

Framework Assessment of the Potential Hazards In the Industry Using Macroergonomics

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Abstract - Danger is the energy source, situation, or behavior that has the potential of causing damage to human harm or cause interference. In fact, in a system that involves a lot of people, occupational safety and health in the organization is very important, so we need an approach that can accommodate the potential hazard assessor system not only consider the human factor as an individual, but also the team and the organization. However, until now have not found a method that judgment. The purpose of this study is to establish a valuation framework of potential hazards in industries that consider technological factors, human, teamwork and organization by using macroergonomics approach. Stages through the development of the framework of data collection were used, selected data categorization, naming concept, categorization, concept, integration of concept and validation of the concept. Based on the results, the potential hazard assessment framework with five step, Identify, Design, Evaluate, Adapt and Control. This framework is named IDEACM (Identify, Design, Evaluate, Adapt and Control of Macroergonomic) Validation framework made directly to the three manufacturing companies since the implementation framework of this study conducted at manufacturing companies that should do a test with comparable companies. Interviewing experts on the potential dangers to the valuation framework macro approach and expert ergonomics K3. IDEACM Framework can be used in manufacturing and other service companies.

Keywords - Framework assessment of potential hazards, Potential hazards, Macroergonomics.

I. INTRODUCTION

Human life on earth is often associated with hazards that could occur anytime. But sometimes the man is never aware of these dangers. Danger is the energy source, situation, or behavior that has the potential of causing damage to human harm or cause interference (OHSAS 18001: 2007). In general, the danger is something that could potentially cause harm. Losses can be a health problem or injury to persons (workers), time lost from work, damage to property, area or workplace, product or damage to the environment, losses in the production process or other damage (Alfatiyah, 2017). Danger can be avoided if people can maintain individual salvation by being more alert to whatever is around them before the danger occurs. Hazards can happen anywhere and anytime, not least when people are working in the work environment.

The working environment is everything related to the work site that includes work infrastructures located around the workers when workers were carrying out work which will influence the result of the work (Suwondo, 2015). Not all of the work environment has been spared from harm. Workers should be aware of potential hazards in their work in order to survive. This is regulated in Law No. 1 of 1970 on Occupational Safety, "Every worker has the right to protection for his safety in doing the work for the welfare and increase the production and productivity of National".

According to research conducted International Labor Organization (in Ibrahim et al., 2015) showed that every day an average of 6,000 people die, the equivalent of one person every 12 seconds, or 2.2 million people per year due to illness or accidents related to work they. In Indonesia, according to the Social Security, number of accidents recorded in 2008, namely 93 823, in 2009 as many as 96 314, while in 2010

recorded 98 711 cases of occupational accidents. The data shows that cases of work accidents on a national scale are relatively high and increasing every year (Ibrahim et al., 2015). This accident cases are usually solved by metide potential hazards, but this method still has drawbacks.

Weaknesses of the potential hazards approach completion method are discussion of ergonomics. Ergonomics more look towards the working posture, frequency and workload without seeing the whole organization of work (Fernandes et al., 2015). Whereas in systems that involve many organizations is a very important factor, so this is where the need for an approach that can accommodate the potential hazard assessor system considers not only the human factor as an individual but also the team and the organization. However, until now have not found the method.

On the other hand, there is a different approach that does not just look at all the problems of the potential dangers of the micro ergonomics but also the macroergonomics. According to Hendrick and Kleiner (2002), ergonomics macro is an approach sosioteknik from top to bottom that is applied to the design of the system overall working at various levels of interaction ergonomics micro-like humans-work, human-machine and human-software with the aim of optimizing the design working system and ensure the system is running with a harmoniously working. Ergonomics macro instrumental in designing some of the sociotechnical system in relation to the "organization man" and "technology". In some previous studies used a macroergonomics approach in designing the product (Purnomo et al., 2014), education (Mayang et al., 2013) and system design work (Purnomo et al., 2011). But there has been no finding of the study that discusses the macroergonomics and potential hazards. Therefore, we need an assessment framework potential hazards in industries that use macroergonomics approach so that the framework is expected to serve as a useful reference for the latest settlement way in finding a better solution.

This study aimed to establish the potential hazard assessment framework in the industry with ergonomic mendekatan macro.

II. RESEARCH METHODS

The study began with a literature study to gather the information required in the implementation of the Thesis. Literature that is used as a reference for the theory among other books and scholarly works such as journals, proceedings etc. related to the macroergonomics, potential hazards and Occupational Health and Safety (K3). Journals are used have a span that is from 2013-2018 or the last 5 years. Then

proceed with the formulation of the problem of how the proposed framework in the industry assessment of potential hazards using macroergonomics approach?. Furthermore, setting goals is to build a framework of potential hazards in industrial assessment using macroergonomics approach.

The following are the steps Making Framework Assessment of hazard as follows:

1. Phase Collecting Data Used
2. Categorize stage of Selected Data
3. Naming Stage Concept
4. Stage Concept Categorization
5. Phase Integration Concepts
6. Concept Validation Phase

III. RESULTS AND DISCUSSION

Manufacture Framework Assessment of hazard

Making the assessment framework potential hazards by using macro-ergonomics approach. The steps in this method is as follows:

1. Stage for Data Used

Finding the data used is the initial stage in the creation of a framework. It aims to facilitate researchers in the development of the framework in order to be relevant. Finding the data used can be derived from the company, experts K3, journals, books, ebook and regulations relating to the potential hazards, egonomi macro, accidents and development of the framework. These data were obtained directly from the internet and the company, after receiving data that has been searched, then continued on the stage of categorization of data to avoid mistakes of determining the data used in the manufacture of the framework.

2. Categorize stage of Selected Data

Phase categorize the selected data is the stage of classifying the data that has been obtained. Categorization of data aims to facilitate the penyusan concept. The data that is relevant in the development of the framework are grouped according to the discussion. Category of the selected data is the data that is associated with the element of macroergonomics and safety. Data related to the macroergonomics elements that are divided from five groups:

- a. Humans are made up of experiences, expertise and past education,
- b. Organizations consisting of rewards, incentives and policies K3,

- c. The technology consists of machinery, equipment and information systems technology,
- d. Environment consisting of noise, temperature, humidity, lighting, work stations and layout,
- e. The work consists of jobs that require attention, production targets and work schedules, while the potential dangers in the form of photographs and data of occupational accidents and their causes.

3. Naming Stage Concept

Naming concept stage is the stage in giving the name of each concept based on previous research obtained from some previous research results related to the assessment of potential hazards. Stages in the process of naming concept, first read the literature review related to the design framework such as the data that has been considered in previous stages. It aims to ensure that the data that has been categorized in accordance with the requirements in naming concept. Both compile literature to create a naming concept can be seen as follows:

a. Danger

Danger is a condition or state of good in people, equipment, machinery, aircraft, installations, material, mode of operation, the nature of work, the production process and environment that could potentially cause interference, damage, loss, accident, fire, explosion, pollution and occupational diseases (Government Regulation No. 50 of 2012).

b. Work accident

Occupational accidents are adverse events associated with the work that resulted in injury or death to persons, damage to property or interruption of the production process (Government Regulation No. 50 Year 2012).

c. Assessment of potential hazards

Assessment of the potential hazard is a step split type - the type of hazards that exist through the provision of hazard value depending on the type of risk that may arise from the hazard identification that has been done (Krisnadinata et al., 2019).

d. Identify (identification)

This phase is carried out to see potential hazards occur, but the identification can be developed with Another approach to the reduction of potential hazards (Eveleigh et al., 2016; Sari et al., 2017). Identification covering all aspects of the workplace (Bahn, 2013). The aspects of the workplace in the form of machines, work assignments, work environment, knowledge workers, the management system and the ability

of workers (Bahn 2014; Govender et al., 2014; Kumar et al., 2015; Johnston et al., 2015; Hafida et al., 2017; Walimuni et al., 2017).

e. Design (Design)

Design (Design) is the stage to create a new system plan or improve existing systems to be better (Hafida et al., 2017).

f. Evaluate (evaluation)

Evaluate (Evaluation) is the stage to assess the results of the overall design to seek conformity design objectives (Shaluf et al., 2015).

g. Adapt (Adaptation)

dapt (Adaptation) is made after the evaluation stage. This stage will be carried out if there is a mismatch, then adaptations are made to the design to fit the purpose (Bahn, 2014).

h. Control (control)

After the adaptation phase in the previous stage, the results should be documented assessment of the potential hazard from happening in the future. Stages to control potential hazards assessment documentation is called Control (control) (Chun et al., 2012 Hafida et al., 2017; Walimuni et al., 2017).

Having obtained a variety of concepts of references is as described above, the third phase is to give the name of the concept by reference or literature. This framework uses elements of the macroergonomics appropriate naming based on previous research, to the framework of this study are as follows: a. Identify, b. Design, c. Evaluate, d. Adap, e. Control. This is because these names correspond to the needs of this study, so that the name of this research framework is IDEACM (Identification, Design, Evaluate Adaptation and Control of Macroergonomics).

4. Stage Concept Categorization

The purpose of this step is to categorize the characteristics of the concept, usability concepts and categories corresponding element in this framework. This is done prior to the integration concept. The following table shows the categories of existing concepts.

No.	Name of concept	Characteristic concept	Use of concepts	Reference	Element category
1.	<i>Identify</i>	1.Important issues to be examined 2. Realistic	To look for problems in research	Bahn, 2014; Govender <i>et al.</i> , 2014; Kumar <i>et al.</i> , 2015; Johnston <i>et al.</i> , 2015; Hafida <i>et al.</i> ,2017; Walimuni <i>et al.</i> , 2017	Human , Organization, Technology, environment, Job
2.	<i>Design</i>	1.Method 2.Provide solution	To design settlement of the problems that occur	Chun <i>et al.</i> ,2012; Widodo <i>et al.</i> ,2014	
3.	<i>Evaluate</i>	1.Relevant 2.Specific	To see the suitability of the design result with the purpose of the study	Shaluf <i>et al.</i> ,2015	
4.	<i>Adapt</i>	Rational	To adjust the design that has been evaluate	Kumar <i>et al.</i> , 2015; Johnston <i>et al.</i> , 2015	
5.	<i>Control</i>	1.Whole 2.continue	To control the design result that has been adjusted	Chun <i>et al.</i> ,2012 Hafida <i>et al.</i> ,2017; Walimuni <i>et al.</i> , 2017	

5. Phase Integration Concepts

Integration concept stage is the stage combine the respective concepts that have been categorized. This stage aims to make it easier to understand the flow framework from start to finish. As for the stages framework IDEACM soon is as follows:

1. Stages in this framework starts from an identification problem based on element macroergonomics,
2. Then proceed to the stages of designing (design) which aims to make improvements of existing problems. At the design stage, the tools used in this framework is the analytical hierarchy process (AHP). AHP is used as a tool due to a decision by an expert in the field.
3. The next stage is the stage of adaptation are steps being taken after the evaluation phase.
4. Evaluation phase, this phase is done in order to get the proposal in accordance with the purpose.
5. After the adaptation phase in the previous stage, the results should be documented assessment of the potential hazard from happening in the future. Stages to control potential hazards assessment documentation is called Control (control).

6. Concept Validation Phase

Validation is useful to look at the framework can already be used as the settlement of the problem or not. If the framework during the validation phase is declared invalid by the expert the framework must change according to the input by experts, but if otherwise valid, the framework can be implemented on a company case studies, as well as in other companies that want to use the framework as a solution to the problem of potential hazards ,

Kind of validation that is used is the Content Validity (Validation content). Content Validity (Validation of contents) is one type of validation that is how it is used is done by using the idea of a 'panel' consisting of experts. Validation framework made directly to the three manufacturing companies since the implementation framework of this study conducted at manufacturing companies that should do a test with comparable companies. by interviewing experts (experts K3) regarding the potential dangers valuation framework macro approach to ergonomics and an expert K3.

In the table below shows the results of the validation to the experts involved in the validation process framework. Based on the results table below, the framework that has been created is declared invalid by any expert. Then the framework can be used in the manufacturing companies have some concerns on the potential dangers in the company. Potential hazards and ergonomic elements macros used can be adjusted in each other's company when using the framework.

No.	Expert	Valid / Invalid
1.	PT. A	valid
2.	PT. B	valid
3.	PT. C	valid
4.	experts K3	valid

IV. CONCLUSION

This research has succeeded in designing a framework assessment of potential hazards to consider ergonomic factors macro, so named Framework IDEACM (Identification, Design, Evaluate, Adaptation and Control of Macroergonomics), divided into five stages, namely: identification , design, evaluation, adaptation and control ,

Framework that has been made and declared valid by four experts K3 then implemented in PT. Males Kunango Pekanbaru. The result obtained in the form of the draft proposed improvement assessment form a potential hazard.

Framework IDEACM (Identification, Design, Evaluate, Adaptation and Control of Macroergonomics) can be used in manufacturing companies and other service companies, only companies that will use this framework needs to adjust the macroergonomics elements to be used according to the characteristics of the problems in the respective companies respectively.

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