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Critical Factors for Implementation of Occupational Safety and Health Management System in Malaysian Petrochemical based Manufacturing Companies

Mohammed Murad[1]*, Rahim Jamian[1], Abdul Mutalib Leman[1], Kauthar A Rhaffor[2], Mohd Fauzi Ismail[3]
[1]Department of Mechanical Engineering Technology, Faculty of Engineering Technology, Univeriti Tun Hussein Onn Malaysia, Johor, Malaysia,
*mohammedmurad123@gmail.com, rahimj@uthm.edu.my, mutalib@uthm.edu.my
[2]Manufacturing Section, Universiti Kuala Lumpur Malaysian Spanish Institute, Kedah, Malaysia,
kauthar@unikl.edu.my
[3]Faculty of Mechanical Engineering, Universiti Teknologi MARA, Pulau Pinang, Malaysia,
mohdfauzi305@uitm.edu.my

ABSTRACT

The industrial incidents become worst over the years and seemed to be of a prime concern to the industries involved. In the context of petrochemical based manufacturing industries, the sector has recently gained the reputation of being a highly hazardous field due to its high incidence of accidents and fatality rates. Occupational safety and health management system (OSHMS) is essential for accident prevention, and has become a matter for concern in petrochemical industries. Successful implementation of OSHMS are heavily depends on several contextual factors. This study attempts to investigate the effect of independent variable (IV) of management factor (MF), personal factor (PF), process factor (PRF) and environmental factor (EF) to dependent variable (DV) of the implementation of OSHMS in petrochemical based manufacturing industry in Malaysia. A survey questionnaire was employed and distributed to 41 employees of selected companies. Overall finding reveals there is strong and positive relationship between all contextual factors (MF, PF, PRF, and EF) and the implementation of OSHMS. The study concludes that these critical factors should be considered in planning and implementing OSHMS.

Key words : Critical factors, OSHMS implementation, manufacturing companies, petrochemical industry**.**

1. INTRODUCTION

Safety is often referred to as a condition wherever an individual is protected against injury or loss. In the industrial sector, accidents and injuries caused mainly as the results of human errors with respect to the physical condition or social environment [1]. Occupational accidents and diseases remain the most appalling human tragedy of modern industry and one of its most serious forms of economic waste [2]. One way to prevent harm within the industry is by adopting occupational safety and health management system (OSHMS) [3]. The OSHMS is considered as a set of policies, strategies, procedures, measures, and controls applied to working activities to minimize risks and maximize safety [4].

The utilization of OSHMS is based on relevant safety and health criteria, standards and performance. The system involves in providing a way to assess and enhance the performance in the prevention of workplace incidents and accidents via the effective management of hazards and risks in the workplace. It is and must be capable of being adapted to changes in the business of the industry, and to legislative requirements. Previous studies have discovered the successful implementation of OSHMS can minimize accidents rates in the industrial sectors [5], [6], [7].

Nowadays, OSHMS has become a matter for concern to successful accident prevention in the industrial sector [8]. Nonetheless, the implementation of OHSMS in the industries have challenges and obstacles to their safety performance. This is due to the lack of means or methods to establish a positive safety practice such as inadequate economic incentives to enhance safety, and reluctant to take a vital role in participating in safety and health activitiesby some workers [2]. Previous studies have shown on the importance of health and safety measures in the industries [9], [10], [11], [12], [13]. The studies have investigated the implementation of OSHMS in the industrial sectors. In addition, many researchers have noted major failures in the implementation of OSHMS, and some attempts have been made to identify its continuous improvement by considering several contextual factors including management, personal, process and environment.

In the context of petrochemical industries, the sectors have recently gained the reputation of being a highly incidence of accidents and fatality rates [6]. Despite the reputation of petrochemical manufacturing industry for being the most hazardous workplace in many countries including Malaysia, however, there is relatively lack of study that focuses on the implementation and effectiveness of OSHMS. Therefore, there is an urgency and need to explore the critical factors

towards successful implementation of OSHMS in petrochemical based manufacturing industry in Malaysia. The main objective of this study is to investigate the factors that influencing the effectiveness of implementation, managementand operations of OSHMS. Whereas, the scope covers the parameters required for planning and implementation of OSHMS in petrochemical based manufacturing industries. This paper begins with the introduction to outline the background and overview of OSHMS in the industrial sector. In the second section, methodology is provided about the research design, framework and method. The third section outlines the results and discussion related to the study. Then, this paper highlights the conclusion of the study.

2. METHODOLOGY

2.1.Research Design

Research design refers to an organised plan and scientific investigation into a specific problem, undertaken with the objective of finding solutions [14]. Choosing a research design depends heavily on the type of information desired, the availability of resources, and the capability of researcher to manipulate the independent variables [15]. Therefore, a good research design enables the authors to address the right questions, and to present meaningful findings.

Research design can be grouped into experimental and non-experimental design [16]. The experimental design is concerned with manipulating the independent variable so that its causal relationship with the dependent variable may be established. The experimental research design is associated with the research in physical and biological sciences. In contrast, in non-experimental design, the researcher does not manipulate the variables, and this type of design is mainly used in social science studies. However, this study was not possible to manipulate the independent variable. Thus, a non-experimental design was chosen for this research work.

2.2.Research Framework

The authors developed the research framework as shown in Figure 1 based on literature sources [5], [6], [7]. The framework comprises independent variable (IV) of contextual factors and dependent variable (DV) of OSHMS implementation, respectively.

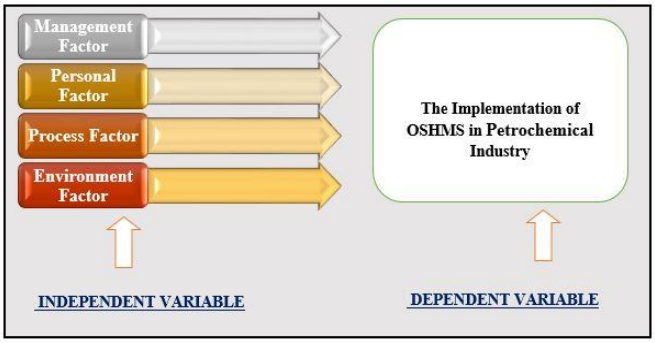

Figure 1: Research Framework

As summarized in Table 1, the construct of IVs are represented by management factors (MF) as IV1 with four items (MF1, MF2, MF3, MF4), personal factors (PF) as IV2 with four items (PF1, PF2, PF3, PF4), process factors (PRF) as IV3 with four items (PRF1, PRF2, PRF3, PRF4), and environmental factors as IV4 with three items (EF1, EF2, EF3). Meanwhile, the implementation, management, and operation (IMO) of OSHMS in petrochemical industry represent the DV.

Table 1: Constructs (Variables) and Items (Factors)

IV/DV	Factors	Code
IV1	**Management Factors (MF):**	
	▪ Management considers employees opinion	MF1
	▪ Management promotes employees involvement	MF2
	▪ Management coordinates policy and commitment	MF3
	▪ Management concerns for safety	MF4
IV2	**Personal Factors (PF):**	
	▪ Meeting between managers and workers	PF1
	▪ Training of workers	PF2
	▪ Incentive for workers	PF3
	▪ Job Promotion	PF4
IV3	**Process Factors (PRF):**	
	▪ Regular safety inspection	PRF1
	▪ Awareness of process flow	PRF2
	▪ Arrangement of process flow	PRF3
	▪ Periodic maintenance	PRF4
IV4	**Environmental Factors (EF):**	
	▪ Work conditions	EF1
	▪ Workplace safety	EF2
	▪ Safety improvement	EF3
DV	**Implementation, Management and Operation of OSHMS (IMO)**	

2.3. Research Method

Research method is a procedure for conducting research process [19], [20]. This research work adopted a quantitative method. Quantitative method for primary data collection in this study deals with questionnaire survey, and secondary data collection is based on literature sources.

Meanwhile, the methods for data analysis in this study include descriptive and inferential statistical analysis. The methods used in this research is not new; the novelty claimed is in the field of the study rather than the methods employed.

A. Data Collection Method

Survey approach was employed in this study as research instrument to collect primary data, where self-administered questionnaires were distributed by hand, postal and online to the respondents. The survey was carried out with 41 respondents from nine companies in Malaysian manufacturing based petrochemical industry. While the past literature are the main sources for secondary data.

B. Questionnaires Design

The survey questions were designed and divided into four parts as follow:

- Part A: Respondent and Organization Profile
- Part B: Factors Implementing OSHMS;
  i) Management Factors (MF)
  ii) Personal Factors (PF)
  iii) Process Factors (PRF)
  iv) Environmental Factors (EF)
- Part C: Implementation, Management and Operations of OSHMS (IMO)

The questions were rated using 5-point Likert scale (1:Strongly Disagree; 2: Disagree; 3: Neutral; 4: Agree, 5: Strongly Agree).

C. Validity and Reliability Tests

Two experts were selected to review and validate the content of questionnaires. The selected academicians are expert in the field of occupational safety and health. In this context, the authors edited the questions to be understandable.

Meanwhile, the reliability test conducted to measure the stability and consistency of the measuring instrument. The respondents involved were required to answer all questions. The internal consistency was measured using the value of the Cronbach's alpha (α) for each item in the questionnaire, which is the most widely method used. Table 2 shows the accepted values of alpha [14].

Table 2: Cronbach's Alpha (α)

Cronbach's Alpha	Internal Consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

D. Data Analysis Method

The statistical tests were performed based on both the descriptive and inferential scales to evaluate the variables. For Part A (Respondent and Organization Profile) of the questionnaire, the data were characterized through descriptive statistical method that was displayed in a form of frequency and ratio. While the others were come in the form of inferential data method.

In addition, such method is mainly utilized to depict the relationship or variable variance by conducting certain statistical tests, and lastly come up with the results of the study [20], [21]. In depth, the correlation test was performed to divulge out the correlation of independent variables (factors) toward the dependent variable (OSHMS).

Furthermore, such investigation is overwhelmingly made to determine the relevance, and thus to figure out the degree of strength of the relevance between the study variables. The relevance among the study factors is pointed out as the correlation, whereas the intensity of correlation in the investigation is lighted by the correlation coefficient value (*r*). In this point, the stronger the relevance among the variables, the closer the correlation coefficient, *r*, where it is ranged in between plus 1 or minus 1 relying on whether the relevance is positive or negative, respectively.

For this study, the intensity of correlation is divulged out according to the size of correlation coefficient as depicted in Table 3 [21]. The data were analyzed using software of statistical package for the social sciences (SPSS).

Table 3: Correlation Coefficient (*r*)

Correlation Coefficient (*r*)	Correlation Strength
0.70 - 1.00	Very strong
0.50 - 0.69	Strong
0.30 - 0.49	Moderate
0.10 - 0.29	Weak
0.01 - 0.09	Very weak

3. RESULT AND DISCUSSION

3.1 Validity and Reliability Test

A. Validity Test

The comments from the expert panel were taken into consideration. Most of the comments were positive response, which proved that the content of questionnaire could be understood.

B. Reliability Test

The reliability of data for the items tested in which 0.86 is the value of Cronbach's alpha coefficient (α). The result implies that the alpha (α) that represent the internal consistency for all variables are above acceptable level. The minimum acceptable reliability coefficient is 0.70 [14].

3.2 Respondent Profile

The profile of 41 respondents from nine petrochemical based manufacturing companies in Malaysia are shown in Table 4. The information comprises the demography of gender, age, job title, and years of experience.

Table 4: Respondent Information and Profile

Profile (N = 41)	Frequency (f)	Percentage (%)
Gender:		
▪ Male	15	36.6
▪ Female	26	63.4
Age:		
▪ Under 20 years	0	0
▪ 21 – 30 years	29	70.7
▪ 31 – 40 years	7	17.7
▪ 41 – 50 years	4	9.8
▪ Over 50 years	1	2.4
Length of Service:		
▪ Less than two years	21	51.2
▪ 2-5 years	12	29.3
▪ 6-10 years	5	12.2
▪ Over 10 years	3	7.3
Position in a Company:		
▪ Director/Management Staff	4	9.8
▪ Supervisory/Technical Staff	10	24.4
▪ Safety & Health Staff	26	63.4
▪ Other	1	2.4

The results depict that the percentage of female respondent (63.4%) is more than male (36.6%). Most of the respondents are young workers within 21-30 years old (70.7%). However, the percentage of respondent with working experience over 10 years is only accounted about 7.3%. In terms of job title, majority of the respondents are the safety and health staffs (63.4%).

3.3 Descriptive Statistical Analysis

A. Management Factors (MF)

Figure 2 shows the analysis results of management factors for implementing OSHMS, which could be divided into sub-factors (partial factors) of management considers employees opinion **(**MF1), management promotes employees involvement (MF2), and management coordinates policy and commitment **(**MF3), and management concerns for safety **(**MF4).

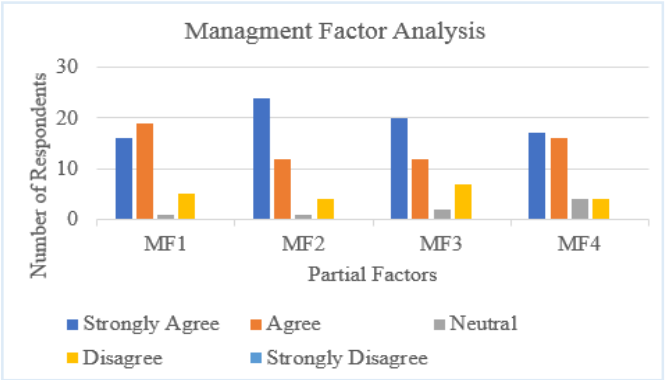

Figure 2: Management Factor Analysis

The results indicate that the responses in general are fall within the score of strongly agree and agree for all factors. In addition, involvement (MF2) obtained highest score of strongly agree by respondents, and followed by commitment (MF3). In this context, these two factors are perceived to be more important than other management factors for successful implementation of OSHMS in petrochemical basedmanufacturing companies. In the other word, employee cooperation in a company enhanced only when management is committed in the improvement activities [7].

B. Personal Factors (PF)

To determine the influence of personal factor on OSHMS implementation in petrochemical based manufacturing company, the authors pointed out four sub-factors (partial factors) that are meeting between managers and workers **(**PF1), training of workers **(**PF2), incentive for workers **(**PF3) and job promotion (PF4). The analysis result of the four personal factors is shown in Figure 3.

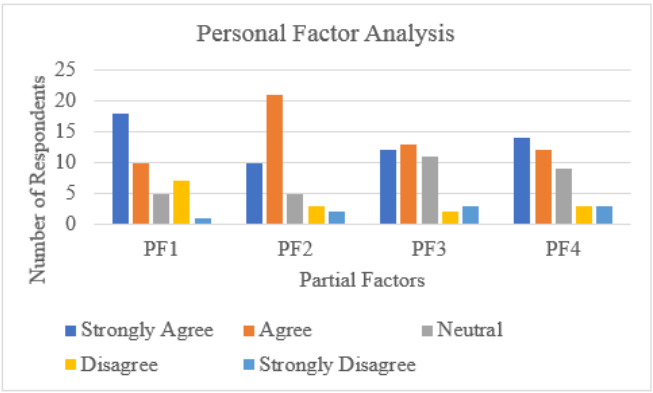

Figure 3: Personal Factor Analysis

The result expresses that there was a consensus on PF1 as the most influence personal factor among the others on the implementation of safety management system in manufacturing industries. Even though the percentages of agreements and disagreements for PF2, PF3 and PF4 are varied from the respondents' perspective, most of the respondents agreed on PF2 as the second personal factor that might influence the implementation of OSHMS. Therefore, meeting (PF1) and training (PF2) should not be taken for

granted in the implementation of OSHMS in petrochemical basedmanufacturing industries. Workers should be trained with adequate safety competency to create a positive safety culture [17], [22].

C. Process Factors (PRF)

Figure 4 depicts the analysis result of process factors, which comprises of regular safety inspection **(**PRF1), awareness of process flow **(**PRF2), arrangement of process flow **(**PRF3) and periodic maintenance **(**PRF4). The result indicates that majority of the respondents strongly agreed on PRF1 and PRF3. Meanwhile, the percentage of agreements and disagreements are fluctuated for PRF2 and PRF4. Thus, PRF1 and PRF3 could be considered as the top two powerful process factors that give effect to the implementation of OSHMS in petrochemical industries.The manufacturing process in petrochemical industries involves complex machines to complete their desired production [23].

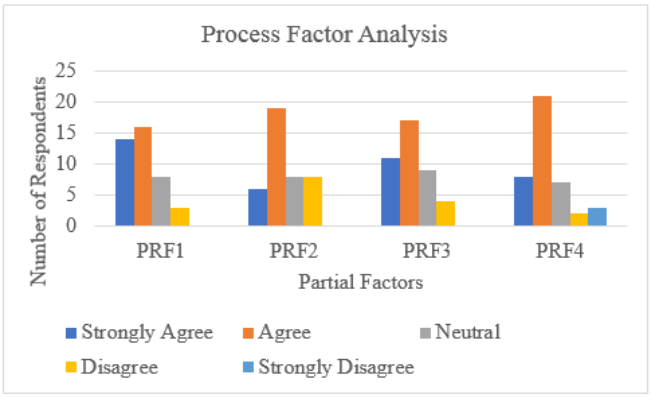

Figure 4: Process Factor Analysis

D. Environmental Factors (EF)

The work environment within the manufacturing plant should not be neglected in achieving successful implementation of OSHMS. In this regard, three sub-environmental factors of work conditions (EF1), workplace safety **(**EF2) and safety improvement (EF3) are taken into account in this study. The result of the analysis for the environmental factors are displayed in Figure 5.

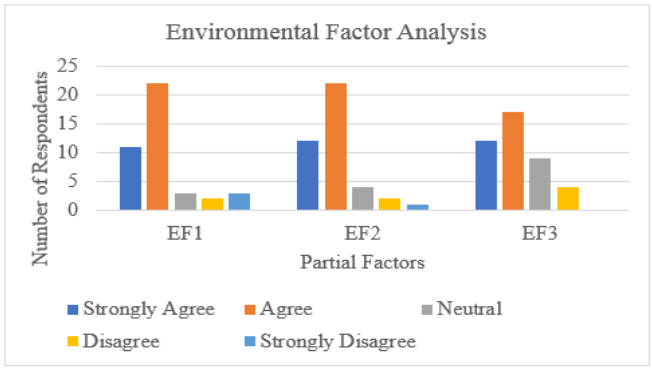

Figure 5: Environmental Factor Analysis

The results demonstrate that both EF2 and EF3 have the significant level of consensus with less disagreement than EF1. Therefore, **w**orkplace safety (EF2) and safety improvement (EF3) should be taken into consideration as the main environmental factors affecting the implementation of OSHMS.The environment conditions at workplace pose longterm threats to health [18].

3.4 Correlations Analysis

Table 5 summarizes the result of Pearson correlation test, which include the strength of relationship represented by correlation coefficient (*r*) between the factors and the implementation of OSHMS. The results highlights that all the factors have significant relationship (*r*> 0.7) with the implementation, management and operations of OSHMS. The results reveals personal factors (PF) have a very strong positive correlation (*r* = 0.96) with OSHMS implementation, followed by environmental factors (EF), management factors (MF) and process factors (PRF). The results also indicate significant relationship among the factors. Previous studies have also discussed the relationship of several contextual factors and OHSMS implementation [5], [6].

Table 6: Correlation Test

Correlation Coefficient (*r*)*	**Factors**	**IOM**	**MF**	**PF**	**PRF**	**EF**
	IOM	1.000	0.952	0.960	0.949	0.958
	MF	0.952	1.000	0.968	0.957	0.967
	PF	0.960	0.968	1.000	0.972	0.978
	PRF	0.949	0.957	0.972	1.000	0.968
	EF	0.958	0.967	0.978	0.958	1.000

*Significant at 0.01 level (1-tailed)

5. CONCLUSION

The implementation of OSHMS has become an important part of management system in the industrial sectors especially for the hazardous industry such as petrochemical companies. Previous studies revealed the success or failure of OSHMS implementation and operations are heavily depends on several contextual factors including management, personal, process and environment.

This study signifies the factors affecting the implementation of OSHMS in Malaysian petrochemical based manufacturing companies. The results highlight the management factor (MF), personal factor (PF), process factor (PRF) and environmental factor (EF) have positive and strong relationship with the implementation, management and operations of OSHMS. Despite of the findings, it would be grateful to pursue further research on identifying the significant relationship between critical success factors and safety management performance in different environment of hazardous industry.

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