	Conducting OHS training for employees covering 25% of the training
e2	0.05	Implementation of existing control measures does not change the risk.
a3	0.46	Carrying out OHS audits/inspections two times a year
b3	0.39	Allocating occupational health prevention budget between 1% and 2% of the total cost of OHS Organization
t3	0.47	Conducting OHS training for employees covering 50% of the training
e3	0.38	Implementation of existing control measures slightly reduces the risk.
a4	0.31	Carrying out OHS audits/inspections three times a year
b4	0.41	Allocating occupational health prevention budget between 2% and 3% of the total cost of OHS Organization
t4	0.31	Conducting OHS training for employees covering 75% of the training
e4	0.34	Implementation of existing control measures reduces the risk.
a5	0.04	Carrying out audits/inspections at least four times a year
b5	0.01	Allocating occupational health prevention cost of more than 3% of the total cost of OHS Organization
t5	0.07	Conducting training for employees covering 100% of the training
e5	0.23	Implementation of existing control measures significantly reduces the risk

Table 4: Occupational Stress Risk Assessment Matrix (OSRAM)

		SEVERITY				
		Insignificant	Minor	Moderate	Major	Extreme
		1	**2**	**3**	**4**	**5**
Almost certain	**5**	5	10	15	20	25
Likely	**4**	4	8	12	16	20
Possible	**3**	3	6	9	12	15
Unlikely	**2**	2	4	6	8	10
Rare	**1**	1	2	3	4	5

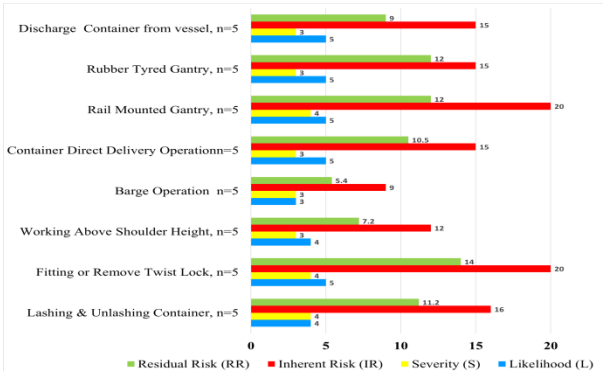
Table 5: Occupational Stress Risk Assessment Matrix (OSRAM) Rating

Risk Rating	Risk Level	Risk	Action
1-3	**Low (L)**	Acceptable	Low risk is no further preventative action is necessary
4-9	**Moderate (M)**	Action Required	Medium risk should be efforts made to reduce the risk.
10-15	**High (H)**	Immediate Action Required (Unacceptable)	High risk is new processes should not be started until the risk has been reduced.

16-25	**Very High (VH)**	Immediate Action Required (Intolerable)	The process should not be started or allowed to continue until the risk level has been reduced

After completing the design risk assessment matrix, the 40 respondent has been chosen to use the OSRAM in order to test the matrix in port application. All respondents gave a full commitment and complete the OSRAM table. There are eight core activities been chosen for field testing, as in Table 8 for lashing and unlashing container the likelihood =4, severity =4, result from inherent risk = 16. The respondent required to identify which control measure been implemented based on Table 3; it will determine the value of residual risk. So, the RR is 11.2. There few activities that the IR is higher than others because some of the likelihood factor was counted in weekly, monthly or 6 monthly occurred. According to the result of risk assessment matrix testing, the highest risk level (IR) was fitting or remove twist lock and rail mounted gantry operation. Other activities with their corresponding risk level also can be observed. Table 6 showed a risk level of each main activities in port terminal. Mitigation measure can be applied until the risk has been reduced to an acceptable residual [21]. Even though, the IR is high, with the activities encounter with correct control measure such audit, training, budget or control the effectiveness. The residual risk will be lower from before. It is important to understand that the concept of risk is dynamic and required to periodically monitor and review.

Table 6: Pictorial diagram for the OSRAM by respondents.



The benefit of occupational stress risk assessment matrix (OSRAM) is for assisting the industrial practitioner and OSH professional in assessing psychosocial hazard risk assessment work and helping employees understand risk existing in their work activities. The OSRAM can provide a semi-quantitative risk assessment by historical accident or complain of the different activities. Prevention requires knowledge about where hazard creates problems, and which way the employees are exposed to occupational health risk [19].

IV. CONCLUSION

After the discovery of the problems that exist in Malaysia industries that risk assessment on psychosocial hazard is lacking, this paper highlighted the need for a systematic risk assessment approach for industrial practitioner including occupational safety and health professional. An occupational stress risk assessment (OSRAM) was designed for the prototype of the efficient semi-quantitative risk assessment tool for promoting occupational health prevention priorities for employees from different industries, activities, and trades.

APPENDIX

The appendix is for guidance in doing assessing occupational stress risk assessment.

Appendix 1: Guidance for the OSRAM likelihood scoring

Occupational Stress Factors	Rating	Description
Social Support	**5**	Likely to occur more than three (3) times in 1 month
	4	Likely to occur three (3) times in 1 month
	3	Likely to occur two (2) times in 1 month
	2	Likely to occur between one (1) times in 1 month
	1	Not expected to occur but still possible
Task	**5**	Likely to occur more than three (3) times in weekly
	4	Likely to occur three (3) times in weekly
	3	Likely to occur two (2) times in weekly
	2	Likely to occur between one (1) times in weekly
	1	Not expected to occur but still possible
Recognition	**5**	Likely to occur more than three (3) times in 6 months
	4	Likely to occur three (3) times in 6 months
	3	Likely to occur two (2) times in 6 months
	2	Likely to occur between one times in 6 months
	1	Not expected to occur but still possible
	5	Likely to occur more than two (2) times in weekly
	4	Likely to occur two (2) times in weekly

Exposure	**3**	Likely to occur one (1) times in weekly
	2	-
	1	Not expected to occur but still possible
Skilled Work	**5**	Likely to occur more than three (3) times in weekly
	4	Likely to occur three (3) times in weekly
	3	Likely to occur two (2) times in weekly
	2	Likely to occur between one (1) times in weekly
	1	Not expected to occur but still possible
Stability	**5**	Likely to occur more than two (2) times in 6 months
	4	Likely to occur two (2) times in 6 months
	3	Likely to occur one (1) times in 6 months
	2	-
	1	Not expected to occur but still possible
Organizational Culture	**5**	Likely to occur more than three (3) times in 6 months
	4	Likely to occur three (3) times in 6 months
	3	Likely to occur two (2) times in 6 months
	2	Likely to occur between one (1) times in 6 months
	1	Not expected to occur but still possible
Response from Customer	**5**	Likely to occur more than three (3) times in 1months
	4	Likely to occur three (3) times in 1 months
	3	Likely to occur two (2) times in 1 months
	2	Likely to occur between one (1) times in 1 months
	1	Not expected to occur but still possible

Appendix 2 : The OSRAM Sheet form

Hazard Identification					Risk Assessment					Risk Control/ Opportunity
					Inherent Risk Analysis			Residue Risk Analysis		
No.	Work activity	Hazard	Which can cause/effect	Existing Risk Control if any	Likelihood (L)	Severity (S)	Risk Value (IR)	Control modifying factor (W)	Risk Value (RR)	Recommended control measures
1	Lashing & Unlashing Container	High volume of work	- Fatigue -poor work life balance	-Toolbox Briefing -Supervison	5	3	15	0.4	**9**	-Cut out unnecessary work -Review workload
		Consistently rapid work	-Tiredness -Lack of attention	-Toolbox Briefing -Supervison	4	4	16	0.3	**11.2**	-Workers job rotation to minimize awkward posture or repetitive movements
		Work difficulties during las & unlash	-Dissatisfaction of work - Increase error during work	-Toolbox Briefing -Supervison	2	2	4	0.3	**2.8**	-Use safe work techniques and team lashing methods
		Direspectful behaviour	-Depression -Tension	-Toolbox Briefing -Supervison	3	4	12	0.4	**7.2**	-Counselling -Work monitoring

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