

The Cost and Benefit on the Investment in Safety and Health of the Enterprises in Thailand

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Abstract—The purpose of this study is to evaluate the monetary worthiness of investment and the usefulness of risk estimation as a tool employed by a production section of an electronic factory. This study employed the case study of accidents occurring in production areas. Data is collected from interviews with six production of safety coordinators and collect the information from the relevant section. The study will present the ratio of benefits compared with the operation costs for investment. The result showed that it is worthwhile for investment with the safety measures. In addition, the organizations must be able to analyze the causes of accidents about the benefits of investing in protective working process. They also need to quickly provide the manual for the staff to learn how to protect themselves from accidents and how to use all of the safety equipment.

Keywords—Cost and benefit, enterprises in Thailand, investment in safety and health, risk estimation.

I. INTRODUCTION

MANY technologies such as those in telecommunication, logistics, consumption, production sectors have been developed to satisfy everyone in the organization. However, available resources are scarce and cannot satisfy. Therefore, it is essential to effectively manage all available resources in order to maximize their utilities and all capital invested. This is an important matter for such entrepreneurs, if they want to achieve their business target and cope with the current economic conditions. When considering an occupational health and safety issue in Thailand, it is inevitable to address costs of such preventive measures. It is widely acknowledged that a preventive measure can be used to reduce the production cost [1]. Therefore, in order to encourage administrative personnel in Thailand to invest on the occupational health and safety, it is necessary to impose a legal requirement on this matter. However, this is not simple task because the benefits, which were gained from the investment in the occupational health and safety, are not always easy to be calculated in the monetary term. Hence, it is difficult for entrepreneurs to see the benefits from the investments [1]. There is an idea that if such benefits received from the investment in occupational health and safety can be shown in financial term, then entrepreneurs may be motivated to make an investment in this matter. This idea becomes an interesting topic in Europe. It can be seen through many studies on the relations between the costs and financial

benefits gained from the investment in occupational health and safety [2]. For entrepreneurs, there are many economic assessment tools available for assessment of the benefits received from the investment. Entrepreneurs can also employ either external contractors or their internal authorities to do this job. However, the economic assessment on the benefits received from the occupational health and safety measures is very sensitive issue [2]. This is because entrepreneurs would not want their trade secrets known to the public (3), for instance, the statistics on accidents occurred, unsafe conditions inside their factories, or information on salaries of their employees. Therefore, it will be very helpful if there is the self-assessment on the investment in occupational health and safety available to those entrepreneurs. The researcher is interested in the topic “the self-assessment on the investment in occupational health and safety”. In order to study this topic, one factory producing electronic devices was chosen as a sample. The CERSSO's Tool Kit (the TK), which was developed for the textile industry, was applied to the data gathered from this factory in order to justify whether the TK could also be used in the electronic devices production factory. This would help entrepreneurs to realize the importance of economic tools in assessing benefits gained from the investment in occupational health and safety as well as encourage them to invest in preventive measures to prevent possible injuries and accidents.

II. LITERATURE REVIEW

A. *The CERSSO's Self-Evaluation with the Costs-Benefits Method on the Investment in Occupational Health and Safety*

The Regional Center for Occupational Safety and Health (the CERSSO) was established in 2001 by the US Ministry of Labour. Its Headquarter is located in San Salvador, Al Salvador and there are branches in 5 Central America Countries –Belize, Panama and Dominican Republic. The main projects of the CERSSO with the support from the Department of Labour of the regional government are to work with employees and participating operators in that regions as well as to educate local organizations, local communities and labor unions [3].

The CERSSO supports the local governments to develop the strategic plan which suits their unique environment in order to effectively implement laws, educate local people about the domestic occupational health and safety. The Tri-Committee on Occupational Health and Safety was established by the support from the CERSSO, and the

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CERSSO still currently continues to support this Committee. For entrepreneurs, the CERSSO has developed 'the self-evaluation tools' in the areas of dangers in workplaces, the analysis on costs and benefits which immediately shows the result in term of money, the reduction of dangers in workplaces including injuries and illness.

Amador-Rodezno has studied the overall evaluation of the CERSSO on costs-benefits in the investment in occupational health and safety. The CERSSO's Tool Kit was created in 2001 by the cooperation between the Pan American Health Organization (PAHO) and The Regional Occupational Safety and Health Center (Centro Regional de Seguridad Salud Occupational: CERSSO). This TK was aimed to allow personnel within a particular organization to be able to assess costs and benefits from the investment in occupational health and safety if they do not want to reveal certain information or protected information which considered to be 'secret' to that organization. Many personnel in many organizations (approximately 2,500 people from 736 organizations in 8 countries) have used this TK and revealed that substantial amount of money would be lost if there was no the investment in occupational health and safety. Many organizations which used the self-evaluation Tool Kit accepted that it was very useful and could be well applied within their organizations. The CERSSO's TK is designed to allow a particular organization to assess itself on the amount of money that will be lost if there is no the investment in occupational health and safety. This Tool Kit has been sufficiently developed to help users collect the data easily. It helps gathering data on risks, medical data, engineering data, and other relevant data altogether. There are 6 steps in this Tool Kit as follows: 1. Define the importance of problems, causes and results by using 3 data: 1.1 Risk factors in the operation are the preparation of data to be used for the analysis of primary risks from the operation either from various working divisions or workplaces. It is the management of a large amount of data by identifying the riskiest conduct in the operation. In this operation, the riskiest conduct was the step of sewing bags which had 32 parts of 164 total risk parts. 1.2 Risk factors from the operation by workers are the assessment on each worker's risky conduct to identify which conduct is more risky than other. In this case, the sewing operation was the riskiest conduct [4].

The chance that each work would encounter the risk is then calculated in percentage and used in consideration with other factors. 1.3 Effects from the risk to health of workers is the relationship between the risk and effects to health of workers. It is to identify which risk will affect health of workers. The importance of problems, causes and results in the sewing operation which relate with 3 topics - risk factors in the operation, risk factors on each worker's conduct, and effects from the risk to health of workers, could be summarily calculated in percentage [5].

Risk factors which have the highest percentage are the injuries resulting from the cut accidents, the repeating movement, and compulsory acts, sitting during the operation,

the long-term operation, the work boundaries, and the work agreements. 2. The Risk Assessment It is to identify the level of risk by the intersection between the expected probability of the effects to occur and the expected seriousness of effects to health. The results from the assessment are classified into 5 levels. The risk which has the highest level will be taken into the evaluation on costs and benefits [6].

III. METHODOLOGY

The data which was studied is the data in 2010 which there was an investment in the occupational health and safety system. When applying the CERSSO's method, the first and the second steps are not followed (identifying the problem and evaluating level of risk), because the entrepreneur has already identified the problem and evaluated the level of risk. Therefore, in choosing the production process, these criteria were applied: Completeness of the data considering expenses for the investment in the occupational health and safety, data related the accidents, all incurred expenses as consequences of accidents; Have good cooperation from the administration and workers; The statistics of the accidents are available. When the case was chosen, the third step of the CRESSO method (preventive measures) was considered.

A. Collect Data

The collected data comprised of primary and secondary data. The primary data was collected from the subjects, the workers in the production. The subjects were interviewed about the production process, operation steps, and the investment in occupational health and safety in their workplace. The subjects were working in the Standard Section. There were 11 members in the group. These members were chosen as subjects for the interview by focusing on members responsible for the standard on OHSAS18001 in their workplace. There were 6 members were chosen as the - subjects for the interview. The interview was subject to their voluntary participation basis [7].

B. Data Analysis Method

This study is a descriptive research. The researcher would conclude the result and describe whether the use of CERSSO tools could be applied to the electronic devices industry or not. Also, there would be an analysis whether or not the CERSSO tool was completeness and reliable.



Fig. 1 Research Conceptual Framework

IV. FINDINGS

A. The Result for the Analysis of Costs and Benefits

The analysis on costs and benefits considered the benefit-cost ratio which was calculated from the benefits divided by

the costs. The ratio was calculated from all expenses spending on accidents plus all avoidable expenses divided by costs from the investment on preventive measures [7].

To conclude the result from the self estimation on costs and benefits from the investment in occupational health and safety by using data on 2010 and the estimation, which were based on the data on the preventive measures, direct, indirect, and other general expenses collected in according to the TK forms, it was found the evaluations on the first part on the preventive measures was 80,639.19 baht, the direct expenses were 12,102.92 baht, indirect expenses were 5,356,022.34 baht, and other general expenses was 1,265.93 baht. When adding the loss resulting from accidents occurred, the total amount was 5,369,391.19 baht. This amount was higher than the expenses for the preventive measures on occupational health and safety by 5,288,752.00 baht. The Benefit - Cost ratio equaled 66.59, which was higher than 1. This meant it was a worthwhile

investment. When calculating the Benefit – Cost ratios in all cases, it was found that the ratios were 85.71 in case study 1, 99.41 in case study 2 where a worker fell down in the production area, and 5.76 in case study 3 where a worker fell down in the production area. This showed that the ratios in all cases were higher than 1. In the case of the estimation, the evaluation found that the expenses for preventive measures were 77,766.83 baht, direct expenses were 1,104.6 baht, indirect expenses were 81,687.96 baht, and other general expenses were 272.05 baht. When add the amount with losses resulting from accidents, the total amount became 83,064.61 baht. This amount was higher than the expenses investing in the preventive measures in occupational health and safety by 5,297.78 baht [8].

The Benefit-Cost ratio equaled 1.07 which was more than 1; therefore, it was worthwhile to invest in the preventive measures as well.

TABLE I
 THE BENEFIT-COST RATIO OF CASE STUDY

Case Study	Preventive investment (Baht)	Total costs of accidents and illness that were avoided (Baht)	Benefit-cost ratio
Case Study 1	60,956.25	5,224,451.96	85.71
Case Study 2	337.94	33,593.86	99.41
Case Study 3	19,345.00	111,345.37	5.76
Case Study 1-3	80,639.19	5,369,391.19	66.59
Case Study estimation	77,766.83	83,064.61	1.07

B. The Result from the Calculation of Expenses for Preventive Measures

The result from the calculation of expenses for preventive measures on all 3 cases can be summarized as follows:

The Expenses on preventive measures which has been carried out by estimating incurred expenses per year.

Case Study 1: A worker's hand was hit by a machine: The worker aged 29 years old and had been working for 4 months was injured by the machine. During controlling the machine L16-52, the worker saw the warning light turned red, which meant the machine stopped its working cycle, as well as saw the oil stopped pouring and assumed that the machine stopped working. The worker used his right hand to take the parts of computer chips out of the machine, but the machine started to work again. All raw materials as well as the hand were pulled into the machine. This resulted in a hand injury by a boring (a picking tool), or a small hook, inside the machine. The worker was sent to an infirmary and later on was transferred to have an operation in a hospital. The hand was injured both front and back sides, 2 stitches for the front and 3 stitches for the back side were required [9].

Case study 2: A worker fell down in the production area: A worker who normally worked in the Line Blast came to replace his colleague, who went for a break, in the Line Air Blow Auto. The job was putting parts into the machine. One worker control 7 machines at a time. During the operation, there were 2-3 machines simultaneously gave signal for putting parts into them. The worker rushed to put parts into all machines and fell down and the worker's head hit the machine

tray leaving the left eyebrow injured. A stitching in an infirmary was required before being able to go back to work.

TABLE II
 COST OF PREVENTIVE MEASURES FOR THE STUDIED CASE IN 2010

Measures	Cost
Case study 1	
Lamps	50,650.59
Labor cost for changing new light bulb	239.01 Baht
Costs of the tools taking parts of Chip out of the machine	2,790.00 Baht
Labor cost for installing a new program	3,159.21 Baht
Cost for training the workers	878.82 Baht
Labor cost for attending workers	3,238.62 Baht
Case Study 2	
Anti-slip	310.76 Baht
Labor cost for installing a new Anti-slip	27.18 Baht
Case Study 3	
Cost of improving the floor condition by installing the Epoxy	16,137.22 Baht
Labor cost for installing the Epoxy	3,207.78 Baht
Total	80,639.19 Baht

Case Study 3: A worker fell in the production area: A worker was walking in the production area and fell down after using the Microscope. Worker's hip was hit and injured. The boss firstly sent the worker to an infirmary but was later informed that the worker had serious pain, so was sent to a hospital. However, the worker could come back to work after that. After the incident, the worker asked for a sick leave for 1 day because of having had pain in the hip area.

V. CONCLUSION

From the case of the falling down accident caused by a slippery floor in the production area resulting from the spreading of oil mist, the preventive measure was the installation of an Oil mist collector to decrease the amount of oil mist from the machine. This measure had the benefit in term of additional money saved from the reuse of the oil, which is omitted in the researcher considers that the said return was the benefit incurred from the investment [10]. Therefore, the data should be applied and inserted into the 'Calculation of the prevention cost' and the form 'Estimation of the Prevention Cost'. Therefore, if any entrepreneur wanted to use the TK, they must include the benefits resulting from the preventive measure, which is not calculated in CERSSO's TK, to the calculation. 2. From the study, it was found that the ratio of benefits and costs obtained from the TK had different values in the same accident scenario. In all three falling down accident cases, the ratios were 99.41/1, 5.76/1, and 1.07/1 respectively. The preventive measure employed in the case dated 29/09/2010 by installing the Anti Slip on the floor had the cost of 337.94 baht per year. The preventive measure employed in the case dated 15/12/2010 by improving the floor condition to prevent it from being slippery had the cost of 19,345.00 baht per year. In the case of the installing the Oil mist collector in order to decrease the amount of oil mist leaked out from the machine had the cost of 77,766.83 baht per year. When considering the ratios for benefits against costs in all cases, it was found that the investment in the first case was the best for the investment because the cost in the investment was the lowest. However, when considering the measure itself, it was still possible that an accident could still occur and become cost to the entrepreneur. The case which has been studied did not fully comply with the risk assessment provided by CERSSO's TK. Rather, it was from the case which had already occurred. Therefore, an entrepreneur must assess all relevant risks and analyze which preventive measure is suitable to address all accidents and worthwhile for the investment in preventing the accident to re-occur and minimizing all possible losses. 3. The TK could be applied to many types of accident. From the literature reviews, this tool could also be applied to the accident of needle stung injuries in the textile industry. In this study, this tool was applied to the machines crushing hands and falling down accidents in the electronic devices production industry. If any entrepreneur encountered many types of accident, the TK could be a good tool to evaluate the worthiness of the investment to prevent such accidents. However, in applying this tool, the user should take into account other missing aspects. The first was to take all benefits occurred from the preventive measure into account when calculating the ultimate costs of such investment in order to get the correct result [10].

Another was to acknowledge that the investment in the preventive measure must focus on the root cause of problem in order to effectively prevent the accident to re-occur. 4. An entrepreneur must carefully analyze the cause of accident

occurred with the available model by applying the TK to that accident. However, the user must analyze in detail the cause of the accident occurred because knowing the root cause of the accident would lead to the proper solution and prevention of such accident. Therefore, the user who would use the TK should be an occupational health and safety officer or personnel who had such knowledge on the cause of accidents in order to evaluate the case properly [9].

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