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TITLE: INDUSTRIAL SAFETY IN RETROSPECTIVE

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ABSTRACT

Aim
The study is being undertaken with the aim of analyzing the impact of industrial and technological development on Industrial Safety.

Methodology
Historical research

Findings
An accident gobble's up productivity. It has been identified that considerable number of employees gets injured due to accidents, which impels us to empathize the requirement of implementing indispensable safety measures in industrial organizations. Safety requirements ebb and flow according to the hazard problems. Well organized safety management is a necessity in any successful industrial establishment hence we may safely conclude that safety has been recognized as an integral part of normal operating procedures and a definite responsibility of all supervisory personnel along with the employees. It is true that interaction between worker and the environment leads to occupational health hazards. This can be minimized by monitoring his/her health and the working environment. Absence of proper safety measures would invariably lead to avertable accidents resulting into injuries, destruction to equipment and machinery. This leads to financial loss both for employers and employees. Industrial safety involves not only purging the agents of injury, but also control of harm to employees. With rapid advancement in industrial process new types of dangers have been introduced in increasing numbers. It is not necessary that all accidents should result in personal injury. The fact of the matter is that accidents without personal injury outnumber those which have resulted in an injury and many go unreported. Safety and health have great importance in industrial development and productivity, therefore utmost attention needs to be given to maintain excellent safety and health standards at the places of work and also off the work. Even though nature of accidents may vary, it is reasonable to conclude that accidents can be prevented.

Research implications
These findings give an insight on to the significance of industrial safety as a factor contributing to organizational effectiveness when supported by responsible leadership.

Value

The complexity of industrial development and optimization of human resource generate tremendous application and applied research value to this study.

Key words: Occupational hazards, Fire, Cost of Accidents, Industrial safety, Social responsibility.

MANUSCRIPT

Introduction

Industrial revolution I and industrial revolution II have transformed lives of people. It has increased employment opportunities and improved the source of revenue of people. Managing organizational behavior is essential for optimization of labor and industrial efficiency. Since the time rapid progress on industrial productivity and technological advancement has become a recurring phenomenon in industrial scenario, managers in particular are vested with tremendous responsibility of managing human resource. A responsible leadership would thus engage in effectively utilizing human potential and motivating them for committing towards organizational effectiveness. It is an accepted fact that practical application of management as a science has utility value for both manufacturing and service enterprises.

There is an uncertain belief that managers at all levels are entrusted with same or similar responsibilities, which is far from truth. There would be considerable departure in their roles both in content and context. Nevertheless it is safe to assume that the ultimate objective is organizational efficiency. In the present business environment profitability is an important measure of excellence. As a result government, private industries, and universities recognize the urgent need for productivity improvement. Profitable ventures create surplus through productive operations. For acceptable degree of productivity in an industry it presupposes an accident-free environment.

Henry Fayol, the father of modern management postulated that activities of an industrial or any other establishment could be categorized into six groups; technical, commercial, financial, security, accounting and managerial. [Mamoria CB, (1997) "Personal Management", Mumbai Himalaya Publishing House] If we concede to this line of argument importance of industrial safety is well assigned. Like all other major functions or activities, protection of property and persons play a very important role. What is the aim of industrial safety? Industrial safety by itself aims at achieving accident-free production. When there is accident-free production it follows that the manufacturing firm has educated, trained workers and a safe working environment. Indian constitution puts it down as a directive that industrial workers must be provided with safe and humane conditions of work. It is the duty of every citizen that we should do our utmost to see that conditions of life for the workers are adequate and they are well looked after. For this it is a must that there is integration between management and labor. What we must try to do is to prevent accidents as much as possible and encourage education in industrial safety? What exactly required is will determination, effort and dedication?

"Our own constitution puts it down as a directive that we must provide safe and humane conditions of work for our industrial workers. We should do our utmost to see those conditions of life for them are adequate and they are well looked after. There must be integration between the management and labor.

What we must try to do is to prevent accidents as much as possible and encourage education in industrial safety. What exactly is required is will, determination, effort and dedication to see this country prosper and progress."

Dr S Radhakrishnan

Former President of India

It is sad, but an acceptable fact that every year large number of employees are injured due to accidents. Hence there is a dire need to implement necessary safety measures in industrial organizations. A study carried out reveals that safety requirements vary according to the hazard problems. Even in case of operations which are not hazardous, some safety planning is very much required like those which are done for hazardous operations. [LC Jhamb & Savitri Jhamb, (2002). "Safety and Services Management"] It is true that managers have a genuine, humanitarian interest in their employees. For this reason, they not only emphasize on proper safety management in their industrial organizations, but also willingly allocate reasonable amount of money for safety. It has been seen that safety contributes towards increase in production, lowered costs and better profits. Well-organized safety management is a necessity in any successful industrial establishment, therefore industrial safety is an important subject, which needs to be studied in depth and given due importance in any industrial organization. Long back there was a feeling that accidents were the outcome of workman's carelessness, with management sharing little or no responsibility. Realization by the State contrary to this belief brought in appropriate labor legislation's like the Factories Act 1948, ESI Act 1948 and Workman's Compensation Act 1923, which were duly amended from time to time. This led to a sharp decline in accident rates. As a result of this, safety has been recognized as an integral part of the normal operating procedures and a definite responsibility of all supervisory personnel along with the employees.

We have to realize that interaction between the worker and environment leads to occupational health hazards. To reduce health hazards, we need to monitor worker's health and also working environment. It is by effective implementation of industrial hygiene program that design engineers, medical experts, supervisors ensure, and workers translate this at the shop floor. When we have situations where the hazards involved in the operations cannot be eliminated, personal protective equipment or safety equipment is provided to the workers for carrying out their duties in order to reduce the impact. Extensive statutory provisions have been made in India for prevention of industrial accidents and thus enhancing safety of industrial workers. These provisions are contained in the Central laws and have been further supplemented by the states. [Jain SP, (1991). "Industrial and Labor Laws", Delhi, Dhanpatrai and Co (Pvt) Ltd, 1999]

Industrialization

With large-scale industrialization, hazards faced by the industrial worker has increased manifold. Absence of proper safety measures would invariably lead to avoidable accidents resulting into injuries to persons, damage to equipment and machinery, financial losses both to employers and employees. To quote Mr. RB Blake, "*Accidents are expensive. Substantial savings can be achieved by preventing them"*. Industrial safety involves not only elimination of agents of injury, but also a reliable control of harm to the employees. Common experience shows that injuries continue to occur despite knowledge of their causes and recommended controls, [Safety Codes published by International Labor Organization, Geneva] therefore implementation of the hazard control program becomes critically important. Government has passed number of Legislations on the subject, however they are not being followed in letter and spirit, this anomaly needs to be rectified. A good safety program can reduce occupational injury/illness and operating costs, which will in turn contribute substantially towards increased productivity and improved profits. Further studies brought out the exceptions in labor legislations like Factories Act 1948 and ESI Act 1948. These acts were constantly reviewed for prevention of industrial accidents, thus enhancing the safety of workers. After the Bhopal gas tragedy as a result of detailed study carried out by management and legal experts' additional provisions to cover hazardous operations were included by legislations. A study was carried out on the Challenger Space Shuttle accident of 28 January 1986 in which seven people died. This revealed differences between engineers and managers, upper and lower levels managers, and insufficient provision for upward communication outside the chain of command. [Tranfield D and Smith S (1998). 'The Strategic Regeneration of Manufacturing by Changing Routines', International Journal of Operations, Vol. 18, No.2, pp. 114-129]
Industrialization has advanced leaps and bounds in the last few decades. This has helped to raise the per capita income and improving the employment opportunities, standard of living. However it has brought in several problems in its wake. One such problem is the industrial accident. With the rapid advancement in industrial process new types of dangers have been introduced in increasing numbers. Mechanical, electrical, chemical and radiation hazards are a definite concern on safety of the employees in the industry. When safety planning and safety measures are lacking, industrial operations may not remain under full control, schedules may get disrupted resulting in increased cost. Mr. R B Blake, the Senior Safety Engineer of the Division of Labor Statistics, US Department of Labor had rightly stated that,

"*The main driving force behind the industrial safety movement is the fact accidents are expensive, substantial savings can be made by preventing them*". [Schuler R and I MacMillan (Fall 1984). "Gaining Competitive Advantage through Human Resource Management Practices", Human Resource Management, pp. 241-255]

The Social Responsibility of Managers

It is sad but true that objective of most of the business firms is economic. However with increased involvement of society and social responsibility consciousness, we find that social attachment to business has enhanced. Taking a cue from business firms the concept of social responsibility is now not only restricted to conglomerates, but also to government, educational institutions, charitable and religious organizations, and nonprofit foundations. [Sharma AM, (1999). "Aspects of labor welfare and Social security", Mumbai, Himalaya Publishing House, 1999] Society has been forceful in their attempt to seek details of involvement by managers at all levels on the subject. The proposed paper is with the aim of analyzing procedures adopted by industries and factories, measures both statutory and non-statutory provided by the government and efficacy of the controlling authorities. These aspects are seen in the light of future environment. It relates to industrial safety management, which is dynamic and alive and explore the shortcomings if any and reasons thereof. It would attempt to analyze whether concrete steps have been taken in this direction to acknowledge, identify and cover these loopholes or whether they still remain unattended posing as grave security risks. The study encompasses safety management at macro level as well as micro level. With the onset of global terrorism and being a fact of life industrial safety takes a new serious turn with 'chemical, biological, nuclear 'dimension being added to it.

Meaning and Necessity of Industrial Safety

Importance of industrial safety has increased because of large scale industrialization in which worker is subjected to various types of hazards along with deadly radiation which endanger human life. Safety has since been recognized as an integral part of the normal operating procedures and a definite responsibility of all supervisory personnel along with the employees. Any business firm is considered to be industrially safe when by effective hazard control it is able to achieve accident free production. Whenever equipment is damaged or a worker is injured, even if it does not have legal approval, we consider it to be an accident. It is not necessary that all accidents should result in personal injury. In fact accidents without personal injury outnumber those which have resulted in an injury. On each occasion an individual is exposed to an unsafe condition, or becomes subject to an unsafe act, there is a possibility of an injury. [Safety Manual published by Central Water and Power Commission, Government of India] Industrial safety has been described as the only aspect of industrial relations where there is no advantage to either side at the expense of the other. It is free from any of the pressures and expedients, which are the main factors considered while deciding provision of any welfare item. Therefore, there is a need for associating safety with welfare to ensure harmony in industrial relations and success of its operations.

Any incident restricting work in an industry not by way of industrial dispute can be considered as an industrial accident. A broad and at the same time generally accepted definition for all purposes relating to safety of personnel is, "An accident is an unplanned and unexpected event which causes or is likely to cause an injury". According to the

Factories Act 1948, "an accident is an occurrence in an industrial establishment causing bodily injury to a person that makes him unfit to resume his duties during the next 48 hours". **[**Jain SP, (1991). "Industrial and Labor Laws", Delhi, Dhanpatrai and Co (Pvt) Ltd, 1999**]** so we can infer that it is unplanned event, which in the course of industrial process had occurred all of a sudden. As it is an unexpected incident which does not have any definite time or place, but occurred in the course of employment in an industrial establishment can be classified as an industrial accident? An important aspect to be considered in this context is the liability of the injured person. An injury which is self-inflicted or occurred as a result of the assent of the injured will not be regarded as an accident. According to the Workmen's Compensation Act, 1923 " An industrial injury has been defined as a personal injury to an employee, which has been caused by an accident or an occupational disease which arises out of, or in the course of employment and which would entitle such employee compensation under this Act. [Jain SP, (1991). "Industrial and Labor Laws", Delhi, Dhanpatrai and Co (Pvt) Ltd, 1999]

Industrial safety of an organization is its prime responsibility, because workers are the soul of any progressive organization. As safety and health have great importance in industrial development and productivity, utmost attention needs to be given to maintain excellent safety and health standards at the places of work of the employees and also off the work. Most of the personnel problems that the employers have to face have roots in the unhealthy and unsafe conditions or environment and unsafe actions of the employees. There is an old adage in safety which says, "Accidents do not happen! They are caused". Whenever an accident occurs it has a direct bearing on the job of an employee and on production. Though danger of accidents exists in all walks of life it is more in industries where man and machine work together.

A safety policy should be governed by following principles: -

1. It is essential to respect human life.
2. All the accidents and risks to health are preventable.
3. Management should ensure that workplace accident do not take place.
4. Safe working conditions are the right and obligation of each worker.
5. Safety training is essential at all levels.
6. If a company cannot afford safety it cannot afford to be in business.[Standing Operating Procedures; Indian Tools Manufacturers]

Some of the causes, which are seen as common unsafe acts and unsafe condition are:-

1. Carelessness.
2. Over speeding or operating at unsafe speed.
3. Experimenting new techniques.
4. Unsafe postures.
5. Lethargy in implementing safety procedures and using protective equipment's.
6. Non adherence to rules, regulations and instructions.

7. Newly inducted person's left unsupervised or under supervised.
8. Compulsion of engineering a machine without adequate relief maintenance. [Sharma AM, (1999). "Aspects of labor welfare and Social security", Mumbai, Himalaya Publishing House, 1999]

Fire, Sources & Methods to Combat Fire

Fire is one of the five elements in this universe, which when used properly, under controlled conditions, and is of immense use. On the contrary if left uncontrolled, it can cause devastation. To understand the remedies available to control and combat fire, it is necessary to understand what "fire" is. For the fire to occur, presence of three things is necessary, which are Fuel, Heat and Oxygen. These three ingredients are commonly available in industries by way of:-

a) Combustible materials, whether solid, liquid or gases which burn on ignition. A match, a lighted cigarette, bidi, spark, internal combustion or friction, can cause ignition. Materials which provide a source for fuel are LPG, Petrol, Diesel, Kerosene, Combustible gases, Alcohols, Paints, Resins, Plastics, Coal, Wood, Paper, Clothes, Polythene, Cotton/cotton waste and Rubber.

b) Heat is generated by open flames, hot surfaces, sparks and arcs, friction, chemical actions and the Sun.

c) A fuel burns at specific temperature in the presence of oxygen. Normal air and some fuels contain adequate amount of oxygen. There are other fuels which contain sufficient oxygen within themselves to support burning.

In order to prevent fire, one of the three necessary ingredients i.e. fuel, oxygen, or heat must be eliminated or controlled and for extinguishing fire one of these ingredients must be removed. Fire is categorized into four classes: -

a) Class A. This type fire has fuel which comprises of normal combustible materials like paper, wood, fibre etc.
b) Class B. In this case, fuel is an inflammable liquid such as gasoline, oil, grease, alcohol.
c) Class C. This type of fire is caused due to electric short circuits, electrical typewriters, computers, motors, generators and electrical outlets.
d) Class D. Fire is caused by combustible metal, like magnesium etc.

Knowledge of fire makes it easy to report the incidents of fire for outside assistance. At times fire may be combination of two or sometimes three types of classes e.g., if a Molotov cocktail is thrown through a window into an office, the resultant fire would involve gasoline and normal combustible materials in the room. Extinguishing such a fire would be a complex job. [Proceedings of the Seminar on Gas Hazards and Explosion by SCS]

Methods to Combat Fire

These methods differ according to the class of the fire because of their typical requirements.

Class A fire requires saturation by water or water fog. Ignited fuel is thus cooled down below the ignition temperature. Water will extinguish the flames and cooling will prevent re-ignition. Carbon-di-oxide extinguishers though less effective may be used.

Class B fire requires depriving oxygen supply. Carbon-di-oxide extinguishers, dry chemical extinguishers, though less effective may be used. Streams of water should not be used because inflammable liquids float on water and fire would spread rapidly.

Class C fire should be put off using non-conducting agents like carbon-di-oxide or dry chemicals. Water may conduct electricity and result in electrocution. Whenever possible, electric circuits should be switched off.

Class D fires are caused by self-combustible materials which are not in common use. Such fires occur rarely. For this class of fire, dry powder type fire extinguishers are more effective.

Fire protection can be divided into two activities which are prevention and suppression. It is important to prevent a fire and avoid its occurrence. Fire hazards in the factory must be identified and reported. Despite all the efforts, fire may occur by chance. In such cases prompt attention by taking steps for quick suppression is mandatory. This can ensure restriction of loss on account of fire. Among other steps, fire suppression can be ensured by timely arrival of firefighters. Actually fire extinguishers are useful only in the initial stages. [Mike Bateman, Brain King and Paul Lewis, (1986). “The Handbook of Health and Safety at Work”]

Health Hazards in Working Environment

Interaction between worker and work environment leads to occupational health hazards. To minimize health hazards there is a need to monitor the health of workers and also working environment. There are five factors, which can cause work hazards in the industry. These are Physical, Chemical, Mechanical, Biological and Psychological factors. Out of these industrial hygiene takes into consideration physical and chemical factors and tries to control them, for which service of design engineers, medical experts, supervisors and workers at the shop floor are utilized.

Personal Protective Equipment (PPE)

It is mandatory by legal provisions that occupiers provide safety equipment (PPE) to employees engaged in a manufacturing activity. Major reason for such a step is that PPEs are able to reduce the intensity of industrial accidents and resultant losses. There would be reluctance on the part of employees to wear these equipments, which may be either due to improper fitting or over confidence. To obviate such tendencies strict regulations within the factories and including this aspect in the code of conduct is a must. Commonly

provided PPEs include Gas mask, Safety goggles, Face shields, Hand gloves, Apron and gum boots, Safety belts and Helmets. [Maharashtra Factory Rules, (1963) Government Publications]

Occupational Hazards

Health hazards and occupational diseases are likely when a worker is engaged in certain types of industries. These include the chemical, environmental and psychosomatic hazards. Gas fumes and dust are generated during production process and unless they are controlled would spread in to the work activity and surrounding areas causing chemical hazards. This when inhaled by the worker or people living in the vicinity is likely to cause temporary or chronic disorder. Similarly incorrect process or machine layout may result in excessive noise and vibrations. Noise, vibration, shocks which are generated in improper atmospheric conditions contribute to environmental hazards. It has been scientifically identified that excessive shocks and vibrations can result in nerve injury or inflammation of tissues of the joints of workers. Even reasonably low vibrations as a result of movement by aircraft, train or any other vehicle to the extent of one cycle per second can cause slow motion sickness. [Ernst and Ernst (1978) "Social Responsibility Disclosure: 1978 Survey", Ernst and Ernst, Cleveland Ohio, USA]

Nature and Cause of Accidents

Nature of an accident may vary from industry to industry. Slipping and falling from a height or over a machine due to slippery floor and getting caught in a machine due to the clothing are some of the incidents leading to injury resulting in to incapacitation or death of the worker. Careless handling of explosives or parts of a machine striking can also cause accidents. It is not that all accidents should result into death or injury but we consider those seriously which result in death or disablement. Incapacitation is definite fallout of industrial accidents, which can be caused by unsafe conditions or unsafe acts. In some cases it may be a combination of both, which varies from situation to situation. It is correct to say that “Accidents have array of grounds, which are closely related. Accidents can be prevented. They do not just happen when a finger or an eye is lost or a back is strained. The cause could be a badly fitted safety guards, or neglect of the rules about wearing protective glasses, or faulty lifting technique”. [Patten DM (1992). "Intra-industry Environmental Disclosures in Response to the Alaskan Oil Spill: A Note on Legitimacy Theory", Accounting Organizations and Society, VoLl7, No.5, pp.471-475] Human errors or unsafe acts include ignorance, stupidity, lack of concentration or foresight, insufficient physical or mental capacity and so on, whereas environment factors or unsafe conditions include dangerous machines, systems of work, materials and so on.

Cost of Accidents

The term cost of accidents is a misnomer. Direct consequence of industrial accidents is suffering. Disablement and death leads to loss of earning capacity and results in depriving regular income to the worker and his family. The net effect is poverty and loss of productivity. Considering these two aspects it is practically not feasible to compute the

losses in to costs. One cannot fix a price for a finger or an arm lost or for the feelings of a child awaiting the return of his father from work, so looking at 'accident cost' from this angle is meaningless. However we commonly find this term being used for denoting financial loss to the management arising out of accidents at work.

Accident Proneness

As per various studies carried out, it has been identified that there is a small section of workmen who are subjected to major proportion of injuries. We may say it follows Pareto principle. Such a category of workers is said to be accident-prone. At the same time the mere fact that one employee has been in more accidents than others is not justification for labeling that employee accident prone, because the condition under which he works may be far worse than the rest of the workers in the plant.

New Types of Accidents

The generations of industrial workers of the yesterdays were immune to certain new types of accidents and health hazards. We are faced with two strange and contrasting aspects, which are fatal accidents and industrial disasters. Industrial data indicates that even though industrial accidents have reduced, but the fatal accidents have increased. Then we have a case wherein industrial accidents have the likelihood of turning in to industrial disaster more than ever before. The other day we heard Tsunami hit Japan which created radiation hazard in the area and definitely would have caused health problems to the workers, people living in the affected area. Prior to this we had in Russia the Chernobyl incident devastating a sizable population, which lived in the area. With the proliferation of nuclear energy both for peaceful and weapon programs, radiation hazard will be a major concern world all over. Then is the over dependency on oil and natural gas which has brought in environmental hazards by oil spillage including the one which has been reported on the beaches of Brazil or unrestricted quarrying in Malaysia. Most prominent and human made industrial accident is the act of terrorism. Recent attack by drones on Saudi oil giant Armco or targeting the Iran's oil tanker in the Red sea gives us an understanding that this type of industrial accidents will be a frequent occurrence. What is concerning is that all of them have the inherent capability to become industrial disaster? One of the contemporary damaging acts by developed countries is dumping hazardous industrial wastes in underdeveloped and developing countries. This may include e waste. Imagine, the nuclear weapons of Pakistan falling into the hands of terrorists, it would be a catastrophe. These are some of the new types of dangers faced by the world in this Industrial era and a case for further research.

Conclusion

Anywhere in the world you travel, the buzz word is 'productivity improvement' and its urgent need is felt not only in private industries, but also in government sector and educational institutions. For productivity we have to concentrate on industrial safety. As

every accident eats into productivity it is important for us to ensure that we take adequate steps to prevent its occurrence. One of the ways is by encouraging education in industrial safety. We find that large number of employees get injured due to accidents, which impels us to understand the need to implement necessary safety measures in industrial organizations. The safety requirements vary according to the hazard problems. Absence of proper safety measures would invariably lead to avoidable accidents resulting into injuries to persons, damage to equipment and machinery, financial losses both to employers and employees. Human angle for providing safety to the industrial workers is no less important in the present industrial environment. It is one of the major reasons for the management to undertake effective safety programs in their organizations, concerns, and factories. Industrial safety involves not only elimination of agents of injury, but also a reliable control of harm to employees.

With the rapid advancement in industrial process new types of dangers have been introduced in increasing numbers. When the safety planning and safety measures are lacking, industrial operations may not remain under full control, schedules may get disrupted and cost may increase. Industrial safety is that condition of enterprise operation in which, by controlling hazards, accident free production is achieved. Industrial safety has been described as the only aspect of industrial relations where there is no advantage to either side at the expense of the other. Industrial safety of an organization is its prime responsibility, because workers are the soul of any progressive organization. Safety and health have great importance in industrial development and productivity. Therefore utmost attention needs to be given to maintain excellent safety and health standards at the places of work of the employees and also off the work. Main causes of accidents are unsafe conditions and/or unsafe actions. Though danger of accidents exists in all walks of life it is more in industries where man and machine work together.

A safety policy should be governed by the principle that safe working conditions are the right and obligation of each worker and safety training is essential at all levels. If a company cannot afford safety it cannot afford to be in business. Lethargy in implementing safety procedures and using protective equipment's increases chances of industrial accidents. Fire hazards in the factory must be identified and reported. Interaction between worker and work environment leads to occupational health hazards. Accidents involve human suffering hence the term cost of accidents is a misnomer.

Industrial development is sometimes taken as a productivity increase concept. This is the generalized view, which hampers industrial safety. If the industrial society takes this as a process development, with, both technological development of the plants and technical expertise improvement of the worker, then there is a room for industrial safety aspects being in-tune with the industrial development. What we generally find is that most of the industries or factories move in to production without incorporating all safety measures. This only shows that the industrial safety arrangements are not keeping pace with the industrial development.

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