OSH Hazards Risk Assessment Using AHP Technique – A Case study of an Electronics Manufacturing Company

Kanesan Muthusamy
Faculty of Engineering and Technology
UCSI University, 56000 Kuala Lumpur. Malaysia
kanesan@ucsiuniversity.edu.my

Joses Shem John David
Faculty of Engineering and Technology
UCSI University, 56000 Kuala Lumpur. Malaysia
josesshem95@gmail.com

Shannen Darshini Surasan Nair
Faculty of Engineering and Technology
UCSI University, 56000 Kuala Lumpur. Malaysia
shannendarshini@gmail.com

Nagesparan Ainarappan
Faculty of Engineering and Technology
UCSI University, 56000 Kuala Lumpur. Malaysia
victor@ucsiuniversity.edu.my

Abstract

This study aims to recognize safety and health-related hazards in a selected electronics manufacturer in Malaysia and perform a risk evaluation on the hazards found. The standard operating practices, accident records, computer operating manuals, and expert judgments were used to recognize the safety and health hazards. The Analytical Hierarchical Process (AHP) methodology was used to compute the risk evaluation and render the correct judgment by considering both qualitative and quantitative aspects of the judgment. In this analysis, the quantitative score of the Saaty's AHP (1-9) scale was used. Experts score through questionnaires, and the scores were revised and improved further via online interviews. The listed hazards were measured pairwise against the three main criteria of severity, probability of occurrence, and cost to avoid. In this study, the selected manufacturing organization listed a total of six hazards. The scores were calculated using Business Performance Management Singapore (BPMSG) tools, which provides the researcher with concrete, simple, and effective results. This case study's findings will be used as a template for the organization to continuously improve workplace safety and health hazards.

Keywords
Occupational Safety and Health (OSH) Hazard, Analytical Hierarchical Process (AHP), Risk Assessment

1. Introduction
The International Labour Organization estimates that more than 2.78 million deaths result from workplace accidents or work-related illnesses annually (ILO 2017). Around 374 million non-fatal injuries occur each year. In 2018 14.78 million eligible workers were registered (DOSH 2019). The total number of injuries at work was 35, 460 and the total number of deaths was 611 in 2018. Besides, 7,258 cases of industrial poisoning and diseases have also been recorded. According to Department of Occupational Safety and Health (DOSH) 2018 Annual report figures, Malaysia's industrial injury rate had decreased from 4.90% of 1 000 employees in 2017 to 4.14% in 2018. After a decrease in percentage, Malaysia has expressed concern over unreported OSH injuries.

The total number of occupational accidents were 35, 460, and the total number of occupational deaths was 611 in 2018. Apart from that, 7,258 cases of occupational poisoning and diseases were reported in Malaysia as per statistics by DOSH 2018 Annual Report. The accident rate in Malaysia's industrial accidents reduced from 4.90% out of 1,000 workers in 2017 to 4.14% in the year 2018. Despite the reduction in percentage, the Ministry of Human Resources, Malaysia, voiced concerns about unreported OSH accidents (DOSH 2019).

The DOSH (2018) in their annual report states despite being able to reduce the number of accidents every year from 2017 to 2018 from 4.90% to 4.14% of accidents, the number of unreported occupational safety and health-related is unknown more. Secondly, the number of accidents and deaths in the manufacturing industry and the state of Selangor is high compared to other sectors and states. There is a need for risk assessment in the manufacturing industry because the statistics show that the manufacturing industry has the highest number of OSH accidents in Malaysia. Thirdly, based on the literature review conducted, studies on OSH which employs the AHP technique in Malaysia is seen to be very few upon identifying the hazards a risk assessment will be done using the AHP technique, where the identified hazards will be checked against some essential criteria, and a weighted result will be produced to rank the risk accompanied with BPMSG software.

1.1 Objectives

This research illustrates the importance of the safety management method for a selected manufacturing company. This research would use the Analytic Hierarchy Process (AHP) technique to emphasize the process of safety management in the management of workplace overall OSH. The objectives of this research are to identify the OSH hazards in the selected electronics manufacturing company using primary and/or secondary data, to compute the risk assessment of the identified OSH hazards using the AHP technique and to prioritize the risk using the AHP technique incorporated with a modern engineering tool or software.

2. Literature Review

In this literature review, a few scopes will be studied. Firstly, research on the definition of risk and risk assessment. DOSH defines risk as "A combination of a hazardous event or exposure with a defined duration or under specified circumstances and the extent of injury or harm to the health of individuals, properties, environment or any combination thereof caused by the event or exposure. According to DOSH, risk assessment is the process of approximation and evaluation of the risks from hazards in consideration of any existing controls' suitability and to decide if the risk is acceptable or not. Risk assessment was described as the mechanism by which the magnitude of the danger was measured and whether the risk was acceptable (Kokangül et al. 2017).

Secondly, a literature review on the available risk assessment methods used by other researchers. In practical terms, several qualitative, quantitative, and hybrid risk assessment methods are used in the real world (Kokangül et al. 2017). The risk assessment techniques used can be divided into quantitative and qualitative approaches. More than 70 forms of risk assessment are categorized into two qualitative and quantitative categories across the world (Mathews et al. 1997). The variety of risk analysis methods is such that there are many appropriate approaches for each scenario, and the option has become something of a question of preference. Many research studies have been performed based on historical evidence to determine risk in construction industries using conventional methods such as probabilistic risk analysis and fault tree analysis (Majumder et al. 2013).

Besides that, a study is also done in identifying the methods in obtaining data on accidents. Aminbaksh et al. (2013) provided a framework for a case study on risk assessment during the planning and budgeting of construction projects. This framework divides the judgment problem into a set of sub-problems more readily known, each of which can be separately evaluated. Figure 1 shows the reference to identify hazards at the workplace. The guideline also recommends the checklist method to determine occupational safety and hazards.

A literature review was conducted in identifying the factors that influence a risk assessment process. Three criteria were used in a study to identified hidden hazards in the CNC operation process, where it includes the possibility of occurrence, severity, and cost to avoid. The researcher explained that the likelihood of occurrence is the measurement of how frequently the hazard occurs. The severity is the seriousness of the consequences of the hazards and the cost to avoid is the financial investment needed to avoid the hazard (Racz et al. 2020). The DOSH Ministry of Human Resource Malaysia reported that the probability and severity of danger are the two critical

criteria used to rate hazards. Majumder et al. (2013) used three input parameters: i) accident parameters, ii) accident severity, and iii) expenses in maintaining safety measures.

Documents and information to identify hazards.
Any investigation of any hazardous occurrence.
Records on first aid and minor injury.
Health protection programs at workplace.
Workplace inspection results.
Complain and comments of employees.
Studies and assessments related to workplace health and safety.
Occupational Safety and Health Act, 1994 regulations reports.
Hazardous substances record.
Any other relevant information.

Table 1. The documents and information to identify hazards.

The following literature review is conducted in identifying the factors that influence a risk assessment process. Three criteria were used in a study to identified hidden hazards in the CNC operation process, where it includes the possibility of occurrence, severity, and cost to avoid. The researcher explained that the likelihood of occurrence is the measurement of how frequently the hazard occurs. The severity is the seriousness of the consequences of the hazards and the cost to avoid is the financial investment needed to avoid the hazard (Racz et al. 2020). The DOSH Ministry of Human Resource Malaysia reported that the probability and severity of danger are the two critical criteria used to rate hazards. Majumder et al. (2013) used three input parameters: i) accident parameters, ii) accident severity, and iii) expenses in maintaining safety measures.

Finally, a review is done on the existing AHP risk assessment conducted by researchers. In recent research, the AHP was successfully applied to cases of risk analysis. For the risk assessment report conducted on shoulder and neck discomfort, the AHP techniques were employed. For that research, priority was given to the effect of different risk categories on pain in that specific area (Padma & Balasubramanie 2007). A case study was done in a giant machine manufacturing company in Turkey where the level of importance and risk classes of hazards could be determined in parallel with the AHP method (Kokangül et al. 2017). Yulong et al. (2008) used an AHP approach in the safety risk evaluation of satellite communications systems and calculating the satellite communications system is facing risk condition. Aminbaksh et al. (2013) used the AHP technique to classify hazards in the construction industry based on their level of importance during the project risk assessment stage. Badri et al. (2013) reviewed risk assessment in Quebec's underground mining operations and carried out tests using the AHP approach to include 250 possible hazards. Zhang et al. (2009) used the Analytic Hierarchy Process (AHP) to evaluate the marine accident due to human factors by calculating the matrix.

3. Methodology

3.1 Background of AHP

Saaty (1998) claimed that the Analytical Hierarchy Process (AHP) is a comprehensive multi-criteria decision-making (MCDM) methodology that integrates qualitative information. AHP includes breaking down complicated unstructured multi-criteria judgment problems into a hierarchy comprised of different levels in terms of a primary goal. This approach helps assess the weights of hierarchically non-structured or unique hierarchical class requirements for those at a higher rank. With AHP, the decision-maker chooses the alternative that better fits decision requirements and generates a numerical score to rate any alternative based on how well each alternative suits them.

3.2 AHP Process

Step 1: Definition of problem

For this study, the goal is to conduct a risk assessment of the OSH hazards. This goal can only be achieved using OSH hazard identification in the selected manufacturing company. The AHP methodology is selected based on the literature review conducted on risk assessment studies.

Step 2: Identification of criteria and alternatives

Based on the literature review, the most common criteria for assessing the risk OSH hazards are severity, probability of occurrence, and cost to avoid. Caputo et al. (2013), Racz et al. (2020), Kim et al. (2010), and Majumder et al. (2013) used the probability of occurrence, severity, and cost to avoid in their study of risk assessment. The DOSH also strongly suggests the usage of both criteria in OSH risk assessment. Figure 1 shows the selected criteria for OSH risk assessment. The criteria from literature review were selected because the data provided by the company includes the probable injuries and injuries caused by the hazards, how frequent a hazard happens and the types of solution to avoid or minimize the hazards.

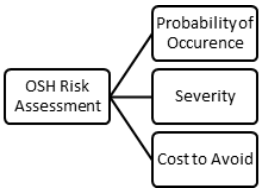


Figure 1. Selected criteria for risk assessment

Step 3: Construction of a hierarchical framework

The first step is to break down the problem of a goal into its respective parts. In its simplest form, such structure consists of a target or objective at the highest level, criteria (and sub-criteria) at the middle stage, whereas the low level includes the alternatives. Arranging all the elements in a hierarchy gives a holistic view of the complex relationships. Figure 2 shows the proposed hierarchical framework.

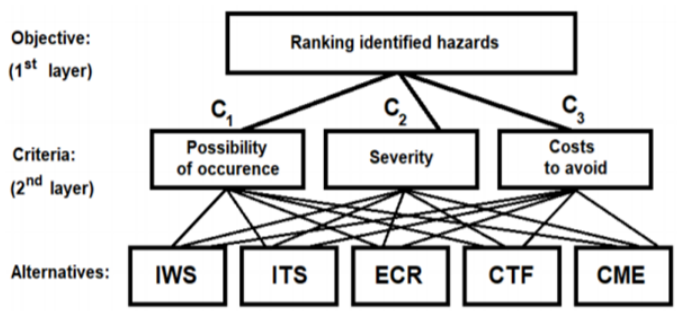


Figure 2. The hierarchical framework model [Adapted from Racz et al. 2020]

Step 4: Pairwise comparison of criteria and alternatives.

The comparison between the elements is made using the AHP-9 scale suggested by Saaty (2008). Table 2 shows the AHP-9 scale that will be used in this study. For this study, three selected experts from the selected manufacturing company will make the pairwise comparison. The experience of the experts will be the key to determining the most accurate score.

Table 2. The 1-9 scale for pairwise comparison

Importance intensity	*Definition*	Explanation
1	Equal importance	Two activities contribute equally to the objective
3	Moderate importance of one over another	Experience and judgement slightly favor one over another
5	Strong importance of one over another	Experience and judgment strongly favor one over another
7	Very strong importance of one over another	Activity is strongly favored and its dominance is demonstrated in practice
9	Extreme importance of one over another	Importance of one over another affirmed on the highest possible order
2,4,6,8	Intermediate values	Used to represent compromise between the priorities listed above

Step 5: Calculating the comparison matrix.

Table 3 below is the main criteria matrix proposed for this study. The scales in diagonal positions X_{11}, Y_{22}, and Z_{33} are always equal to one. The other scales are filled accordingly based on the experts, incorporating the AHP (9) scale. The next step requires the normalization of matrices. This step incorporates Eq. (2), (3), and (4) to obtain the normalized value. After the weight vector has been obtained, it is multiplied by the element's weightage at a higher level. The cycle is repeated for each level until the top of the hierarchy is reached. The overall weightage is then obtained in respect of the objective for each alternative decision. The alternative with the maximum weightage value should be deemed the best option.

Table 3. Proposed main criteria matrix.

Criteria	Severity, C1	Probability of Occurrence, C2	Cost to Avoid, C3
Severity, C1	1	3	5
Probability of Occurrence, C2	1/3	1	3
Cost to Avoid, C3	1/5	1/3	1

$$B = [b_{ij}] \tag{2}$$

$$b_{ij} = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}} \tag{3}$$

$$eigenvector, w = \frac{1}{n}\sum_{i=1}^{n} b_i \tag{4}$$

Step 6: Consistency checking

Checking for consistency of the proposed comparison value. The checking of consistency begins by determining the maximum eigenvalue. Maximum eigenvalue can be checked using Eq. (5). The consistency ratio is determined using Eq. (6). The value of the Consistency Index (CI) is determined from Figure 3. The value selected for the size of the matrix is three because the matrix consists of three criteria. The obtained value should be less than 10% to show that the proposed comparison value is consistent and accurate [9].

$$\gamma max = \frac{1}{n}\sum_{i=1}^{n} \frac{(Aw)i}{wi} \tag{5}$$

$$R = \frac{\gamma max - n}{CI} \tag{6}$$

Size of Matrix (*n*)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Random average *CI* (*r*)	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.51

Figure 3. Random Consistency Index (RCI) Values

4. Data Collection

4.1 Questionnaire

A questionnaire was constructed, and its sample is shown in Figure 4. This questionnaire was designed as an online questionnaire. This questionnaire is aimed to collect the AHP scales from the experts from the selected company. AHP (9) scale, as shown in Table 1**,** was used in this questionnaire.

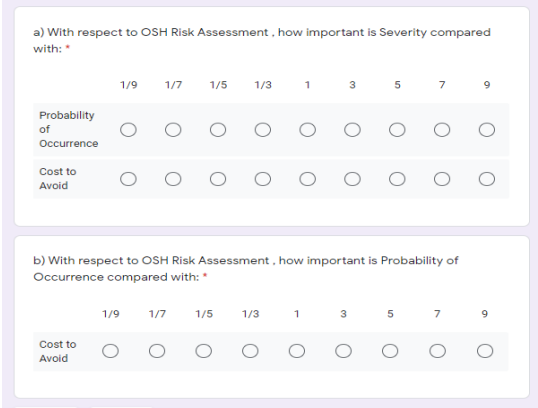


Figure 4. AHP Questionnaire.

4.2 Phone Interviews

Phone interviews are done in two parts of this study. Firstly, the researcher will obtain the data of the selected company's hazardous activities. If it was found for any unclear data, the researcher proceeds for a phone interview with the person in charge of the selected company. This interview clarifies any misinformation of the data and further obtains hazardous activities based on experience and judgment. Secondly, when the questionnaire is returned to the researcher, the experts are later scheduled for a phone interview. This interview is done to discuss further the scales provided by the experts.

4.3 OSH Hazards

Based on interviews and communication via email, Table 4 shows the identified hazardous activity obtained from the selected company.

Table 4. The identified hazards from a selected company with abbreviations

Alternatives	Abbreviations
Lifting TV from carton to table and vice versa	LTV
Transporting TV to the main building	TTV
Long hours sitting in front of PC	LHS
Exposure to vibration during a vibration test	ETV
Cutting hazard during polystyrene cut	CHP
TV drop test	TVD

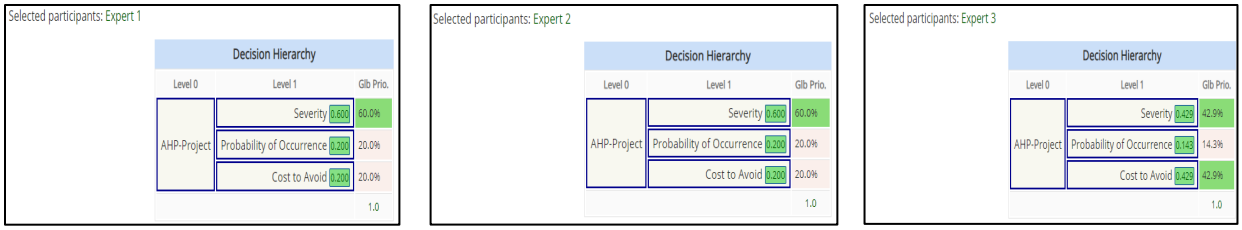
5. Results and Discussion

5.1 Main Criteria and Alternatives Results

A) Main Criteria with respect to the goal

The main criteria weightage for Expert 1 is 0.600 0r 60%, 0.200 or 20%, and 0.200 or 20% for severity, probability of occurrence, and cost to avoid, respectively. The main criteria weightage for Expert 2 is 0.600 0r 60%, 0.200 or 20%, and 0.200 or 20% for severity, probability of occurrence, and cost to avoid, respectively. The main criteria weightage for Expert 3 is 0.429 0r 42.9%, 0.143 or 14.3%, and 0.429 or 42.9% for severity, probability of

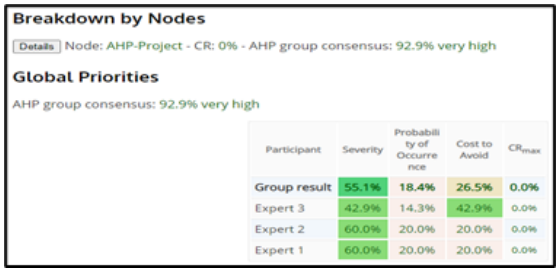
occurrence, and cost to avoid. Figure 5 shows the sample results for Expert 1, 2, and 3 of the main criteria weightage.



(a) Expert 1 (b) Expert 2 (c) Expert 3

Figure 5. The weightage for the main criteria of expert

The consolidated weightage for severity is 0.551 or 55.1%, the probability of occurrence is 0.184 or 18.4%, and the cost to avoid is 0.265 or 26.5%. This consolidated weightage has a consistency ratio of 0% and has an AHP group consensus of 92.9%. Figure 6 shows the consolidated weightage produced by the software.



Breakdown by Nodes

Details Node: AHP-Project - CR: 0% - AHP group consensus: 92.9% very high

Global Priorities

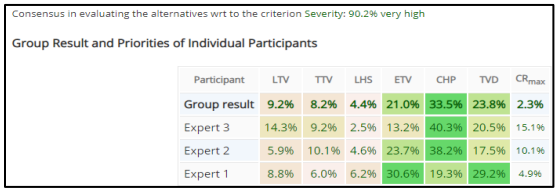
AHP group consensus: 92.9% very high

Participant	Severity	Probability of Occurrence	Cost to Avoid	CR_{max}
Group result	55.1%	18.4%	26.5%	0.0%
Expert 3	42.9%	14.3%	42.9%	0.0%
Expert 2	60.0%	20.0%	20.0%	0.0%
Expert 1	60.0%	20.0%	20.0%	0.0%

Figure 6. The consolidated weightage of the main criteria

B) Severity with respect to alternatives

Severity is an indicator of how severe the effects of the hazards under consideration are. The consolidated weightage for alternatives with respect to severity are 0.092, 0.082, 0.044, 0.210, 0.335, and 0.238 for LTV, TTV, LHS, ETV, CHP, and TVD, respectively. The consolidated result's consistency ratio is 2.3% and has an AHP group consensus of 90.2%.



Consensus in evaluating the alternatives wrt to the criterion Severity: 90.2% very high

Group Result and Priorities of Individual Participants

Participant	LTV	TTV	LHS	ETV	CHP	TVD	CR_{max}
Group result	9.2%	8.2%	4.4%	21.0%	33.5%	23.8%	2.3%
Expert 3	14.3%	9.2%	2.5%	13.2%	40.3%	20.5%	15.1%
Expert 2	5.9%	10.1%	4.6%	23.7%	38.2%	17.5%	10.1%
Expert 1	8.8%	6.0%	6.2%	30.6%	19.3%	29.2%	4.9%

Figure 7. The consolidated weightage of alternatives concerning severity.

Table 5. shows the ranking of alternatives concerning severity. The result shows that CHP has the highest risk in terms of severity. Based on the company's data, this activity has the possibility of causing minor cuts, puncture wounds, and deep lacerations. LHS is ranked the lowest in risk. A study by Canadian Centre for Occupational Health and Safety (CCOHS) states that limited mobility leads to injuries in the muscles, bones, tendons, and ligaments responsible for movement. Another factor is the constant, localized tension in specific body areas. The lower back and neck are the most affected areas. While the severity caused by LHS is severe, but it happens in the long term only. The short-term effect includes tired eyes and leg cramps, thus explaining the lowest rank in severity.

Table 5. The ranking of consolidated alternatives weightage concerning severity.

Category	Weightage	Rank
CHP	0.335	1
TVD	0.238	2
ETV	0.210	3
LTV	0.092	4
TTV	0.082	5
LHS	0.044	6

C) Probability of Occurrence with respect to alternatives

The probability of occurrence represents how frequent the hazards may occur. The consolidated weightage for alternatives with respect to probability of occurrence are 0.121, 0.051, 0.322, 0.107, 0.198, and 0.200 for LTV, TTV, LHS, ETV, CHP, and TVD, respectively. The consolidated result's consistency ratio is 4.2% and has an AHP group consensus of 67.9%. Based on the results, LHS was found to have the highest weightage and TTV with the lowest weightage. Figure 8 shows the consolidated weightage for alternatives concerning the probability of occurrence.

Consensus in evaluating the alternatives wrt to the criterion Probability of Occurrence: 67.9% moderate

Group Result and Priorities of Individual Participants

Participant	LTV	TTV	LHS	ETV	CHP	TVD	CR_{max}
Group result	12.1%	5.1%	32.2%	10.7%	19.8%	20.0%	4.2%
Expert 3	17.2%	3.2%	49.1%	5.3%	10.8%	14.4%	9.9%
Expert 2	6.4%	8.6%	6.9%	12.9%	37.3%	27.9%	12.0%
Expert 1	9.0%	2.5%	53.0%	11.8%	10.9%	12.7%	14.8%

Figure 8. The consolidated weightage of alternatives concerning the probability of occurrence.

Table 6. shows the ranking of alternatives concerning the probability of occurrence. The results show that LHS is ranked highest in terms of probability of occurrence. LHS is an everyday activity in this selected company because of the time spent designing tasks on the desk. LTV and TTV are physical work that only will be done by contracted foreign workers. This activity is only supervised by the experts, thus explaining the probability of occurrence being in the lower third. On the other hand, ETV is a vibration test, where is not done as frequently as the drop test.

Table 6. The ranking of consolidated alternatives weightage concerning the probability of occurrence.

Category	Weightage	Rank
LHS	0.335	1
TVD	0.238	2
CHP	0.210	3
LTV	0.092	4
ETV	0.082	5
TTV	0.044	6

D) Cost to avoid with respect to alternatives.

The cost to avoid reflects the financial commitment required to avoid or mitigate the presence of the hazards. The consolidated weightage for alternatives with respect to severity are 0.072, 0.087, 0.149, 0.250, 0.144, and 0.297 for LTV, TTV, LHS, ETV, CHP, and TVD, respectively. The consolidated result's consistency ratio is 1.3% and has an AHP group consensus of 60.4%. Based on the results, TVD was found to be with the highest weightage and LTV with the lowest weightage. Figure 9 shows the consolidated weightage for alternatives concerning cost to avoid.

Consensus in evaluating the alternatives wrt to the criterion Cost to Avoid: 60.4% low

Group Result and Priorities of Individual Participants

Participant	LTV	TTV	LHS	ETV	CHP	TVD	CR_{max}
Group result	7.2%	8.7%	14.9%	25.0%	14.4%	29.7%	1.3%
Expert 3	5.8%	6.5%	6.5%	24.5%	8.3%	48.5%	4.6%
Expert 2	4.7%	7.4%	5.9%	16.3%	32.8%	32.8%	3.7%
Expert 1	7.1%	7.1%	47.9%	22.5%	6.6%	8.7%	8.5%

Figure 9. The consolidated weightage of alternatives concerning cost to avoid.

Table 7 shows the ranking of alternatives with respect to cost to avoid. The ranking results in terms of cost to avoid show that TVD requires the highest cost to avoid. LTV is ranked last in terms of cost to avoid.

Table 7. The ranking of consolidated alternatives weightage concerning cost to avoid.

Category	Weightage	Rank
TVD	0.297	1
ETV	0.250	2
LHS	0.149	3
CHP	0.144	4
TTV	0.087	5
LTV	0.072	6

5.2 Final Hazard Ranking

Based on the result computed in the software, the consolidated weightage is 0.259, 0.246, 0.202, 0.123, 0.092, and 0.078 for CHP, TVD, and ETV LHS, LTV, and TTV, respectively. The consistency ratio for the final weightage is 4.2%, and an AHP group consensus of 78.2% was achieved. Figure 10 shows the consolidated final weightage of the OSH Hazards Risk Assessment. Figure 11 shows the final AHP hierarchy with respective consolidate weightage for each level. Table 8 shows the final ranking of hazards from the highest risk to the lowest risk.

AHP group consensus: 78.2% high

Participant	LTV	TTV	LHS	ETV	CHP	TVD	CR_{max}
Group result	9.2%	7.8%	12.3%	20.2%	25.9%	24.6%	4.2%
Expert 3	12.6%	7.4%	12.1%	14.7%	26.4%	26.8%	4.6%
Expert 2	5.7%	9.1%	5.3%	19.7%	36.6%	23.5%	3.7%
Expert 1	8.4%	5.6%	25.9%	25.0%	14.4%	20.7%	8.5%

Figure 10. The consolidated final weightage for OSH hazards risk assessment.

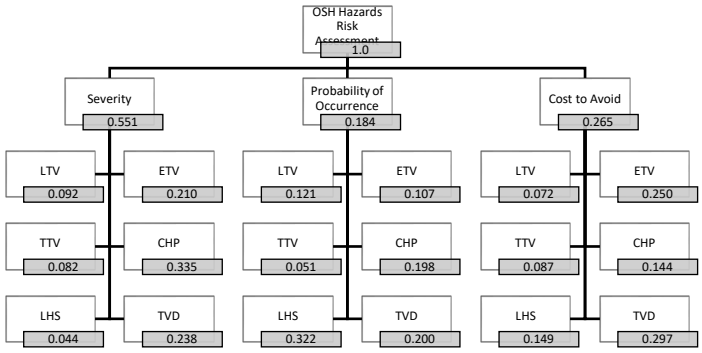


Figure 11. The AHP hierarchy with final weightage

Table 8. The final ranking of hazards.

Category	Weightage	Rank
CHP	0.259	1
TVD	0.246	2
ETV	0.202	3
LHS	0.123	4
LTV	0.092	5
TTV	0.078	6

This study shows that CHP is the most hazardous activity in the selected company based on evaluation with three main criteria severity, probability of occurrence, and cost to avoid. Based on this result, it shows that administrative control is not enough in minimizing the risk. Thus, implementing an anti-cut glove is necessary for making sure that these hazards can be further avoided or minimized. Secondly, TVD is ranked as the second-highest risk hazard. Currently, the usage of safety boots is being implemented in this activity. TVD hazards can be further avoided by implementing automated drop test equipment.

The third-ranked risk is the ETV. Currently, only the usage of earplugs is implemented to minimize the risk on safety and health, which is only suitable for the short term. To further improve in the long run, a monitoring device can be installed to minimize the exposure and the magnitude of exposure. The LHS was ranked fourth; the company currently only implements administrative control in terms of awareness and reminding the employees of proper posture during sitting. If the company decides to investigate the long-term effects of LHS, implementing an ergonomic chair and adjustable height table will minimize the severity of the long-term effects.

Finally, LTV and TTV are ranked fifth and sixth, respectively. In all evaluations of main criteria, LTV and TTV were consistently ranked in the bottom three category, thus explaining the lowest risk among all the other hazards. The severity of these hazards is very low because it typically involves injuries that can be recovered faster. The awareness of posture and hand gloves usage is pervasive throughout the company, thus minimizing the accidents.

5.3 Validation

The consensus reached in this study is high at 78.2%. Goepel (2013) states in the study that any percentage of 85% and above has a very high consensus, and a percentage of 75% to 85% are considered a high consensus. Values below 50% suggest that there is little or no agreement within the team and a wide range of opinions. Values in the 80–90% range suggest a high degree of overlap in goals and definitive agreement among group members' judgments. This study affirms the result of the AHP consensus is within a desirable level of consensus.

In terms of consistency ratio, the final CRmax is 4.2%. This result can be further supported by Goepel (2013) where it states AHP provides for (logical) discrepancies in judgments; the AHP consistency ratio CR is a measure of this, and CR does not reach 10% significantly as a rule of thumb. Even though it is observed that Expert 1 and 2 has 14.8% and 12.0% went evaluating the alternatives with respect to probability occurrence, Aull-Hyde et al. (2006) states that when the geometric mean is used to combine, regardless of the accurate measurements of the individual comparison matrices, consistency of the aggregate comparison matrix is ensured given a sufficiently large group size. In other words, individual CR does not affect the overall CRmax. Goepel (2019) also states that to accept answers with a CR more significant than 10%, preferably up to 20%, based on the project's nature and goal.

6. Conclusion

This research has met all the stated objectives. The first objective is to identify the OSH hazards in the selected electronics manufacturing company. This objective was achieved by obtaining industrial data from the selected company. Two modes of collection of data were done. First is obtaining an existing accident report from the company through email, where the Excel file of the data was sent to the researcher. Secondly, potential hazards were obtained using communication through telephone, where the researcher interviewed the experts to identify potential hazards based on observation and experience. The second objective was to compute the risk assessment of the identified OSH hazards using the AHP technique. This goal was met by conducting a literature review of existing studies that utilized the AHP methodology. This goal was met by conducting a literature review of existing studies

that utilized the AHP methodology. The article was studied to obtain the criteria which influence the risk assessment of OSH hazards. The third and final objective was to prioritize the risk using the AHP technique incorporated with a modern engineering tool or software. This study uses an online software named Business Performance Management Singapore (BPMSG) AHP Online System.The risk was prioritized by evaluating the weightage produced by the software. The results produced in this study were further evaluated with existing articles and studies to ensure that this study's modal is reliable and supported by other studies. This study shows that AHP methodology can be implemented in any risk assessment situation and produce results if the qualitative approach is taken.

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Biographies

Kanesan Muthusamy received the Ph.D. degree in Information Engineering (Operations Research) from the Osaka University, Japan. In the past, he has held various engineering and management positions with Robert Bosch, Motorola, and Panasonic. Currently, he is an Asst. Professor with the Faculty of Engineering and Technology, UCSI University, Kuala Lumpur, Malaysia. His research interest includes OR/OM, TQM, Project Management and OSH. Dr. Muthusamy is a Chartered Engineer registered with the Engineering Council, United Kingdom and Professional Engineer registered with the Board of Engineers, Malaysia.

Joses Shem is an Undergraduate Student with UCSI University, Kuala Lumpur, Malaysia. He has reached the completion of an Undergraduate Degree in Mechanical Engineering and is interested in OSH, TQM and Engineering Management.

Shannen Darshini is an Undergraduate Student with UCSI University, Kuala Lumpur, Malaysia. She has reached the completion of an Undergraduate Degree in Mechanical Engineering and is interested in TQM, Engineering Management and OSH.

Nagesparan Ainarappan received an undergraduate BEng (Hons) degree from the The Manchester Metropolitan University, Manchester (UK) and Master's in Project Management from The George Washington University (US). He held various engineering and management positions with Maxis Communication Bhd. Currently, he is an Asst. Professor with the Faculty of Engineering and Technology, UCSI University, Kuala Lumpur, Malaysia. His research interest includes IoT Based Automation, IoT Based Smart Cities/Interfaces and Project Management, HIRARC/OSH. He is a Chartered Engineer with the Engineering Council United Kingdom, a Professional Engineer registered with the Board of Engineers Malaysia, and a European Engineer of Federation of European Union (FEANI).