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Safety in Construction Projects

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ABSTRACT

The construction project sector is one of the vital aspects of a nation in development processes and the economy. It is one of the most dangerous sectors also, not in terms of gravity, but in terms of occurrence of accidents. It is the second largest employer for workers after the agricultural sector, which makes it more prone to accidents. The environment, health and safety (EHS) is an area that spans all professions and is an important part of the industry. Good knowledge about this can lead to saved human lives, which is more important than loss of property. EHS empowers a worker/person in relation to their work, conduct and motives. EHS allows a worker to be more aware, to be more careful and to be more productive. Psychological analysis can enable a worker to be more efficient and productive. It increases the will power of workers, "where there is a will, there is a way". If and only safety is ensured workers can focus on their work. Thus construction project should be provided with sufficient provisions for workers safety. This thesis is regarding the assessment of construction projects in India, which leads us to various disclosures in the sites and thus paint the picture of how they are being welfare in the industry. This report also tells us the voids that have remained untouched and which play an important role in the protection of workers. This report addresses these vacancies and suggests solutions with them. The study was carried out on an observational basis which promoted the psychological analysis of workers, their understanding of safety policies, their active participation in safety meetings and the meaning of the training given to them. Psychological study 5 W (why, where, whose, who and whose) responds to accidents. This study recommended in the safety engineer talks from the reformed and organizing worker.

Introduction

The BOCW Act outlines a number of rules and laws that state the instructions to be followed by the employer to protect employees. The instructions are detailed with in-depth details and are exhaustive. These details are sent by employers to contractors who in turn give it to workers. However, with strong and detailed acts being present, accidents still occur at large. The construction industry has been reported as the highest occupational injury rate worldwide (Abudeye et al, 2006); Feng and Wu, 2013). Despite the existence of Occupational Health and Safety (OHS) laws, accident frequency in construction still remains at a high level. As many researchers pointed out, continued unsafe conditions are mainly due to management commitment and incorrect alignment of subordinates' actions. (Surji et al., 2001; Arcilos et. Al., 2012; Sunindigo and Zou, 2012; Martin and Lewis, 2014). Construction sector is one of India's largest employers, with 1,00,00,000 employees, so these deaths occur in large numbers. The fatal accident rate for construction is 4-6 times higher than for manufacturing projects. This is a labor-intensive process, so you have to deal with security issues in a comprehensive way. According to a survey, 166 of the 1000 workers were injured in the construction activities.

A number of laws, acts, rules and regulations exist to meet the needs with regard to safety but all these are mostly present on paper and the area landscape changes considerably. In addition to enforcing so many acts, rules and regulations, responsibility for implementing these acts has been given to the Labour Commissioner. Unlike the main inspectorate of factories, which share the same responsibility for ensuring safety standards in the manufacturing sector and have the necessary technical background experience, the Labour Commissioner has no technical background. On the other hand, construction safety being a technical subject, the Office of the Labour Commissioner may not be equipped with adequate information to inspect the construction sites. Unfortunately, neither Central nor State government make efforts to enhance their manpower or form a new department for strict enforcement of this legislation. In many of the construction projects, to fill up the posts as acknowledged by the norms laid down in the policies, the industries generally tend to fill up the posts with people not related to safety technical background thus diminishing the effectiveness of the EHS policies enforcement.

EHS plays an important role in the design of activities around the site in a construction industry. The morale of the workers will remain elevated if there are no deaths on the construction site, thereby increasing the productivity of the site. A safety culture must be developed as an integral part of the work culture of an organization in which the basics of the ETS are taught and implemented by workers before they are taught the latest technologies, and as technological progresses, the need for training of workers (operators) in accordance with the latest tools, trends and techniques to ensure the safe operation of high-tech equipment and to avoid dangers to human life must be included in safety culture. On construction sites, because they are labour-intensive, the technologies only help the work and the workers, but the workers have a higher priority than the technologies as human life is precious than any technology. Technology can help workers to become more efficient and careful in implementation of EHS.

The construction industry is not a homogeneous sector because of its type of work. All construction industries are temporary. Because they are

transient, a different approach is needed to implement EHS policies for each site. Although the number of employees is growing rapidly, the construction industry often uses dangerous technologies and relatively low-cost safety measures due to financial constraints (Brindha, 2005).
This study tends to focus on the effective implementation of EHS policy on construction sites in India. This task is achieved through a direct approach reporting on-the-spot activities, while the indirect approach leads to a pattern analysis. Direct approach is the conversation with the employees' one after the other, which leads to discussions that the top management does not say. The worker is the person who first intervenes directly in the accidents, so his knowledge of EHS matters is necessary to understand and improve. Indirect approach goes through books, magazines, articles, EHS meetings, top management conversations that tell about the accident data, the rate of deaths, and this approach helps in predicting a trend in accidents. The analysis base on this basis is very practical because data resources are available for prediction.

Main question for us is:

- Why the accidents do still happen despite having so many laws and technologies are present in comprehensive details?
- Is the implementation of the policies by contractor/employer/government ineffective?

The psychological approach here is based on research and not an administrative approach. The answer to the above after the author lies in the application of the "Human Factor Theory". Solutions are presented by psychological study that analyses the thinking/mentalities/mentalities of workers in the following areas/sectors of the construction industry:

1. Excavation of earth
2. Drilling for foundation
3. Piling and Deep Foundation
4. Road making
5. Site Transport
6. Floor and wall opening
7. Demolition of structures
8. Structural and Steel erection for bridges
9. Concrete framed structures
10. Material handling
11. Compressed air area
12. Tools used
13. Construction machinery
14. Common hazards

The author has noted that the laws, rules and regulations related to ETS are imposed on workers in the construction industry. This makes the workers think and so he tries to pursue the policy imposed on him by the contractor/employer. For areas related to productivity, it can be an effective step, but for issues related to ETS it is dangerous. The workers are human beings, but in some construction industries they are treated less humanely. This treatment by the employer forces them to adapt to the policies laid down, to accept them, rather than to provide valuable insights into the elimination of gaps or disadvantages in the policies. Employees must be taken into account for the policy scenario as they have the job – work experience more than the employer or the management. This experience can be vitally used to make the EHS policies better than just making it a set of laws written down on a piece of paper. This study aims to introduce an improvement in approach to workers Safety & Health by empowering workers to basic safety and health procedures and thus enabling them to take responsibilities in EHS matters. This study also aids in EHS effectiveness by providing training modules improvement and an analysis of worker's psychological needs. The increase in psychological nature will thus amplify the productivity of the worker and thus enlightening the worker in EHS fields. The study has used the methodologies of doing a field study and then conducting surveys in construction sites in construction industries. Questionnaires are also used to check the views of workers regarding the matter of EHS and regarding the management.

1.2 Problem statement

Despite having several laws and advanced technologies, safety in construction projects is not fully ensured resulting in occurrence of very large number of accidents. Proper study of main cause of such accidents and steps required to combat these accidents is a challenging task which need to be done. Although India has a vast number of people working in tis sector but very few research works have been done on this topic.

1.3 Objective

1. To analyse psychological problems handled by construction workers at present in an unbiased way
2. To develop new method of evaluating and modify existing methods
3. To provide suggestions this will help in the solution of worker's problem.

1.4 Thesis Organization

The Thesis consists of a total six chapters including chapter 1: introduction, The other chapters are as follows:

Chapter 2: Literature Review
Chapter 3: Methodology
Chapter 4: Data
Chapter 5: Analysis & Results
Chapter 6: Summary & Conclusions

The chapter 2 Literature review details the background for this work and the past researchers done in similar field. It gives the brief details from those journals and articles which were sources of inspiration and guide for the study. This chapter deals with the works that have been done in the past as well as the problems that might come during the study. This chapter helps in setting the direction to advance further for the study and gaps in the previous studies.

The Methodology chapter deals with the methods that can be adopted and the method that has been adopted for the study.

Next is the chapter of Data. In this chapter the details of the data that are required to carry out the test are given.

After chapter of material Data estimation, comes the chapter analysis & Results in which the data is analysed, and some results based on the collected data will be found out.

At last there is a conclusion chapter, chapter 6, in which a summary of what can be derived from the test data and the results that have been found out, is given. There will also be a discussion on how the study can be useful in the field and the recommendations for the concern authorities have also been summed up that can have used to bring improvement in the policies and service quality to attract more commuters.

1.5 Summary

The main purpose of this chapter is to an overview of the basic aim behind carrying out the study, the understanding of the problem statement for which the work is being carried out, the objective to be achieved after the successful completion of the research and the scope of the work. At the end of the chapter, organization of the whole thesis has been discussed briefly and thesis will proceed in the last chapters.

2 Literature Review

2.1 Introduction

Act – It is an instrument that records a fact or something that has been said, done or agreed upon. The most common types of legislation are legislative, judicial and notarial acts. Notaries are further of two types – law in public form and law in private form.

Rule – They are standard sets of instructions, informally referred to as law. Laws are the legal version of rules or rules.

Regulation – It is a legal norm designed to shape behaviour that is a by-product of imperfection. A regulation can be used to impose conduct ("command and control rules"), to calibrate incentives ("incentive regulation") or to amend preferences.

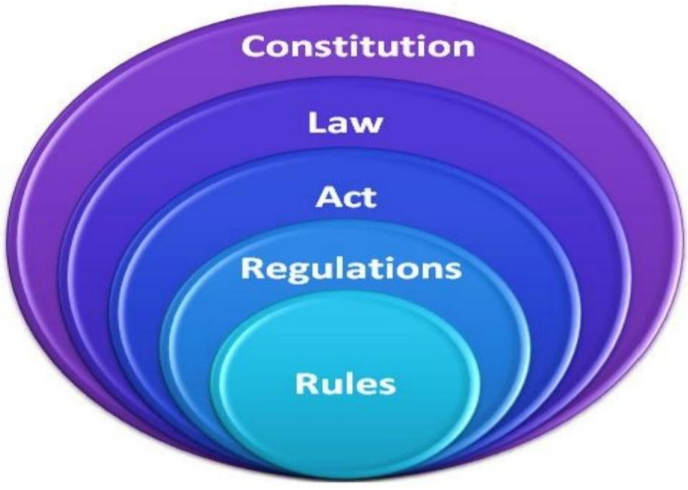

Fig 2.1 Difference between Acts, Rules & Regulations

Meswani, Hital R (2008) said that laws, rules and regulations provide the framework for any organization to continue with the work, as in this era of globalization, due to intense competition in the market, consumers are now focusing on products with EHS standards.

Fong D (1999) said that man has a tendency to make mistakes, and therefore strict measures are needed to keep it at bay. The nature of man depends on various factors such as moral, social, personal, psychological, etc. or is influenced. We must pursue a policy that keeps these factors in mind.

Walter and Frick (2000) explained: "With the growing market of OHSM systems, psychologists are now trying to reintroduce behaviour as the main risk factor for controlling such systems." These are called framework regulations because they create general and general obligations for employers, employees and the self-employed.

These are called framework regulations because they create general and general obligations for employers, employees and the self-employed. The aim is to improve health and safety management and to make it clearer what is required of employers. A more systematic and better organised approach to health and safety will be promoted. Therefore, a company operating a health and safety management system that includes the tasks of the Health and Safety at Work Act and the Framework Regulations should be able to comply with all future safety guidelines that are enforced.

Mohamed, Sherif (2001) explained that the relationship between the safety climate and safe working behaviour on construction sites is regulated by regulations that lead to increased productivity.

Jaselskis, E., Anderson, S. and Russell, J (1996) stated that strategies to improve building safety performance are essential and need to be upgraded in management systems that lead to the elimination of ambiguities.

Kartam, N (1997) stated that the computer-aided security enhancement, which leads to improved integration and performance of the critical path method (CPM), should be integrated into OHSAS.

Laitinen, Marjamäki and Päivärinta's (1999) explained that many proactive safety observation techniques have been developed in recent decades, few of which have proved to be accident predictions.

Mikkelsen, Spangenberg & Kines (2010) found that the safety index provides a proactive measure of physical and behavioural safety at work (percentage correct vs. false safety observations), as well as "traffic light" monitoring systems that assess safety conditions/behaviour as red – high-risk, yellow – medium-risk, green – low-risk. Despite these positive results, there is still uncertainty about how to effectively motivate and positively reduce the death rate on construction sites.

Zohar (2008) explained that a number of studies provide evidence that the aspects that prioritize management have a spill over effect on workers' attitudes and behaviours.

Hofmann, Morgeson & Gerras (2003) explained that studies on Leader – Employee Exchange and Security Communication, Security Climate and Security Citizenship – have used questionnaires that focus on the theory of social exchange and measuring the quality of exchange. They found that leaders - employee exchanges tended to stimulate employees to address safety issues.

Stajkovic and Luthans (2003) conducted a meta-analysis that suggested that feedback and recognition of oversight were among the strongest incentives influencing job performance. Daily oversight feedback on safe and unsafe behaviours and conditions reflects the importance of the real priorities between production and safety, especially when the work is carried out under extreme time pressure.

In India, the departments of the Department for Work and Employment, headed by the Labour leader, deal with occupational health and safety issues in the construction sector. Directorate-General Factory Advise Service Labour Institute (DGFASLI) provides technical assistance in the development of model rules, the conduct of surveys and the implementation of training programmes in the construction sector.

2.4 Literature gap

Literatures have mostly focussed on developed countries. A very few number of work has been done in developing country like India. Moreover psychological aspect of safety in construction projects has not been discussed. India being a populous country have lot of workers employed in construction projects, as a result the study becomes of great importance.

2.5 Summary

A detailed review of the literature on safety of construction projects has been discussed in this chapter. Several aspects like psychological, legislative have been discussed and their implementation in various circumstances has been seen.

3 Methodology

The psychological studies in industry are studies of people in the workplace or in industry, about their recruitment and qualification of jobs. It is always primarily the study of people as individuals or as a group as in the work study.

1. The study deals with information on human behaviour. It is a question of applying information on human behaviour to the various problems of human life, human relations, the mental health of workers in the workplace, ways to increase workers' mood.

2. It is also about the aspect of the working environment, such as lightning, temperature and its impact on workers' performance and safety.

The above is understood by following the below laid down ideas:

1. Understanding (large) accident prevention - It is about identifying hazards and risks and selecting and training people to understand the risks and what they can do about them, and to ensure that they have the right roles and responsibilities for controlling the risks. Failure to do so will result in errors that cause an accident.

2. Competence for tasks - Ensuring that people who are struggling with risk control tasks have the appropriate competences for these tasks. Training inadequacies and a lack of competence can lead to a lack of an essential control element when a requirement is made to the risk control system.

3. Priorities, Attention & Conflict Resolution - Involvement of workers and communication on inadequacies in workplace and equipment planning to address the discrepancies between demand capacities. Mismatch failures such as excessive workload can lead to tunnel vision and distract attention from safety.

4. Safety - Ensure that standards and procedures are used. Sometimes the organization fails to update its own knowledge base. Sometimes a standard (ex. from external sources) is overlooked or not assumed to apply, or it is submitted to someone in a different position in the organization, removing it from the people who need it. Aspects such as changes or organizational changes can exacerbate this problem or create the possibility to realize this organizational weakness.

The Questionnaire:

The questions in this questionnaire were constructed from various daily observations in subway construction and construction sites. The question was only personally constructed and no public help or opinion was taken. The questions are addressed exclusively to the categories of persons who are involved in the pages. The questions were asked by workers, contractors, THE EHS chief and, most recently, the project manager. Their answers were recorded on a sheet and kept secret for this study to avoid distortions and changes.

Table 3.1: Questionnaire

Question	**Workmen**	**Contractor**	**Main EHS manager**	**Project official**
Have you got any training related safety at construction site?	3	2	5	3
Has EHS Officer/Engineer asked you regarding EHS related matters?	4	2	5	2
How frequent have you faced or saw any unsafe act or unsafe accident in site?	3	3	4	3
Have you participated in the EHS meeting held with workers?	3	2	3	3
How is the relation between you and EHS officer/engineer of the site?	3	3	3	4

Scale –

5 – Super active

4 – Proactive

3 – Active

2 – Semi active

1 – Non active

The above scale represents the activity of the Workers/Contractor/ EHS Manager/Project Managers. This activity is in terms of the implementation and understanding of EHS activities, the concern and, above all, the usefulness and availability of security policies. This questionnaire shows workers knowledge of EHS matter mentioned on the website.

4 Observation & Analysis

Construction project worker's attitudes for safety are affected by their risk perception, management, safety rules and procedures in place. Worker's generally tends to pay more attention to EHS matters if they are given responsibility in those matters and their though thinking attitude changes for the better. Workers exhibit a positive mindset and are more open and willing to talk and discuss on the matters of EHS than prior days. The above studies showed a continuous pattern of attention being visible in the worker's talks and ideas. The study showed the human factor effect being able to be taken into consideration, but since no human is perfect, so it is suggested to repeat the above task time to time as regular practice in areas of EHS is as necessary as having meals three times a day.

The attitude of workers visible in security climate, which can be considered as micro – elements of an organization, while security management system and practices are considered macro elements of the organization.

The attitude of the worker, which is considered as micro-elements, is trained and looked after, as they are the ones who are confronted with the maximum of accidents. The focus has shifted from macro elements to microelements to improve the safety culture of construction sites in India.

India, as a labour-intensive industry, was advised to focus on implementing laws rather than creating new ones. India has one of the toughest laws on paper, but the reality is a reflection of that.

Table 4.1 Sample for study

Target Population	Workers from construction projects
Sample taken	135 workers at construction site
Refined Sample	120 workers whose data found consistent

Table 4.2 Questionnaire Design

Rate 1 to 5 based on your perception of these factors present on construction project site:

Following of general principles of health and safety	
Approving of health and safety plan	
Procedure adopted on event of accidents	
Work hour at construction site	
Giving instruction for right operating procedure	
Awareness-raising talks	
Meeting of all stake holders	
Knowledge of EHS to workers	

The construction project safety plan is a 4-step process:

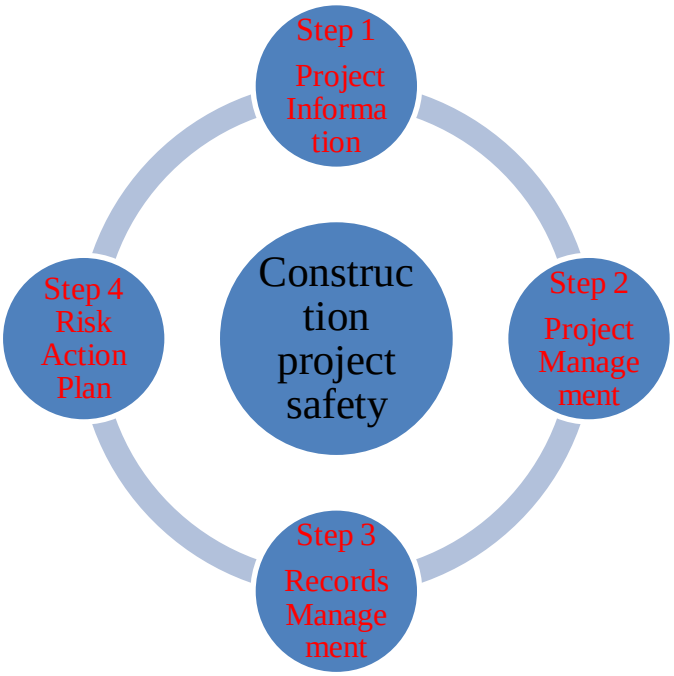

Fig 4.1 Construction project safety stage

The following code of practices can be included for workers and contractors -

1. Workers should age between 18 and 55 years.

2. All workers should be tested before recruiting them for the site. They should have sufficient physical fitness so that they can carry heavy load or climb up to certain height.

3. Smoking should be strictly prohibited at construction project site

4. Supervisors should ensure proper supervising on the construction site. They should make sure that all workers working under him doesn't create any time of hazard or himself or others.

5. No one is allowed to work without a helmet. The chin strap of the protective helmet must always be worn.

6 No one should perform his duty at or above 2.5m height without having the harness, preferably should be firmly provided anchorage at proper level.

7. No one is allowed to enter the construction project site and work on the ground in absence of proper foot protection,

8. Eye protection equipments should be taken care of when workers are employed in grinding of rocks, chipping stones, piling, welding metals and gas cutting. For other works, as when EHSO suggests eye protection should be taken care of.

9. Various safety equipments like shoes, helmet, safety harness etc. shall be arranged before starting the job as per recommendation of EHSO. PPE noncompliance can attract monetary fine.

10. All excavated pits should be barricaded and barricade to be maintained until the backfilling is completed. Safe approach should be ensured into every excavation at construction site.

11. Construction site should be provided with sufficient light where tasks are carried out at nights also.

12. Dangerous parts of fixed or moving machinery should always be taken care off and lubrication should be done regularly.

13. Ladders used at the construction site should have proper strength at top as well as bottom and the ladder should not be used as working platform.

14. Erection and dismantling zone should be properly barricaded and the worker employed at that site should be properly instructed to maintain safety from hanging machines.

15. Running at the site of construction site should be strictly restricted except only in the case of emergency.

16. Throwing of materials from height should never be allowed.

17. No one should be allowed to carry out any electrical connection except that the electrician working specifically for this.

18. Power supply should be taken through RCCB of 35 mA sensitivity.

19. Insertion of bare wires for purpose of tapping power from electrical supply is strictly prohibited.

20. All major, minor accidents and near misses should be reported to Site Chief Engineer / EHSO to enable the management to take necessary actions to avoid recurrence,

5 Result & Recommendation

It is suggested that owner and contractor possess charismatic ability to influence ideas in project manager and ask them to be ideal for other employees. A quality of leadership in requirement of care is required in the front-line environment. The supervisors requires enough attention and help from the contractor for their well-being and organizational identification of the projects. Perfect leadership paths from the owner to the site manager of subcontractors in construction projects to provide help into effective ways of implementing management measures and to publicise strategies and values on construction sites. Education and training are the worthwhile application of a psychological studies.

Measuring workers' mental workload provides an alternative source of information on safety conditions on the ground. This assessment can enable project managers to identify vulnerable people and thus complement on-site risk identification. Integrating both perspectives could help project managers prioritize security resources to protect vulnerable people at higher risk. The proposed framework would allow for the possibility of quantitative assessment of the psychological requirements of construction activities, as almost all complex construction work can be divided into relatively simple and interdependent tasks.

(1.) Influence of Safety and Role Modeling:

- Make subordinates proud of their work and trust in security improvements.
- Talk frequently about worker security values to fellow employees.

- Never compromise security to fulfill other need and requirements
- Present a right model to follow safety norms and regulations.
- Always have great responsibility whenever security problem arises.

(2.) Safety training & motivation:

- Convey clearly and enthusiastically regarding security vision.
- Look for different points of view and ideas on security to stop from taking arbitrary decision.
- Suggesting innovative process and procedure for security purpose.
- Rewarding safety training and learnings throughout the work.
- Promoting the taking part of subordinates in security-oriented decisions.

(3.) Self Respect and Safety caring:

- Actively take care of the everyday life of subordinates and try fulfilling their needs for safe and their well-being.
- Make them aware of the security concerns of subordinates and give them enough resources.
- Give particular attention for on-site safety concerns.
- Be impartial and maintain harmony among the different department in order to deal with security transactions.

(4.) Safety control and management of performance:

- Organize workers to achieve security targets and work with them to achieve goal.
- Establish a security responsibility system for all persons working in project and regularly review their implementations.
- Change and revise the safety rules time to time and in good time.
- Proactively and thoroughly deal with near-miss and security in conforms.
- Appreciate and fine moderately and according to law for consolidating security control.

(5.) Officials commitment:

- Senior officials promotes and incentives to improve security.
- Senior officials positively and decisively require corrections in security issues.
- The top management constantly demands and motivates all employees on site and motivates them to work safely.
- Senior management gets advice from on-site workers at the time of security procedures and regulations are being developed or review is taking place.
- The project prepares enough for addressing security concerns.

(6.) System for managing safety:

- Safety regulations and norms are capable of preventing and mitigating every type of accidents.
- Updating and review of safety norms and rules take place.
- Safety regulations as well as procedures are highly feasible and simple to follow.
- Safety regulations and norms are strictly followed.
- Safety regulations and norms can absolutely ensure safety.

(7.) Communicating with employees:

- Senior officials communicate security aspects clearly at every levels of the work.
- The senior officials talks and reacts on feedback of employees on site.
- Anyone can comment and comment on security issues related on their perceptions of security rules.

(8.) Role of safety:

- Everyone's goal is to get a high security level.
- Everyone positively reports safety related accidents and also probable dangerous situation.
- Everyone wishes in participating in security plans when asked for.
- Everyone take part to the analysis security of their job.

(9.) Training of safety:

- I am fully aware of the applicable and associated safety rules.
- I can identify probable situations of hazards.
- I can use appropriate protective equipment and tools.
- I get a proper education to do my job with safety and train collegues.

(10.) Supporting workplace environment:

- My co-workers and I assist and help each other in security matters.

- I can easily communicate effectively with co-workers on security concerns.
- I see my manager as an ideal in behavioural safety and security management. People can always easily get equipment's needed for working according to standard safe rules and process.
- The inspection of safety in the projects is very beneficial in improving the workers safety.

6 Summary and Conclusion

The greatest increase in efficiency is the training of workers, supervisors and manager. Successful prevention of accidents, forming of safe and healthy habits, development of proper working culture follow the outcome of the use of psychology in an organization.
Following are which points support the aforesaid statements:

1. Recruitment procedure for workers – Various suitable tests should be used to choose the perfect person for the perfect job. Tests such as intelligence test (IQ), suitability, interest in work, skills tests for personality should be taken. These tests will reduce turnover rate resulting in more productivity, and more job satisfaction.

2. Training Techniques -Psychology can help to devise the training requirements of workers. Training methods like studying machines, learning in a programmed way, training related to sensitivity, role playing can help in the training courses of organization.

3. Rewarding for performance – Psychology helps to assess the worker by appraising him for good performance, by holding a monthly prize as the best EHS worker or by providing the plaque of the zone's concerns for safety.

4. Determining Wage structure – The financial matter is a part and parcel in the life of worker, and so determining the right structure of wage should increase morale and output of workers.

5. Encouragement of workers – Workers gets motivated about their work scenario and encourages them to consult to a psychologist or safety engineer about their work profile and the up gradations they desire. These conversations encourage workers that the top officials are with them, worried for workers.

6. Work related Guidance and counseling – These scenario helps to find the suitable type of job for workers and for addressing their personal issues, as family concerns can adversely affect the work they perform.

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