Identifying Factors for Sustaining the Zero Accident Vision: A Case of Tire Company in Sri Lanka

Chathurangani J.H.A.D[1] and Asanka D. Dharmawansa [2]

[1] *Department of Industrial Management, Faculty of Applied Sciences, Wayamba University of Sri Lanka, Sri Lanka*

[2]*Department of Industrial Management, Faculty of Applied Sciences, Wayamba University of Sri Lanka, Sri Lanka*

#For correspondence; <chathuranganidilukshi@gmail.com>

Abstract— Zero Accident Vision (ZAV) encourages the vision that accidents are preventable. The objective of this study is to identify the factors which enable, and impede ZAV in a tire industry. Behaviour-based safety may be affected by providing good safety training, building a safe and healthy work environment, offering safety incentives, and developing safety empowerment based on the literature. Primary data were gathered by distributing the questionnaire. The sample size was 98 among 120 population of the company shop floor members who are the most aware of the work environment and risking accidents. Descriptive analysis and multiple regression analysis were used by SPSS-22. Descriptive analysis was helped to identify the response patterns of employees. Multiple regression analysis identified factors and its impact on sustaining ZAV. Pearson correlation was used to analyse the relationship between variables. All independent variables, safety training, work environment, safety incentives, and safety empowerment significantly affected ZAV. Safety training and safety incentive were enabling factors which should be continued and, safety empowerment and work environment were impeding factors which should be developed further to sustain ZAV.

Keywords— Zero Accident Vision, Safety, Behaviour

Introduction

Workplace safety is critical for the continued functioning, survival, and optimal performance of organizations (Ashour et al, 2018) such as tire industry. Improving the safety of complex industrial systems and preventing serious injury or death is a difficult task (Zwetsloot et al., 2013). Safety is a major concern for organizations as they are a source of significant direct and indirect costs. Direct cost accrues in the form of medical and health bills, claims for deaths and permanent incapacitation, penalties, damage of work equipment, litigation expenses, and related encumbrances. Indirect costs are increasing insurance costs, product losses, pain, suffering, grief, increased staff turnover, and related issues (Ashour et al., 2018).

Occupational accidents threaten to physical and mental safety of workers, enterprises, and communities. Hazards to physical safety of workers include mechanical/machine hazards, slips and falls from heights, ergonomic hazards such as repetitive motion, awkward posture, and excessive force, flying fragments that could injure an eye or risk of a work-related motor vehicle crash. Psychosocial hazards in the workplace affects physical safety directly or indirectly. The impact of accidents is not always easy to recognize and quantify. When someone is injured, colleagues face emotional issues that may impact heavily on the company, particularly in the case of worker death. All

workplaces exist in communities and societies. The community or society in which the enterprise exists has a great impact on employee health and the success of the enterprise (Mealifft, 2010). So, the occupational accident is an issue.

The International Labour Organization (ILO) estimates that 2.3 million women and men worldwide suffer from occupational accidents or illnesses every year. From that, 6000 death occurs every single day. According to ILO, it is concerned about the increase in accidents and ill health (International Labour Organization, 2011). World Health Organization (WHO) estimates that 160 million new cases of work-related illnesses occur every year. It stipulates that workplace condition accounts for over a third of back pain, 16% of hearing loss, 10% of lung cancer and 8% of the burden of depression. The total cost of such accidents and health matters are estimated at 4% of the world's Gross Domestic Products (GDP), (Mealifft, 2010).

In Asia and Pacific, more than 1.1 million people die due to occupational accidents or work-related illnesses each year. Asia was the largest contributor, accounting for about two-thirds of global work-related deaths (International Labour Organization, 1996).

There are about 4,000 occupational accidents in Sri Lanka annually and it is estimated that the number of working days lost due to accidents is about 600,000 each year. In Sri Lanka, occupational safety and health considerations were limited to mining and related machinery from 1896 to 1950. Now, it has been extended to factories under the Factories Act. The deficiencies in the formal sector occupational safety and health coverage are a major concern, as Occupational Safety and Health (OSH) statutory provisions cover only 30 percent of the workforce (International Labour Organization, 1996).

Occupational safety is an important sector which industries should pay attention to. The selected tire company is facing challenge of achieving ZAV. According to the preliminary data gathered through observations, employees' ideas, it was revealed that the safety training, work environment, safety incentive and safety empowerment have been a major contribution for sustaining the ZAV. The main research problem addressed in this study is whether safety training, work environment, safety incentive and safety empowerment have an impact on the sustainability of ZAV in the company and identify enabling and impeding factors to sustain ZAV.

Methodology and Experimental Design

Details of Data Collection

This research has used primary data. The distributing questionnaire was the data collection method. The sample was selected from the company shop floor members who are the most knowing about their work, work environment, and also most subjecting to accidents. The sample size was 98 among 120 populations.

Conceptual Framework

The research project has based on the foundation of the conceptual framework. The conceptual framework of the research project is presented in Figure 1. According to the conceptual model, the dependent variable is "Sustain the ZAV". There are four independent variables. They are "Safety training", "Work environment", "Safety incentive" and "Safety empowerment".
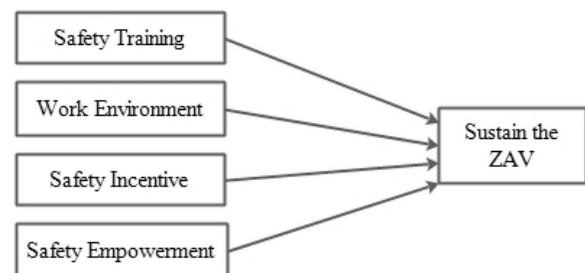

Figure 1. Conceptual Framework

Hypothesis

Various ways are followed for safety training like a formal orientation program and on-going capacity building programs. And, organization use these ways as safety performance indicators (Ashour et al., 2018). Safety training is an important tool for determining general organizational success and the success of occupational health and safety programs (Ashour et al., 2018). Researchers have examined the relationship between safety training and safety performance that give outcomes like recognizing injuries, accidents, incidents, and fatalities. Therefore, this research is proposed the following hypothesis.

Hypothesis 1 - H_1: There is a significant relationship between safety training and sustaining the zero accident vision (ZAV)

A better work environment of a good work environment is related to several organizational performance indicators. Creating a stable work environment is very important to increase an employee's job satisfaction and the ability to work safely. (Dai et al., 2014, cited in Ashour et al., 2018). Work environment effects on health and survival (Hemstrom, 2001, cited in Ashour & Hassan, 2019). Work pressure which includes excessive workload, mandatory workplace and time pressure (Diaz and Cabrera, 1997, cited in Fernández-Muñiz et al., 2012) probably leads to increased psychological stress among workers (Karasek & Theorell, 1990, cited in Fernández-Muñiz. et al., 2012) which may increase the tendency of engaging in unsafe behaviors or errors. Work environment-related stressors including role ambiguity, role conflict, heavy workload, pressure, and physical discomforts are adversely affected their safety and health (Lundstrom et al., 2002). Organizational factors affect the criteria of the work environment. A positive perception of employees that their work environment is well-placed for them to work safely is led to

comply with safety activities and committed to achieving ZAV. And also they tend to reduce risk-taking behaviours (Ashour & Hassan, 2019). Therefore, this study proposes the following hypothesis.

Hypothesis 2 – H_2: There is a significant relationship between work environment and sustaining the zero accident vision (ZAV)

Giving incentives or feedback for the number of positive outcomes and all similar studies is successful in improving safety conditions or in reducing accidents. Bonus is not necessarily a monetary incentive but it can be praise, positive comment for the worker's good behaviour towards their safety or other's safety or firm's safety. A safety incentive program can be designed as informal (feedback, self-recording), social (praise, recognition) and tangible reinforces (trading stamps, cash bonuses) (Vredenburgh, 2002). Appreciation of safety behaviour is a psychological approach that was required (Saracino et al., 2015). An incentive program can be offered recognition which can help modify behaviour. Safety incentive program must be directed to prevent accidents, not punishment after an accident. It should be based on measurable safety activities and behaviours can motivate to improve safety performance (Fell-Carlson, 2004) of the whole company. To sustain the ZAV is also the safety performance of the company. Therefore, this research is proposed the following hypothesis.

Hypothesis 3 – H_3: There is a significant relationship between safety incentive and sustaining the zero accident vision (ZAV)

Employee involvement is contributing to ensure workplace safety. It is a behaviour-based technique. Employee involvement can be as empowering to the decision making process, participating in safety committees, empowering to affect the changes needed in all safety-related issues, empowering to design and implementation, monitoring, and follow-up of the safety management process.

Because of that employee empowerment, employees will have a sense of ownership of the programs and those programs will eventually lead to preventing accidents and injury rates (Ashour & Hassan, 2019). Employees are the only people who sense the condition of their work. And they can clearly understand their critical role in promoting safety. Safety empowerment includes having an important voice in the safety decisions, having the power to initiate and achieve safety improvements, considering them to be responsible for their actions and concerning about their organization's safety performance (Fernández-Muñiz et al., 2012). Employee's positive and supportive safety attitudes is a prerequisite to proactive safety management (Hsu et al., 2008) and support their organization's objectives and goals. Therefore, this research is proposed the following hypothesis.

Hypothesis 4 – H$_4$: There is a significant relationship between safety empowerment and sustaining the zero accident vision (ZAV)

Results

Reliability Analysis

It looked for a score of over 0.7 for high internal consistency. In this case, α=0.902, 0.855, 0.730, and 0.772 for all categories of safety training, work environment, safety incentive, and safety empowerment respectively which show the questionnaire is reliable. The Cronbach's Alpha for the entire mode is 0.934. Then, the whole questionnaire is reliable.

Validity Test

To check the validity of data, factor analysis was used. The validity of the dimensions was explained using KMO value and significance level. In the factors analysis test, below conditions are applied for validity.

KMO value>0.5

Significance<0.05

Table 1. Summarized of KMO value and significance level

Variable	Degrees of freedom	KMO value	Sig.
Safety training	45	0.881	.000
Work environment	45	0.847	.000
Safety incentive	28	0.738	.000
Safety empowerment	21	0.719	.000

Table 1, shows the validity of the data. Since KMO value each variable is above 0.5 and the significance of each variable is below 0.05, it can be assured that the research data is valid.

Descriptive Analysis

It is mentioned that all variables were tapped on a five-point scale. From the results, it may be seen that most of the respondents have agreed with all the statements of independent variables since the mean of all independent variables is over average on the five-point scale. That means safety training; work environment, safety incentive, and safety empowerment have in somewhat standards. But, it can be found that what are the variables which should be emphasized further develop as a company. The mean on safety incentive is rather low (3.0485 on a five-point scale), as is the mean on safety empowerment (3.5306 on a five-point scale), safety training as somewhat enriched (3.6888 on a five-point scale) and work environment have the largest mean (3.7847 on a five-point scale). The mean of 3.4286 on a five-point scale for the dependent variable (sustaining ZAV) indicates that most of the respondents are satisfied with the current situation of sustaining ZAV in the company.

Multiple Regression Analysis

3) Correlation Analysis

Table 2. Summary of the correlation matrix

Hypotheses	Pearson correlation	P-value	Results
Hypothesis 1	0.722	0.000	Accept H_1
Hypothesis 2	0.692	0.000	Accept H_2
Hypothesis 3	0.627	0.000	Accept H_3
Hypothesis 4	0.675	0.000	Accept H_4

There is a strong positive relationship between sustaining the ZAV and all four independent variables as shown in Table 2. P-values are less than 0.05. Hence, there is statistical evidence to claim that there is a significant relationship between sustaining the ZAV and safety incentives. The hypothesis is accepted.

4) Model Fitting

Table 3. Coefficient table

Factor	VIF	B	P-value
(Constant)		0.233	.333
Safety training	2.586	0.305	.001
Work environment	2.363	0.192	.028
Safety incentive	1.553	0.241	.000
Safety empowerment	2.189	0.172	.046

Significance of coefficient

Significance level: $\alpha = 0.05$, p value: 0.001, 0.028, 0.000 and 0.046 for safety training, work environment, safety incentive and safety empowerment respectively as shown in Table 3.

It can be rejected by the null hypothesis since p-value $< \alpha$. At the 5% significance level, there exists enough evidence to conclude that slopes of safety training, work environment, safety incentive, and safety empowerment are not zero and hence, safety training, work environment, safety incentive, and safety empowerment are useful as a predictor of ZAV.

The coefficients table (Table 3) shows that all b coefficients for the model are statistically significant.

It is,

Predicted ZAV = 0.233 + 0.305*Safety training + 0.192*Work environment + 0.241*Safety incentive + 0.172*Safety empowerment

5) The Model Summary

The coefficient of multiple determinations (R^2 value) is 0.667. Therefore, about 66.7% of the variation in the dependent variable is explained by safety training, work environment, safety incentive and safety empowerment for effecting to sustain the ZAV.

6) Multicollinearity

Based on the coefficients table (Table 3), obtained VIF value of 2.586, 2.363, 1.553, 2.189 meaning that the VIF value obtained is between 1 and 10 and tolerance values are greater than 0.2. Therefore, it can be concluded that there are no multicollinearity symptoms.

Discussion and Conclusion

The main objective of this study was to identify the factors which enabling and impeding to sustain ZAV. The multiple regression analysis identified the model for the sustaining ZAV.

Sustaining the ZAV = 0.233 + 0.305*Safety training + 0.192*Work environment + 0.241*Safety incentive + 0.172*Safety empowerment

From this equation, it can be said that safety training, work environment, safety incentive, and safety empowerment sustain ZAV. The multiple regression equation gives constant values as a combination of all parameters. Safety training and safety incentive are highly impacted by the dependent variable. These factors should be kept continuously as those enabling-factors that sustain ZAV. Safety empowerment and work environment are fewer impacts on the dependent variable. These factors should be improved more to sustain ZAV as these are impeding factors in sustaining ZAV.

Because safety training was becoming an enabling factor, it can be ascertained that the factor provided to personnel is adequate to enable them to assess hazards in their work areas. Adopting new members to the work environment is one of the parts of the safety training program. Two recommendations can be made. One is using a buddy system to help orient new employees in the safety and health and quality systems. Other is instituting of a system of continual re-education and retraining of employees in current safety and health issues.

Another enabling factor is safety incentives. Then it can be ascertained that the current safety incentive program can be motivated to improve safety performance. It can be recommended to continue the safety incentive program, using feedback as a safety incentive. One of the powerful feedbacks is model behaviours.

Current safety empowerment was becoming the most impeding factor to sustain the ZAV. Current safety empowerment is not at a significant level. More emphasis is needed on higher team work and reporting system quality with added team member collaboration, coordination, and information sharing. Improving employee decision making strength can lead to increased safety performance in the plant.

The current work environment of the company was becoming the next more impeding factor to sustain the ZAV. The risk factors must be identified to create a safe work environment with regard to occupational diseases and injuries. Hazards must be recognized, assessed, and controlled to prevent exposure to hazards and the resulting diseases and injuries through eliminating or substituting, engineering controlling, administrative controlling, and personal protective equipment. It fulfils health, safety and well-being concerns in the psychological work environment rendering greater job satisfaction. The company should start to recognize, assess and control psychological hazards through an eliminating or modifying it at the source, lessening the impact on the worker and helping the worker protect him from its effects. Safety will increase employee job satisfaction.

References

Ashour, A., and Hassan, Z., 2019. Nursing Involvement and Safety Participation among Secondary Health Care Nurses in Jordan: The Mediating Effect of Work Environment. International Review of Management and Marketing, 9(5), p.104.

Ashour, A. M., Hassan, Z., & Alekam, J. M. E. (2018). A Conceptual Framework for Upgrading Safety Performance by Influence Safety Training, Management Commitment to Safety and Work Environment: Jordanian Hospitals. International Journal of Business and Social Research, 8(7), pp.25-35.

Fell-Carlson, D., 2004. Rewarding safe behavior: strategies for change. Aaohn Journal, 52(12), pp.521-529.

Fernández-Muñiz, B., Montes-Peón, J.M., and Vázquez-Ordás, C.J., 2012. Safety climate in OHSAS 18001-certified organizations: Antecedents and consequences of safety behavior. Accident Analysis & Prevention, 45, pp.745-758.

Hsu, S.H., Lee, C.C., Wu, M.C., and Takano, K., 2008. A cross-cultural study of organizational factors on safety: Japanese vs. Taiwanese oil refinery plants. Accident Analysis & Prevention, 40(1), pp.24-34.

International Labour Organization. (1996). Safety and health at work in Asia and the Pacific (ILO in Asia and the Pacific). Available at https://www.ilo.org/asia/areas/safety-and-health-at-work/lang--en/index.htm

International Labour Organization. (2011). World Statistic. Available at https://www.ilo.org/moscow/areas-of-work/occupational-safety-and-health/WCMS_249278/lang--en/index.htm

Lundstrom, T., Pugliese, G., Bartley, J., Cox, J., and Guither, C., 2002. Organizational and environmental factors that affect worker health

and safety and patient outcomes. American journal of infection control, 30(2), pp.93-106.

Mealifft. (2010). FInal HW Framework 31 Jan.doc. Retrieved from https://www.npg-rsp.ch/fileadmin/npg-rsp/Themen/Internat__OECD_EU_WHO/WHO_2010_healthy_workplace_framework.pdf

Saracino, A., Antonioni, G., Spadoni, G., Curcuruto, M., Guglielmi, D., and Mariani, M.G., 2015. A safety incentive system based on workers behavior and calculated through a Fuzzy Inference System. A safety incentive system based on workers behavior and calculated through a Fuzzy Inference System (pp. 3309-3317). CRCnetBASE.

Vredenburgh, A.G., 2002. Organizational safety: which management practices are most effective in reducing employee injury rates? Journal of Safety Research, 33(2), pp.259-276.

Zwetsloot, G.I., Aaltonen, M., Wybo, J.L., Saari, J., Kines, P., and De Beeck, R.O., 2013. The case for research into the zero accident vision. Safety Science, 58, pp.41-48.

Author Biographies

The paper originates from the original dissertation work of my BSc Degree in Industrial Management, and Statistics and Mathematics at Department of Industrial Management, Faculty of Applied Sciences at the Wayamba University of Sri Lanka.

Asanka D. Dharmawansa obtained his Ph.D. and M.Sc. degrees in Management and Information systems engineering from Nagaoka University of Technology, Japan. He obtained his B.Sc. Degree in Industrial Management and computing and Information Systems from the Wayamba University of Sri Lanka. He has published peer-reviewed research articles and reviews in the fields of information Science, e-Learning, and human-computer interaction.