

CHAPTER 2
LITERATURE
REVIEW

2.1 Occupational Safety and Health (OSH)

In 1950's, a common definition of occupational health was adopted by the Joint ILO/ World Health Organization (WHO) Committee on Occupational Health as its first session was revised at its twelfth session in 1995 with the goal of all OSH programs is to foster a safe work environment. OSH is a basically standard which is set in legislation that aims to eliminate and reduce hazards at workplace. The OSH primary focuses on policies that include the compliances with government guidelines, regulations and laws.

According to Levitt and Samelson (1993), OSH is an interdisciplinary field which encompasses among the disciplines of industrial hygiene, occupational medicine, engineering, epidemiology and toxicology that includes the surroundings, related person and employees' condition. OSH involved of all the interactions, which can protect employers, employees and public who are affected by the workplace environment.

Concept of OSH has significant importance where the healthier and safer working environment was very widespread and appreciated in industries to have more standardized OSHMS. In preventing diseases and injuries, the failures to acknowledge are important in limiting the effectiveness of interventions (Lahiri *et al.*, 2005 and Toffel & Birkner, 2002).

In reducing the risk at workplace, OSH is an important aspect which emphasizes the discipline that concerned on preserving, protecting human and facility resources. There are laws to protect the employees whereby employers must choose to ignore any concern (Laws of Malaysia, 2000). It is mandatory for all companies to provide a safe and conducive working environment for their employees as stated in the OSHA (1994).

According to OHSAS:18001 (2007), OSH means the conditions or factors that affect the temporary employees, contractor personnel's, visitors and any other person at the workplace. OSHMS is a part of the overall management system that facilitates the management of OSH risks and maintaining the OSH organization's policy. Within these definitions, it is possible to contrast systematic approaches with reactive workplace safety and health cultures, as shown in Table 2.1 below.

Table 2.1: Contrast between Reactive Workplace Safety and Health Culture, and Systematic Approach (OSHMS: Strategic Issues Report, 1999)

REACTIVE WORKPLACE SAFETY & HEALTH CULTURE	SYSTEMATIC APPROACH
Hazards are dealt with reactively	Hazards are identified
Risk controls are depending on individuals	Risk controls are described in procedures
Risk controls are not linked	Risk controls are linked by a common method
OSH activity happens but is not planned	OSH activity is planned
Controls are reviewed after an accident	Controls are monitored and reviewed regularly
Responsibilities are not defined	Company policy is communicated
Focus on own backyard only	Public and supplier risk management in planned way

Source: OHSMS 2011

A possible approach to these issues is through a team building directly or indirectly from everyone involved as safety and health practices will have significant returns. Publicity campaigns, inspections, enforcements and ongoing seminar are the programs created in reducing the number of accidents. Improving communications and publicity for regulations and requirements and providing tangible recognition as financial incentives were included the role of ESH.

The role of management and involvement of all employees are very important in order to cultivate the positive beliefs, norms, practices and attitudes are the important keys that play in safety and health cultures. According to Gardner *et al.*, (1999), the promotion of OSH cannot be achieved without the employees' full co-operation and commitment.

With OSH in the workplace, it means there are some benefits; (1) reductions of unnecessary costs in corrective procedures by focusing on preventive measures, (2) increasing work productivities and (3) avoiding any injuries. The perceptions of connection between effective OSH and resulting financial benefits should be improved and OSH is not usually viewed as a contributory factor to the economic viability of an organization Robson *et al.*, (2007). The focus of OSH is to have a healthy and productive workforce for the good of the people and the nation (Abdul Rahman, 2006). By having an efficient OSH program, it will make employees feel secure and comfortable working at workplace.

2.2 Review the Laws and Acts Related to Occupational Safety and Health (OSH) in Malaysia

In Malaysia, the role of OSH was existed since 130 years ago. According to the DOSH (2010), the development of safety and health at workplace can be categorized into five eras; (1) Steam Boiler Safety Era took place prior to 1914 (2) Machinery Safety Era took place from 1914 until 1952 where Machinery Enactment 1913 replaced the various steam boiler enactments of Allied Malay States on 1st January 1914 (3) Industrial Safety Era took place from 1953 until 1969. In 1953, the Machinery Ordinance 1953 was enacted to replace all previous legislations.

(4) In 1967 the era was called the Industrial Safety and Hygiene Era where, the Parliament had approved the Factory and Machineries Act (FMA 1967). Beginning in 1970, the Factory and Machineries Act 1967 and eight of its regulations were enforced replacing the Machinery Ordinance 1953. In 1980, the application of the Factory and Machineries Act 1967 was extended to Sabah and Sarawak (5) Since the year 1994, it is the OSH Era where the Parliament passed a new legislation known as the OSHA 1994 which was gazette on February 1994.

2.2.1 Occupational Safety and Health Act (OSHA) 1994

According to Soehod & Laxman (2007), Malaysia is the first Asian country to have enacted the safety and health legislation covering all occupations. The OSHA (1994) covers OSH in both private and public sectors which consisting of 15 Parts (Appendix 1), is an enabling measure which is superimposed over existing safety and health legislations. The long term goal of the act is to create a safety and health working culture among all Malaysian employees and employers.

OSHA (referred to as “OSHA” or the “Act”) that came into force on 25th February 1994 and the Act 514 is an enabling Act which is superimposed over existing safety and health legislation such as the Factories and Machinery Act 1967 (Act 139) (Ahmadon *et al.*, 2006). The main goal of this Act is to ensure that the employers provide safe working condition to the employees. It requires employers to perform minimum duties to ensure the safety, health and welfare of employees, and joint responsibilities with employer in government organizations are expected to ensure safety in a workplace (Almeida, 2006).

The aims of this Act (of persons at work) are: (1) to secure safety, health and welfare against the risks that arising out of the activities, (2) to protect person against risks at workplace in arising safety and health out of the activities, (3) to promote an occupational environment that adapted to psychological needs, (4) to provide the means associated OSH legislation may be progressively replaced by a system of regulations and approved industry codes of practice operating in combination with the provisions of this act designed, and (5) to maintain or improve the standards of safety and health.

The OSHA 1994 provides the legislative framework to promote, stimulate and encourage high standards and wide regulations of safety, health and welfare of person at work. Regulations would normally be formulated on the basis of proposals that submitted by NC for OSH or Director General after consultation with tripartite safety and health's organization. As a main act, the promulgation of the OSHA 1994 has made further provisions for securing the safety, health and welfare of any employees' activity connection that will help in reducing occupational incidents and accidents in Malaysia. It is based on the concept of self-regulation whereby the act place certain duties on employers, employees, self-employed persons and all in order to prevent the accidents, ill health's and injuries.

Act 514 of OSHA 1994 provides the promotion, co-ordination, administration and enforcement for OSH and have defined the general duties of employers, employees, self employed, suppliers and this place certain duties and also emphasis on the prevention of accidents, ill health and injury. Regulations have effect on detailing the specific requirements of the legislation by prescribing minimum standards or having a general application or they may define specific requirements related to a particular hazard or particular type of work. Department of Occupational Safety and Health (DOSH) needs to carry out inspections on government organizations to find out how well they have complied with the legislation and ascertain if the health and safety requirements of their employees at the workplace are being met (Cruetz, 2006).

2.2.2 Department of Occupational Safety and Health (DOSH)

The OSHA 1994 is enforced by Department of Occupational Safety and Health (DOSH), a government department under the Ministry of Human Resources Malaysia. DOSH will be ensured through the enforcement and promotional works that employers, self-employed persons, manufacturers, designers, suppliers and employees always practise safety and health work culture, comply with existing legislation, guidelines and codes of practice, in assistance with OSH' implementation and improvement in the workplace.

Through enforcement and promotional activities, it will ensure the employers, self-employed persons and employees practice a good working culture and will formulate and review on OSH and welfare as a basis in ensuring safety and health at work. It is the secretariat to NC for OSH, a council established under section 8 of OSHA 1994. DOSH has its own roles and responsibilities which to become secretariat and give inputs to the NC regarding safety and health, (2) To study, identify and formulate policies and regulations, (3) To analyse and identify steps to control safety and health dangerous encroachments, (4) To review an instrument related to safety and health industrial hygiene instruments and personal protection equipment (PPE).

In addition, DOSH as a government enforcement agency stated that compliance with the act and its regulations still needs significant improvement. Due to limitations of manpower, DOSH only managed to comprehensively enforce legislation in certain sectors such as manufacturing, construction, mining and quarrying. In other sectors, DOSH's enforcement has been reactive, such that it was conducted based on imminent issues, complaints or accidents (Malaysian Ministry of Human Resources, 2006).

2.2.3 Problems Relating to OSH in Manufacturing Industry

The safety in workplace is one of the most essential issues that cannot be taken for granted. It is because even it was only a minor accident, it may cause serious and huge effect to the organization especially within the industry which involves machinery handling including of prime movers, trucks, forklifts and cranes which is very much related with the issue of safety and health awareness. Moreover, Gustin (2008) indicated that “safety is a condition of employment” and consequently everyone has to “make a commitment and assume responsibilities”.

According to the ICA 1975 (2006), manufacturing activity’ is defined as:

“The making, altering, blending, ornamenting, finishing or otherwise treating or adapting any article or substances with a view to its use, sale, transport, delivery or disposal; includes the assembly of parts and hip repairing but shall not include any activity normally associated with retail or wholesale trade”

It is important to note that since manufacturing is one of the major contributors to the Malaysian economy, the development of manufacturing sector must also be in line with the awareness and compliance of the industry towards safety and health. The policy for manufacturing in Malaysia does not only cover technology, market access, productivity component but must also consider numerous hazards in the work environment.

Malaysian Industrial Development Authority (MIDA) classified manufacturing sector in Malaysia into twelve industries, which are basic metal products, electrical and electronic, electronics manufacturing services, engineering supporting, food processing, machinery and equipment, medical devices, petrochemical and polymer, pharmaceuticals, rubber products, textiles and apparel and wood-based industries.

Manufacturing license applied by manufacturing companies was approved by the Ministry of International Trade and Industry (MITI) and has been submitted to the MIDA, an agency under MITI. MIDA is the government's principal agency for the promotion of the manufacturing and services sectors in Malaysia, also in providing information on the opportunities for investments, as well as facilitating companies which are looking for joint venture partners.

In the industrialized nations of the world, workplace accident has become a major problem, which is supported by Biggs, Sheahan & Dingsdag (2005), who concurs that accidents now cause more deaths than all infectious diseases and more than any single illness except those related to heart disease and cancer. This suggestion was indeed put up by Heinrich (1941), who advocated that 88% of all accidents were caused by unsafe acts of people, 20% were by unsafe machines or conditions while another 2% were by acts of God.

In reducing the risks and accident at workplace, apart from OSH, the term 'safety culture' was introduced by the International Atomic Energy Agency (IAEA) is also an important aspect (Gadd & Collins, 2002). This term 'safety culture' arose due to the Chernobyl major accidents in 1986 (Ostrom, Wilhemsen & Kaplan, 1993).

2.3 Safety Culture

There has been increasing interest among researchers and practitioners since the past two decades towards the concept of safety culture because of its impact on safety outcomes such as injuries, fatalities, and other incidents (Choudhry, Fang & Mohamed, 2007) where the aim of safety culture is to avoid taking any unsafe actions (Fernandez-Muniz *et al.*, 2007).

The term safety culture as listed below has numerous definitions according to various disciplines, is the sharing of common beliefs and values that safety is a priority;

“Safety culture’ is defined as those aspects of the organizational culture which will impact on attitudes and behavior related to increasing or decreasing risk”- Guldenmund (2000)

“Safety culture as the attitudes, beliefs, and perceptions shared by natural groups as defining norms and values, which determine how they react in relation to risks and risk control systems”- Hale (2000)

“Safety culture is the collective corporate value that results in positive view point and actions of all employees concerning safety and health”- HSE (2002a)

Williamson *et al.*, (1997) stated that “In understanding the safety culture of a workplace, the perceptions and attitudes of the workforce are important factors in assessing safety needs”. Three attributes of safety culture according to Cooper (2000: (1) psychological (how people feel – safety climate), (2) behavioural (what people do – safety-related actions and behaviours), and (3) situational (what the organization has – policies, procedures, regulations, organizational structures, management systems).

A periodic review of safety culture and the implementation of safety improvement plans are very important as leadership on safety issues is visible in changing an organization culture. According to Fitzgerald (2005), safety culture can encourage proactive accident prevention as shown in research that companies through culture change have recognised an important component in creating and maintaining a safe environment.

The active measurement of safety performance and reinforcement of positive behaviours are in placed with the consistent behaviours of management. To link the OSH and economic performance, companies with a strong safety culture will inherent organisation, willing to look at ways of improving and maintaining a healthy working environment (Walters & Lamm, 2003).

The product of individual and group values, attitudes, perceptions, competencies and patterns of behaviour that determine the commitment to, and the style and proficiency of an organization's safety and health management. Organizations with a positive safety culture are characterised by communications founded on mutual trust, by shared perceptions of the importance of safety and health, by confidence in efficiency of preventative measures (ACSNI, 1993)

According to the Malaysian DOSH (2010), ILO Safety Culture Model has identified different levels of safety culture. These levels of safety culture are influenced by three main independent variables namely; (1) Individuals commitment, (2) Managers commitment, and (3) Policy commitment. Safety culture can be viewed as a component of the organizational culture that refers to the individuals, jobs, and organizational characteristics that affect employees' health and safety (Fernandez-Muniz *et al.*, 2007).

Some symptoms of safety culture problems in an organization according to UK Advisory Committee on the Safety of Nuclear Installation (2003) are: (1) employees are blamed for problems (2) the emergence of strong subcultures (3) employees are afraid to report accidents or injuries (4) excessive sick-time (5) high turnover (6) lack of commitment to process safety (7) lack of consistency in worker attitudes about what issues are important (8) lack of preventive maintenance (9) lack of teamwork (10) poor housekeeping (11) top management are unaware of the “real” condition of the plant and employees, recurring problems, over-emphasis on behavioral safety. An organization has to improve a “weak” situation when some of these symptoms appear or there will be a decline in performance.

Guldenmund (2000) has concluded that the safety culture indicates “the strong convictions or dogmas underlying safety attitudes specifically underlie all organizations’ attitudes”. There are some proofs for companies that having employees with positive patterns of attitude towards safety and health practices, in building a good safety health culture’s on so many diversities. They need to measure safety performance and information, and bring people together to learn how to work more safely.

Based on the principle of self-regulation, the government organizations in Malaysia, especially manufacturing industries are required to comply with the OSHA 1994. As such, the implementation of an OHSMS in all organizations will assist in preventing OHS problems and is also a means to facilitate legal compliance. However, there is currently a lack of research on the effectiveness of the implementation of OHSMS in various sectors in Malaysia. It was not necessarily due to less than optimum engineering design or equipment failure, but people’s ‘poor’ human factor (Taylor, 2010).

2.4 Implementing ESH; Mechanism in Achieving the Safety and Health Performance's Objective

A Safety and Health Management System (SHMS) is a set of interrelated elements that establishes and supports OSH policies and objectives, generally known as a mechanism in achieving the safety and health performances' objectives. The underlying or root causes of deficiencies and characterized was emphasised on continually improving and systematically eliminating by the management system approach. Gallagher (1997) defined SHMS as the organization of planning and review, management organizational procedures, consultative actions and specific program components to enhance safety and health performance.

Safety management refers to the tangible practices, responsibility and performance related to safety. Mearns *et al.*, (2003) noted some common themes of safety management practices; (1) management commitment to safety, (2) safety communication, (3) safety and health objectives, (4) training needs, (5) rewarding performance, and (6) employees' involvement.

The CASA (2002) explained safety management systems as the combination of work practices, beliefs and approaches to improve and manage all facts of an organization's operations to ascertain that an organization is free from accidents. The overall objectives of the safety management system are to prevent, to reduce and to control workplace hazards by ensuring an ongoing improvement process with the fulfilment of requirements that could assist businesses to self-manage that is related to hazards.

Lars Harms-Ringdahl (2004) has defined the safety management as the aspect of the overall management function that determines and implements safety policy and suggested a simple definition of OSHMS as the systematic way in managing the OSH risks of a company. Previous studies have demonstrated that effective safety management improves the level of safety in organizations and thus can be seen to decrease damages and harm from accidents (Bottani, Monica & Vignali, 2009).

Glendon and McKenna (1995) have mentioned in their study, that an effective safety management is both functional and humanizes where functional part involves the monitoring, management control, executive and communication sub-systems. In addition, humanizes involved the leadership, political and safety culture sub-systems paramount to safety culture. The system is a set of plan, actions and procedures based on the common OHSMS.

Safety management systems provided by the framework will focus on technical, human and organizational aspects and was combined to form a solid integrated approach. Bottani, Monica & Vignali (2009) had evaluated the performance of safety management systems among adopters and non-adopters companies whereby 116 companies were examined. Some of them have implemented and not yet implemented the safety management systems. They conclude that adopters companies demonstrated excellent performance compare to non-adopters companies.

Over the last five years, the safety regulations provided by OSHA 1994 is very comprehensive but the level of awareness and practicability of it are generally lower than expected (Abdul Hamid *et al.*, 2003).

Some of the other reasons of failures in implementing safety and health programs at sites (Abdul Hamid *et al.*, 2003) are; (1) Lack of enforcement by proper authority such as lack of monitoring, safety auditing and enforcement conducting will give the impact of lack of serious commitment and insufficient workforce (2) Attitude of site management team; to be deficient in attitude of the site management team and the increasing cost effect unsafe, old and obsolete PPE that was provided.

(3) Ineffective safety campaign; In avoiding any accident and injury, safety awareness campaigns are very important, but lack of coordination can involve in ineffective safety campaign (4) Inadequate safety training and course; Most safety officers are not certified enough to provide and to enforce safety guidelines on the site (5) Incompetent safety officer; as required by OSHA 1994, company must appoint a safety officer to conduct due to lack of safety commitment and budget allocation by management team, but most of the companies simply do not comply.

As mentioned by Smallwood and Haupt (2000), safety and health at the work place in past were completely ignored and resulted in being the main cause during accidents at the work place. A good cooperation between SOCSO and government bodies, employer associations and employees unions in increasing awareness have emphasized the need to cultivate a safety and health working culture that contributed towards reducing accidents rates. Current promotion on ESH development of incentives shows the positive benefit in company's good practice and management.

The advancement of technology and the changes in work processes have alerted organizations to dedicate their attention to organizational and management impacts on safety performance particularly the function of safety and health management. NOHSC (1997) have mentioned that, in managing the safety and health in the workplace systematically, the system consists of five elements (1) policy, (2) organizing, (3) planning and implementation, (4) evaluation, and (5) action for improvement.

Petersen (2000) stated that excellent safety and health management must fulfill the following six criterias; (i) Safety must be a core value of an organization through daily behavior-based safety by supervisors and teams; (ii) There must be involvement by middle managers to ensure quality performance of subordinates, supervisors or team performances to demonstrate safety behaviour in the workplace; (iii) Visibly demonstrated executive action; (iv) Obtain hourly involvement in meaningful daily activities; (v) Allow flexibility; (vi) Be perceived as positive by employees.

Nevertheless, the assessment of an SHMS is a proactive measure of an organization's safety performance (Kelly & Boucher, 2003). Hence, effective safety and health management has been considered as an important element in managing the interaction between systems and people. Organizations have started to show interest in safety and health management for the following reasons (Hale *et al.*, 1997). Reports on major disasters that emphasized the failings of management to, protect the safety and health of their employees, government requirements for OSHMS to assist organizations to comply with regulations and increased awareness of corporate responsibility.

2.5 Occupational Safety and Health Management System (OSHMS)

2.5.1 Definition and Purposes of OSHMS

There are no clear boundaries between OSH activities, OSHM and OSHMS, the OHSMS are not. A well-defined set of management system and OSHMS is an integral part of the overall management system of organization (Nielsen, 2000). Definitions bellows illuminated the OSHMS as implementation of OSH policy in achieving the safety and health targets but it missed the extent of its applicable in the company. The definitions of OSHMS as bellows;

“OSHMS is a set of interrelated or interacting elements to establish OSH policy and objectives and to achieve those objectives”- ILO-OSH (2001)

“OSHMS is a part of an organization’s management system used to develop and implement its OSH policy and manage its OSH risks”- OHSAS 18001 (2007)

“What makes an OHSMS a system ‘is the deliberate linking and sequencing of processes to achieve specific objectives and to create a repeatable and identifiable way of managing OHS. Corrective actions...(are also) central to a systematic approach” (Bottomley, 1999).

‘OHSMS as ‘...a combination of the planning and review, the management organizational arrangements, the consultative arrangements, and the specific program elements that work together in an integrated way to improve health and safety performance’ (Gallagher, 2000).

‘...an OHSMS can be simple or complex, it can be highly documented or sparingly described, and it can be home grown or based on an available model’
(Bottomley, 1999).

Robson *et al.*, (2007) stated that there is no agreement on what constitutes an OHSMS and its dimensions are broad. From these definitions of OHSMS, three critical components appeared: (1) management planning and accountabilities; (2) consultation with employees; and (3) certain program components such as incident/ accident reporting and investigation, monitoring and evaluation (Gallagher *et al.*, 2003).

OSHMS is a single- system access to all of the OSHA rules and regulations that need to be complied which is provided as the solution by ESH management in accessing to be comprehensive, current, historical laws, regulations and standards from OSHA. OSHMS has properties such as internally integrated, proactive, elements of evaluation and continuous improvement, unlike Non-MS Programs of OSH (Robson *et al.*, 2007).

The reasons why OSHMS should be well-managed fall under the three main following headings (Bateman, King and Lewis, 1994) that includes the humanitarian, financial and legal. First, in humanitarian consideration, a lot of people died in workplace accidents due to occupational illness and from long term problems. The economic cost is a scale of human suffering that should be accepted in an advanced and in civilized society as retrenchment of the country’s industrial base has played a part.

Second, the financial costs of accidents serve as the second reason in the implementation of safety and health effective management. Measurable costs refer to payment paid are made by the insurance company’s’ insurances, in the long run the

insurance premium paid will inevitably reflect the claims history of the employer as a compensation paid to the employees in the form of damages that related with legal and administrative costs.

Third, the most damaging effect of legal sanctions can be on the organization's own image of itself as OSH is under the legislation, in terms of general or specific application. The well-management in humanitarian consideration, financial cost and legal sanctions will contribute to the effectiveness of safety and health. Many companies which have the implementation of OSHMS have been reported a positive advantage.

According to Bryan (1999), the OSHMS is a planned, documented and verifiable method of managing hazards and associated risks and can be defined as the plan to reduce and eliminate hazards and risks at workplace. Several sectors including public, private and NGOs have developed and adopted the idea of OSHMS as these standard and guidelines have provided the requirements for any type or size of organizations for developing and implement OSHMS.

2.5.2 Advantages, Disadvantages and Obstacles of OSHMS

The ILO (2005) reported that occupational accidents and ill-health are avoidable and cooperation among all people with a positive commitment will ensure this mission can be achieved. However, individual accountability is the main factor in a safety mission where it must be expanded to all departments starting from the management to all employees (Murphy, 2003).

Fernandez-Muniz *et al.*, (2008) identified some features for an effective of OSHMS which OSH risks management facilitates associated with organization's business. The main purpose of the rules and legislation is to prevent accidents, ill health and injury from happen so that will always protect the employees' safety and ensuring healthy workplaces.

According to Radhlinah (2000), the industries can have advantages and benefits from improved attitude change that cultivates a vision for the future which elevates safety concerns and effectively integrates into the overall management mix. Some of the main reasons for being concerned about OSHMS include the economics, legality and morality, management, safety and health aspects.

Overall, the advantages and benefits of implementing OSHMS include increasing productivity, product quality, higher morale and health status of employees and compliance with standards and regulations. The indirect advantages are in improving corporate image, chances of winning contracts and job satisfaction or morale and can reduce absenteeism and staff turnover.

As for disadvantages, it also can reduce lost workdays, turnover of personnel, business interruption costs, compensation costs and also reduction or elimination of property damage due to the incidents. According to Fernandez-Muniz *et al.*, (2008), the occupational accidents and unsafe working can damage the materials, reduce the productivities, contribute a bad effect on human resources and diminishes employees' motivations. This conviction is now also recognized by governments, employers and workers (ILO-OSH, 2001).

Even though the use of an OSHMS approach has gained popularity, Gallagher, Underhill and Rimmer (2003) discovered some obstacles to its effective implementation of an OHSMS. The barriers are; (1) lack of succeed in meeting the necessary requirement factors such as management commitment, employee involvement, (2) unsuitable usage of audit tools to guarantee compliance; (3) difficulty of implementation in certain sectors due to workforce attributes such as in familiarity with OSHMS, lack of resources, temporary employees that are not committed, etc.

Besides these barriers, they also noted that research on the effectiveness of OSHMS was still not in agreement due to (1) an inconsistent definition of what OSHMS is; (2) the focus was more on individual correlation rather than on OSHMS; (3) no reliable measures of OHS performance; and (4) inconsistent findings of empirical research especially to denote association between OSHMS performance and injury outcomes (Gallagher, Underhill and Rimmer, 2003). To overcome the ESH problems, most employers have taken a proactive approach in providing the best equipment and training and employees should be prepared on the potential issues and solution for more active role in looking for the safety and health implications that proved by some researches.

By using workplace-related health promotion programs could lead to not only lower absenteeism but also lower health care costs (Aldana, 2001; Busse and Bridger, 1997), the fitness programs can also assist in a reduction of health care costs (Aldana, 2001). Workplace health promotion programs have gained some advantages and benefits including managing back pain (Loisel *et al.*, 2002), reducing MSD-related employees compensation costs and injury rates (Doupbrate and Rosecrance, 2004 and Lewis *et al.*, 2002). Damon and Nadia (2008) have recognized the hazards and measured safety and health risks such as set suitable safety controls in place, and give recommendations.

According to De Greef and Van den Broek (2004), workplace health promotion should be able to influence both individual and organizational outcomes. Doupbrate and Rosecrance (2004) said that, employers must implement such measures in contributing to the quality and efficiency and promote safety and health procedures.

Vassie and Lucas (2001) survey of OSHMS in the manufacturing sectors indicated that empowered workers who played active health and safety roles could result in health and safety performance improvement even though the empowerment was limited. Although employees' participation and involvement are crucial, the accountability and responsibility in the safety and health must come from senior management as required by the OSH legislation.

2.5.3 OSHMS in International Countries; Standards and Guidelines

Most countries have similar standards regarding to the basic standard and guidelines of the OSHMS. Some of internationally available standard and guidelines for OSHMS are OHSAS 18001 (1996), ILO-OSH (2001), BS 8800 (2004), and OHSAS 18001 (2007).

(i) OHSAS 18001: 1996

In avoiding confusion with the many guidelines regarding safety and health at the workplace, OHSAS 18001: 1996 was introduced (OHSAS, 2007). This was developed in relation with the quality of EMS certification of ISO 9001 (Quality) and ISO 14001 (Environmental) standards that allows the organization to control and manage its risk in relations to OSH. It gives submissions and benefits to assist in the organization's establishment of an OSHMS.

The certification or registration of its OSHMS by an external organization makes self-determination of conformance with their OHSAS specification for an organization via audit or consulting parties. Figure 2.1 tells us about six elements in OHSAS 18001: 1996 that includes; (1) OSH policy (2) Planning (3) Implementation and Operation (4) Checking and Corrective Action and (5) Management Review.

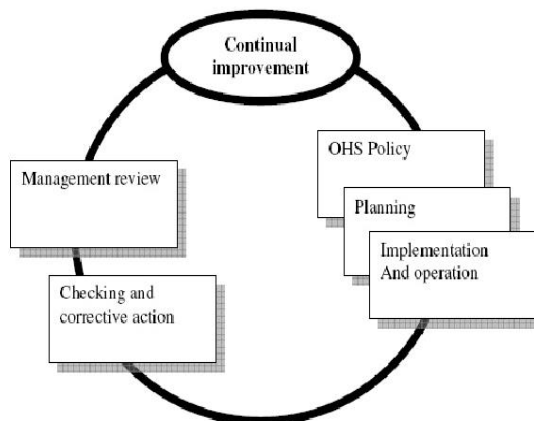


Figure 2.1: Elements of OHSAS 18001: 1996 (Source: OHSAS, 2007)

ii) ILO-OSH (2001)

On a global scale by United Nations agency, ILO has developed voluntary Guidelines on OSHMS 2001 (Appendix 2) as assisting the governments, employers and employees in a teambuilding approach to OSH organization's workplace environment. In ensuring OSH, it should be implemented as the objectives of the OSHMS that identify the possible flaws and weaknesses to overcome through a process of continual and step-wise improvement.

According to ILO (2001), there are three guidelines provided for countries; (1) National framework for OHSMS was established as preferably supported by national laws and regulations (2) Guidance of voluntary arrangements for development was provided to strengthen the compliance with regulations and standards that leading to continual improvement in OSH performances (3) Guidance on development of both national and tailored guidelines on OSHMS was provided as respond appropriately in organization's size and the nature activities.

iii) BS 8800 (2004)

The British Standard is called BS 8800:1996, which contains six elements of an OSHMS (Ahmadon *et al.*, 2006). The elements of the OSHMS (Figure 2.2) specified under the BS 8800 are as follows; (1) Policy (2) Organizing (3) Planning and Implementing (4) Measuring Performance (5) Audit (6) Initial and Periodic Status Review. This base determines the scope and content which contribute to the success of system and any negligence that can letdown the performance of OSHMS that mainly relies on continual monitoring, performance of continuous improvements and relevant processes. Improper OSHMS can lead to poor safety records with the aim of 'zero accident' which is hard to achieve due to the rough and tough nature of the industry.

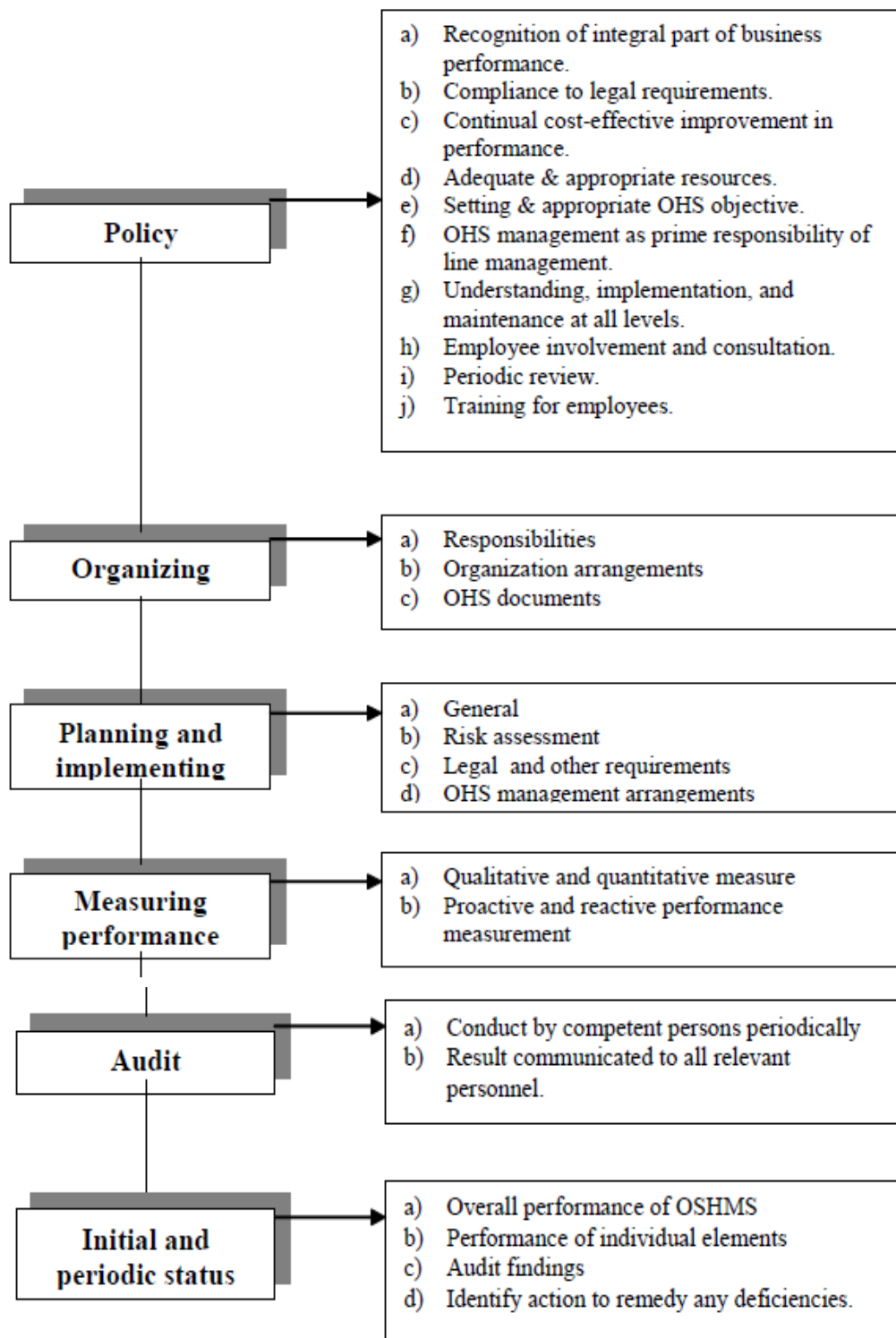


Figure 2.2: OSHMS Element of BS 8800: 1996 (Source: Ahmadon et al., 2006)

iv) OHSAS 18001 (2007)

On the other hand, OHSAS 18001 is a model for an OSHMS that enables an organization to control its OSH and improve its performance (NSAI, 2001). Figure 2.3 shows the OSHMS Model by NSAI (2001).

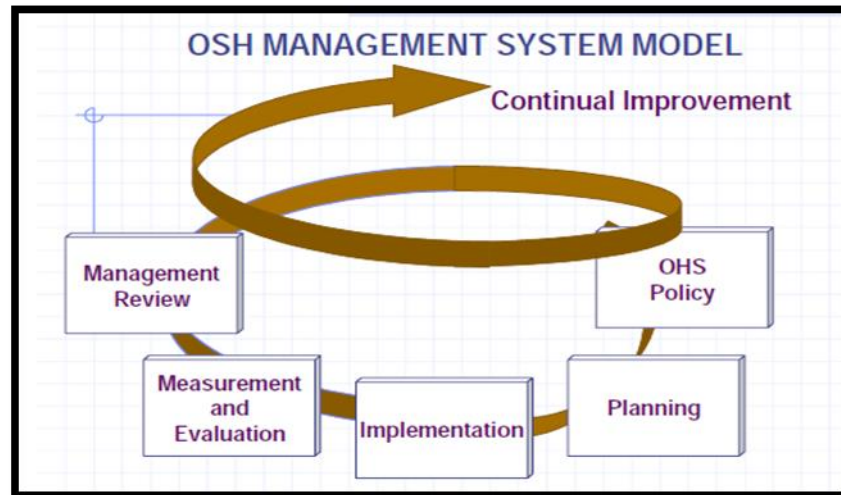


Figure 2.3: Element of OSHMS Model (Source: NSAI, 2001)

By introducing incentives for employees' participation, it can promote the OSH and improve the competency of employees in training and development. The control and review of activities will help to improve the overall system. The base of any OSHMS is the identification of hazards and measures to control them as explained by Makin and Winder (2008) in their research.

Overall, the implementation of the OSHMS must be applicable to all levels of organizations that confirm to the existing laws and regulations which related to safety and health workplace. Hinze (1997) claimed that managing safety essentially involves four levels that include the; (1) company policy, (2) project management, (3) site management and (4) individual where the failure at each level is the reason for the occurrence of accidents.

2.5.4 Understanding the Conceptual Model

A model of a concept is quite different because in order to be a good model it need not have this real world correspondence, which was usually built by analysts who are not primarily concerned about the truth or falsity of the concepts being modeled. Gregory and Hutson (1992) and Mylopoulos (2003) have defined the conceptual modeling as;

“An activity of formally describing some aspects of the physical and social world around us for the purposes of understanding and communication”

Gregory and Hutson (1992) stated that the value of a model is usually directly proportional to how well it corresponds to a past, present, future, actual or potential state of affairs. In the most general sense, Duan & Cruz (2011) have defined the model as; *“A model is anything used in any way to represent anything else”*. The conceptual model plays an important role in the overall system development life cycle (Sokolowski and Banks, 2010). They had depicted the role of the conceptual model in a Typical System Development Scheme in Figure 2.4 below.

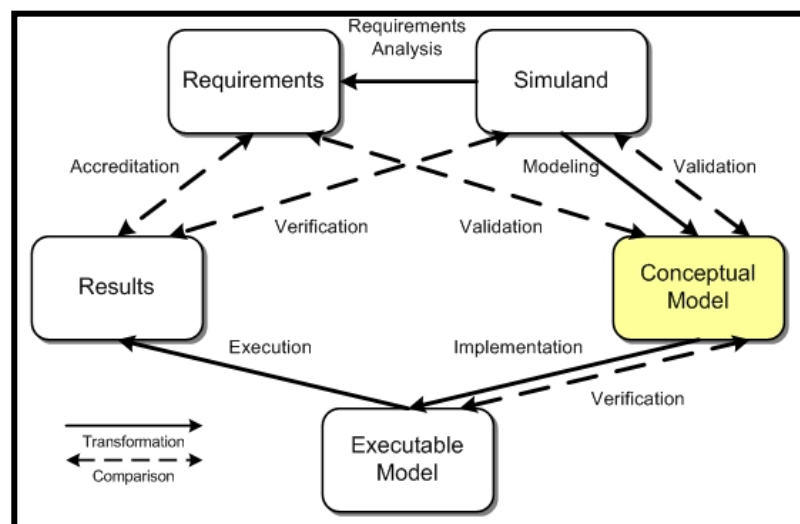


Figure 2.4: Conceptual Model in a Typical System Development

(Source: Sokolowski and Banks, 2010)

According to Kung and Solvberg (1986), the objective of a conceptual model's primary is to convey the fundamental principles and basic functionality of the system in which it represents and should satisfy four fundamental objectives; (1) Enhance an individual's understanding of the representative system (2) Facilitate efficient conveyance of system details between stakeholders (3) Provide a point of reference for system designers to extract system specifications (4) Document the system for future reference and provide a means for collaboration.

The advantages of having conceptual model is, it is a part of a continuous program for providing safety and health information to all employees of steel factory where the management shall share the responsibility for the safety and health employees, contractors, visitors and others who are within at any one's time. Then, it works as a guideline in having the policy and safety and health manual to provide a safety and health work environment. The importance of conceptual model are as an effort to prevent injuries, illness and death from work related causes and to minimize losses of material resources and interruptions from accidental occurrences. They are directed towards the control of all types of hazards encountered in the performance of duties (Kung and Solvberg, 1986).

The disadvantages of having the conceptual model is, if it is not fully developed, the execution of fundamental system properties may not be implemented properly, giving way to future problems or system shortfalls (Sokolowski and Banks, 2010). These failures do occur in the industry and have been linked to; lack of user input, incomplete or unclear requirements, and changing requirements. Those weak links in the system design and development process can be traced to improper execution of the fundamental objectives of conceptual model.

2.5.5 Various Models and Conceptual Frameworks in OSHMS

(i) ILO- Occupational Safety and Health Management Systems (2001) Model (ILO-OSHMS (2001) Model)

The ILO is a specialized agency of the United Nations with a primary goal to promote opportunities to obtain decent and productive work in conditions of freedom, equity, security, and human dignity. ILO-OSH 2001 provides a unique international model; compatible with other management system standards and guides by developed its voluntary Guidelines on OSHMS in 2001: ILO-OSH 2001 Guidelines (Appendix 2). The ILO-OSHMS Model (ILO-OSH, 2001) as shown in Figure 2.5.



Figure 2.5: ILO- Occupational Safety and Health Management Systems Model (Source: ILO-OSH, 2001)

Detail elements and sub-elements of ILO-OSH (2001) Model are as follows (Figure 2.5); (1) Policy; OSH policy and worker participation (2) Organizing; responsibility and accountability, competence and training, OSHMS documentation and communication (3) Planning and implementation; initial review, system planning, development and implementation, OSH objectives, hazard/ risk prevention (4) Evaluation; performance monitoring and measurement, investigation of work; related injuries, ill health, diseases and incident/ accident, and their impact on safety and health performance, audit and management review (5) Action for improvement; preventive and corrective action, and continual improvement.

Based on ILO- OSH 2001 Guideline, the importance of this model is, it can be used on two levels; (1) At the national level, with preferable supported by national laws and regulations, it is provided for the establishment of a national framework for OSHMS. Some precise information provided on developing voluntary arrangements to strengthen compliance with regulations and standards, for continual improvement of OSH performance (2) At the organizational level, it encourages the integration of OSHMS elements as an important component of overall policy and management arrangements. NOHSC (2002) indicated that an evaluation of OHS performance enables an organization to discover OHS problems and take necessary preventive action.

These guidelines on OSHMS according to internationally agreed principles defined by the ILO's tripartite constituents have provided a unique international model, compatible with other management system standards and guides. The strength, flexibility basis for the development of a sustainable safety culture in the organization were provided by this approach which reflect ILO instruments relevant to the protection of employees' safety and health protection.

(ii) Managing Outstanding Safety Model (Stewart, 2002)

Model of Managing Outstanding Safety (Source: Stewart, 2002) is one of various safety management models (Figure 2.6) which was introduced by James Melville Stewart (2002). Many models of safety management are descriptive, this model was developed from detailed observation of organizations with consistent (year-over-year) outstanding safety performance by identifying key 'drivers' and their impacts, in order to understand and identify excellent factors that contributed to safety and health workplace.

The outcome for this model is safe physical environment and safety-aware attitudes and should result in outstanding safety performance (Stewart, 2002). This model is good in a way as it focuses on outstanding safety performance and its determinants that drive towards an outstanding safety performance. Commitment of senior management is vital to increase safety and health performance (Vassie, Tomas & Oliver, 2000).

The importance of this model focuses on how organizations can be designed to achieve outstanding safety results, based on research that has benchmarked the 'best' in safety worldwide. It presents a process for step-change, and reviews the experience of organizations which have made this journey successful. From his study, he stated that the excellence in safety begins with management's commitment (Stewart, 2002). Management's commitment to OSH is reflected in the ability of the upper-level management to demonstrate an enduring, positive attitude towards OSH and to promote OSH in a consistent manner across all levels within the organization.

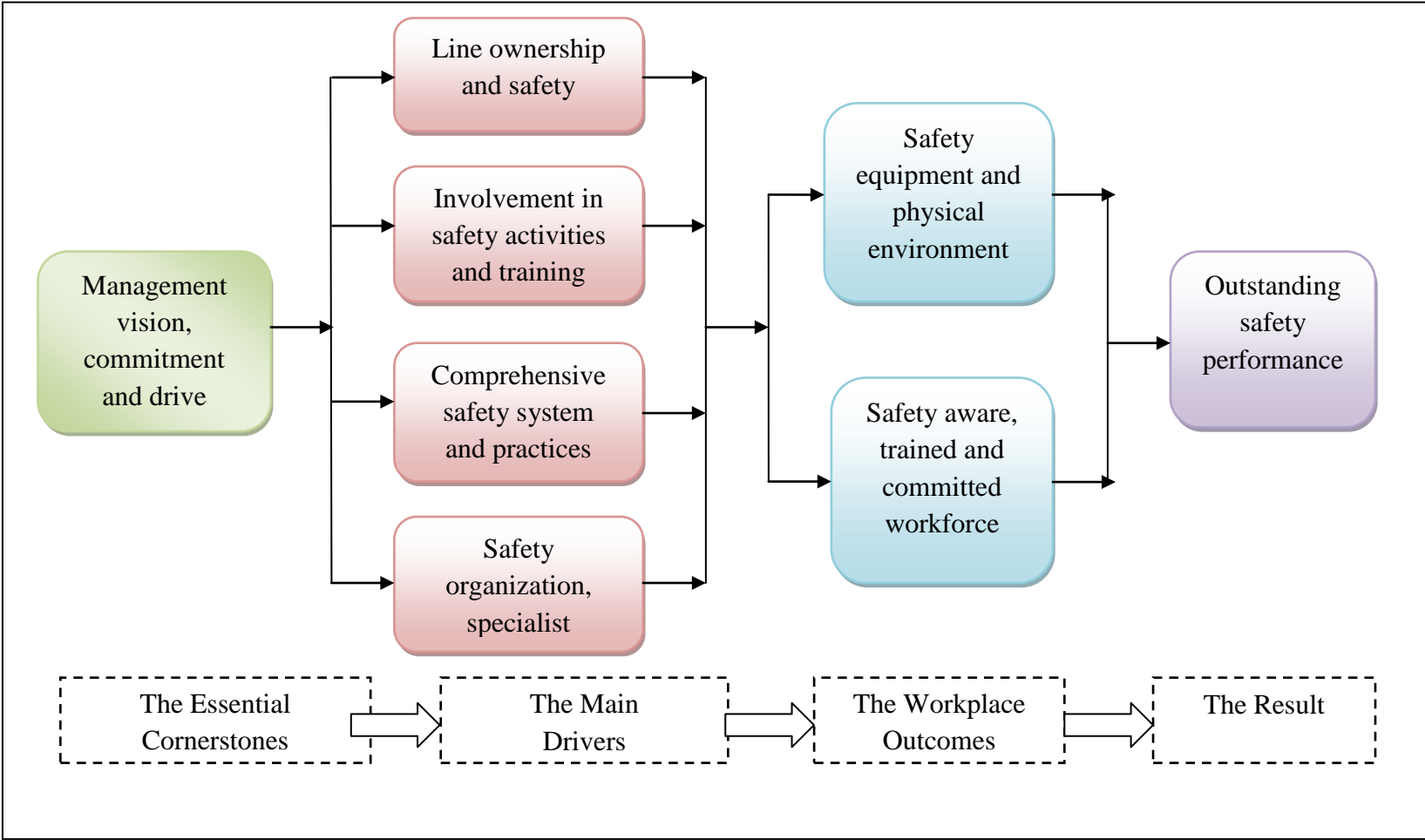


Figure 2.6: Managing Outstanding Safety Model (Source: Stewart, 2002)

iii) European Agency for Safety and Health at Work (EU-OSHA) Model

(Source: EU-OSHA, 2002)

The European Agency for Safety and Health at Work (EU-OSHA) is a decentralized agency of the European Union, set up in 1996 by Council Regulation (EC) of 18 July 1994 (EC, 1994) with the task of collecting, analyzing and disseminating relevant information that can serve the needs of people involved in safety and health at work. The importance of EU-OSHA (2002) Model is in creating a culture of risk prevention that involves designing practical instruments which can be used by companies of small and medium sizes (Figure 2.7).

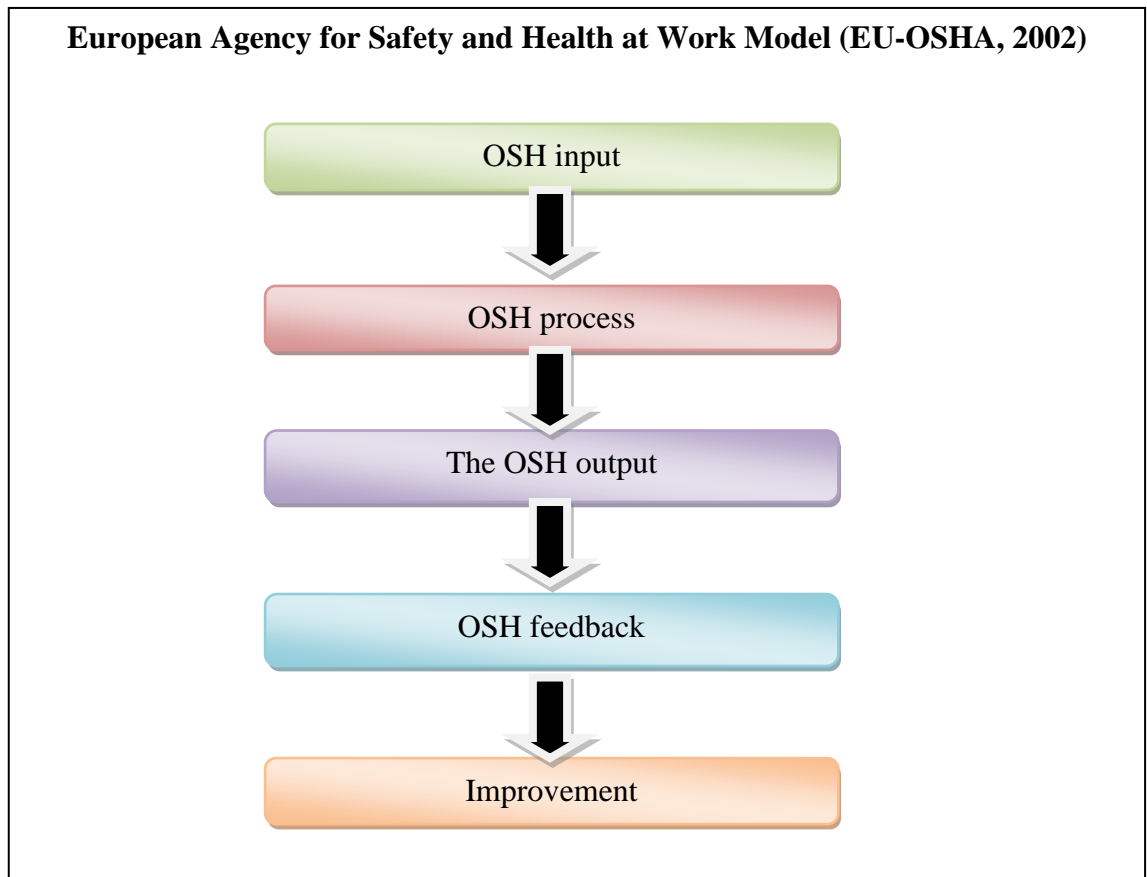


Figure 2.7: European Agency for Safety and Health at Work Model

(Source: EU-OSHA, 2002)

This model can help to assess workplace hazards and risks, and share knowledge and good practices on safety and health. Organizations need to hire the right people for the right job to ensure the minimization of workplace hazards. The study of Hassan, Nor Azimah and Chandrakantan (2005) found that hiring practices is one aspect that requires serious attention by companies as employees should be hired based on good safety records from previous experience in other companies. Studies on the use of OSHMS in the Member States of the European Union in the Year 2002 have identified five ideal elements of an effective OSHMS. Detailed elements in European Agency for Safety and Health at Work Model as follows;

(1) OSH input – initiation; There are four variables under this category: management commitment and resources; regulatory compliance; accountability, responsibility and authority; and employee participation (2) The OSH process – formulation and implementation; five sub-elements under the formulation of the OSH process: OSH policy/ goals and objectives, performance measures, system planning and development, baseline evaluation and hazard/ risk assessment, and OSHMS manual and procedures. The implementation of the process consists of four variables including; training, hazard control, preventive and corrective action and procurement and contracting.

(3) The OSH output contains five sub-elements: OSH goals and objectives, number of illness and injury, workforce health, changes in efficiency, and overall organization performance (4) OSH feedback; the communication system and the evaluation system are two variables involved in this section (5) Improvement– open system elements. Three variables in this category are continual improvement, integration, and management review.

(iv) National Occupational Health and Safety Commission (NOHSC)

Model (Source: NOHSC, 1997)

The National Occupational Health and Safety Commission (NOHSC) is an overarching federal commission, established as a statutory corporation, with members appointed by jurisdictional governments, the Australian Chamber of Commerce and Industry and the Australian Council of Trade Unions (under NOHSC Act, 1985). It leads and coordinates national efforts to prevent workplace death, injury and disease in Australia.

It has a broad range of non-directive functions, including initiating research, collecting statistics, developing national standards (although, because of the Federal Parliament's constitutional limitations, NOHSC standards have no legal force unless adopted in legislation or regulation by State and Territory Governments), advising government and providing education. In NOHSC Model, NOHSC (1997) have stated that, the classification of this model is divided into two parts; traditional vs. innovative management and safe workplace strategy vs. safe person-control strategy (Figure 2.8).

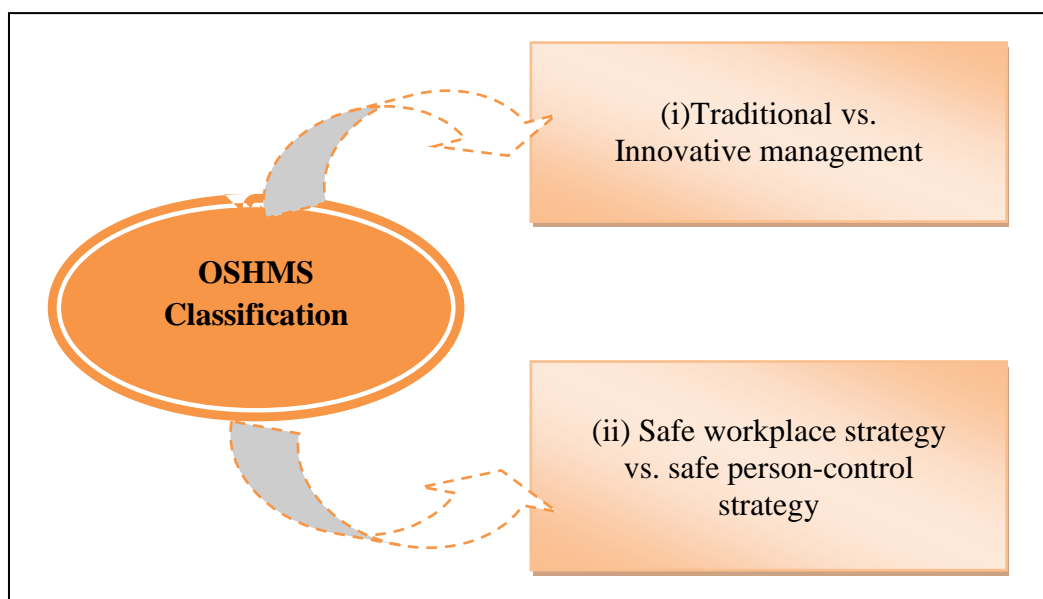


Figure 2.8: National Occupational Health and Safety Commission (NOHSC) Model
(Source: NOHSC, 1997)

The detail elements in this NOHSC Model (NOHSC, 1997) are as follow; (1) Traditional vs. Innovative management; Traditional management focuses on the “key persons” involved in safety and health management (supervisors and safety and health specialists) and employee’s participation is not vital. On the other hand, innovative management viewed employee obligation as crucial with the role of management in safety and health management. (2) Safe workplace strategy vs. safe person-control strategy; Safe workplace strategies point to the managing of hazards during the design and implementation stage and safe person control centres’ on the supervision of employee behaviour.

This model found that, a good and safe workplace environment and employee participation as key factors that contribute to safety activities in organizations. A strong commitment from top management and good employee involvement are critical elements for effective OSHMS with support from supervisors in determining their role effectively. From prior studies, the most notable determinant is management attitude or action toward safety. Management commitment to safety indicates the extent to which top management demonstrates positive and supportive safety attitudes (Hsu *et al.*, 2007).

2.5.6 OSHMS in Malaysia; OSH-MS1722

There is a growing concern about safety and health at work and Malaysia has put a special emphasis on OSH issues due to its speed of economic development. Since 1999, the scenario of OSHMS in Malaysia shows that, most transnational companies operating in Malaysia have their own OSHMS. OHSAS 18001 has been the only OSHMS being implemented in Malaysia where 268 companies had certified to this system (SIRIM, 2009). Since there is no national standard for OSHMS in Malaysia, based on the ILO standards, the OSH Management Systems – Malaysian Standard (OSH-MS), was developing by Government, in Year 2003. Until Year 2005, the OSH-MS1722 was introduced but only private organizations are certified to the standard.

As positive benefits, the concept of the OSH-MS1722 will help employees to understand its application in Malaysia and legislation needed to be followed by industry. OSHMS also provides companies with the framework to develop a solution to the increasing challenges they face at the workplace nowadays. Malaysia also has a guideline in OSHMS, named as Guideline on OSHMS by DOSH (Appendix 3), Ministry of Human Resources, which provides generic advice on the application on MS1722:2011 OSHMS.

The OSH-MS1722 audit checklist and software has been developed to complement the OSHMS Guidelines. The OSH-MS comprises five elements; (1) Policy (2) Organizing (3) Planning and Implementation (4) Evaluation and (5) Action for Improvement, and 16 measures. With the understanding in the concept of the OSHMS, it will help us to understand the applications in legislation that needs to be followed by industry. OSHMS is based on the nature of OSH legislation in encouraging the organization to use a systematic approach.

The purpose of this guideline is to provide direction and assistance in implementing OSHMS that can contribute to the protection of employees from hazards and its associated risks, the elimination of work-related injuries, disabilities, ill health, diseases, near misses and fatalities. This guideline is intended to; (1) interpret the requirement MS1722:2011 (2) assist compliance to legal requirements (3) ensure continual improvement in OSH performance and (4) cultivate OSH culture in organization.

Apart from fulfilling the general legal duties under the OSHA 1994 requirements, the organizations that adopt the OSHMS will gain many benefits such as improving productivity and preventing accidents from happening. One such standard is the OHSAS: 18001. Official introduction of OHSAS 18001 standards by SIRIM QAS, forms a basis of OSHMS is timely (Nimi, 2002).

Other benefits on implementation of OHSAS 18001 and MS 1722 Certification Scheme according to SIRIM QAS International (2013) is to improve the management of OSH risks, reducing the probability of accidents in the workplace, and also continually improves safety and health performance, including compliance with regulatory requirements.

According to Almeida (2006), the Former Malaysian Human Resources Minister, Datuk Dr. Fong Chan Onn urged all organizations in high-risk industries be required to adopt the OSH-MS1722 as an accident-free environment helps an organization to enhance its productivity and profitability. According to Ahmadon *et al.*, (2006), the main purpose of rules and legislations are to prevent accidents, ill health and injuries at workplace.

The ILO highlighted that implementing an OHSMS is a way to improve the safety culture in organizations and at the same time comply with OHS regulations (Dias, 2005). Cooper (2000) identifies the characteristics of safety culture model which are psychological, behavioral and situational factors. Self-regulatory processes have been promoted as a part of this model in reducing risks in organization.

This is in fact consistent with Malaysia, where the introduction of self-regulation, through the enactment of the OSHA 1994 was to promote safety culture (Faridah *et al.*, 2010). In promoting OSHMS, DOSH in its strategies, also looks forward for the outcome of self-regulation for the Year 2011- Year 2015. This time frame becomes the indicator for DOSH to meet their target of having OSH culture at workplace in Malaysia for the Year 2016- Year 2020 and having preventive a culture beyond 2020 (DOSH, 2010).

2.5.7 OSHMS in Malaysia; Guideline on OSHMS by Department of Occupational Safety and Health (DOSH), Ministry of Human Resources

In achieving the objective of the study, this Guideline on OSHMS by the Department of Occupational Safety and Health (DOSH), Ministry of Human Resources (Appendix 3) is very important as a reference and guideline to review OSHMS at companies and develop ESH Conceptual Model. This guideline has been developed to guide and assist organizations on the implementation of the MS1722: OSHMS. The requirements standard, in replacement of the MS 1722: Part 2:2003 –OSHMS as Guidelines standard which has been withdrawn by Standards Malaysia.

This guideline is divided into four main parts, Part I brief explanation on scope and purpose about OSHMS. Terms and definitions based on MS1722: OSHMS-Requirement standard in Part II. Explanation and description of the OSHMS elements is given in the Part III. Part IV gives examples of form and checklist for references and implementation of the OSHMS.

This guideline is intended to assist organizations to develop and implement an effective OSHMS that can be integrated with other management systems. The implementation of an effective OSHMS is crucial for an organization to achieve a sound OSH performance and to comply with legal requirements. Organizations of all industries, types and sizes use this guideline as it provides generic assistance for establishing, implementing and improving an OSHMS.

Element in Guideline on OSHMS by DOSH, Ministry of Human Resources

OSH, including compliance with the OSH requirements pursuant to national laws and regulations, and practice, is the responsibility and duty of the employer. The employer show strong leadership and commitment to OSH activities in the organization, and make appropriate arrangements for the establishment of an OSHMS. Guideline on OSHMS by DOSH, Ministry of Human Resources show that, the system contains the main elements of policy, organizing, planning and implementation, evaluation and action for improvement, is based on ILO- OSH 2001 Implementation Manual, ILO- OSHMS Model (ILO-OSH 2001).

Detail explanations on the elements as follows; (1) Policy; Include activities related to the development of the organization's OSH policy statement and structures and practices that insure active and meaningful employees participation in OSH arrangement (2) Organizing; Addresses the establishment of OSH responsibilities and accountabilities structures, a training system, competency definitions, documentation practices and a communication system.

(3) Planning and Implementing; Addresses those activities associated with the fulfilment of the principles expressed in the OSH policy statement. These activities include the initial assessment of the OSH arrangement that then support the actual system planning, development and implementation functions (4) Evaluation; Addresses those functions associated with measuring the management system's performance. This involves the development of performance monitoring and measurement protocols, investigation practices for accidents, auditing methods and management review arrangement.

(5) Action for Improvement; Addresses issues associated with preventive/ corrective actions and continual improvement. With the information obtained from performance monitoring and measurement, investigations, audits, and management review, appropriate prevention/ corrective and continual improvement actions can be taken. The relationship between the five categories is represented in the conceptual framework of OSHMS with its sub element is shown in Figure 2.9 below. Detail elements and sub-elements of ILO-OSHMS Model (ILO-OSH, 2001) have discussed before in Figure 2.5, Section 2.5.3.

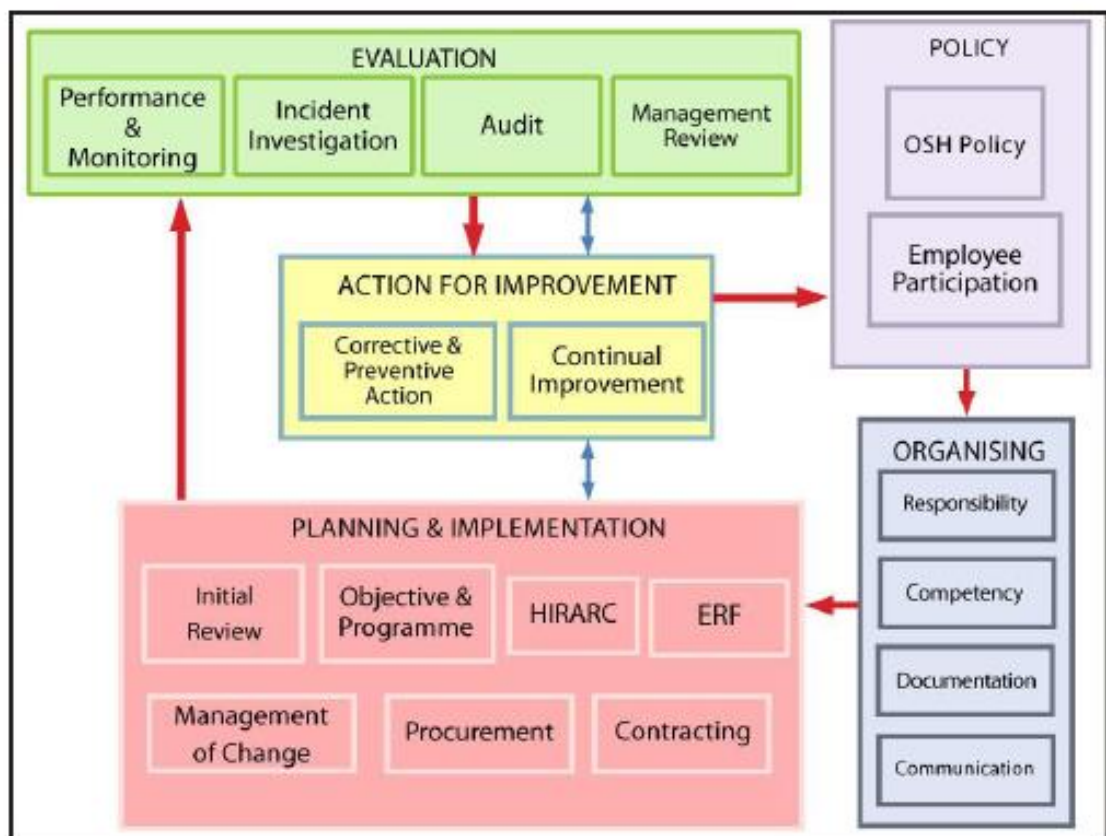


Figure 2.9: Model Implementation Framework
(Source: *Guideline on OSHMS by DOSH*)

Note: The red arrow represents the interaction between each main element of OSHMS, whereas the blue arrow represents the systemic interaction between the sub-elements respectively

2.5.8 Summary on Effectiveness and Benefit of OSHMS

In conclusion, prior studies also demonstrated a reduction in illness/ injury incidence in companies which implemented an OHSMS (Bottani, Monica & Vignali, 2009; Robson *et al.*, 2007). Consequently, to systematically prevent and control the possibility of accidents and illnesses in the workplace and to comply with statutory requirements, OSHMS have become one of the major strategies for addressing a safety and health workplace by adopted the internationally recognized safety standards and guidelines as realizing the importance of OSHMS (LaMontagne *et al.*, 2004).

Biggs *et al.*, (2005) have mentioned that, an effective OSHMS consists of elements that have been successful in protecting the employees' safety and health depends on several factor (De Greef and Van den Broek, 2004); (1) the management's visible involvement, (2) priority commitment on systems, (3) employee's involvement in safety and health decisions, (4) ongoing worksite analysis, (5) identify, implement a hierarchy of controls and prevent the hazards, and (6) specific employees' safety and health training. Datuk Lee Lam Thye, former Chairman of NIOSH stated that adoption of an effective OHSMS assists in meeting legislative obligations; develop a safety culture and the best approach to reduce accidents (Lee, 2000; Lee, 2004; Hamisah, 2003; Almeida, 2006).

Others, the advantages of an effective OSHMS as indicated by CASA (2002); (1) Market the safety standards of the organization's operations; (2) Guard against direct and indirect costs of incidents and accidents; (3) Improve communication, morale and productivity of employees; (4) Meet an organization's legal responsibilities to manage safety. David (2003) mentioned that, advantages from effective OSHMS includes the citations or penalties, rising employee's compensation costs, retention and satisfaction, high injury and illness, lost work days and increasing OSH regulations.

2.6 Hazard Identification, Risk Assessment and Risk Control (HIRARC)

In achieve the OSH objectives, it is important to understand the basis of OSH which is Hazard Identification, Risk Assessment and Risk Control (HIRARC). The purpose of HIRARC according to Guidelines for HIRARC by DOSH (2008) (Appendix 4), Ministry of Human Resource Malaysia, is to identify all the factors that may cause harm to employees and others, to consider what the chances are of that harm actually be falling anyone in the circumstances of a particular case and the possible severity that could come from it (the risks); and to enable employers to plan, introduce and monitor preventive measures to ensure that the risks are adequately controlled at all times.

HIRARC is simple enough to be used by small and medium industries and versatile enough to be used by all in various sectors, including manufacturing sectors, economic, construction or any other sectors. As a core business of all OSH personnel, safety committee members and supervisors, it is very important as the directive from the Chief Secretary of the government service to all government departments and agencies (letter of directive: UPTM 159/267/50 Klt.4 dated 20/8/2004).

HIRARC consist of; (1) Hazard Identification, (2) Risk Assessment and (3) Risk Control. Hazard identification is the recognition of things which may cause injury or harm to a person. Risk Assessment is the looking at the possibility of injury or harm occurring to a person if exposed to a hazard. The introduction of measures which will eliminate or reduce the risk of a person being exposed to a hazard is known as risk control. In this study, the simple HIRARC at a steel factory was done based on the Guideline on HIRARC by DOSH, 2008 (Appendix 4), regarding data from the Company and observation methods.

2.6.1 Introduction on Hazards

Hazards can be divided into three main groups, health hazard, safety hazard, and environmental hazard.

i) Health Hazard

An occupational health hazard is any agent that can cause illness to an individual. A health hazard may produce serious and immediate (acute) effects, or may cause long-term (chronic) problems. All or part of the body may be affected. Someone with an occupational illness may not recognize the symptoms immediately. Health hazards include chemicals, biological hazards (such as bacteria, viruses, dusts and molds), physical agents and work design (ergonomic) hazards. By the observation at steel mill and from the data received by a Company, the health hazards at steel factory and recommended measures taken were identified (as discussed detail in Table 4.6).

ii) Safety Hazard

A safety hazard is any force strong enough to cause injury, or damage to property. An injury caused by a safety hazard is usually obvious. By the observation at the steel mill and the data received from the Company, the health hazards at the steel mill and recommended measures taken was identified (Table 4.7).

iii) Environmental Hazard

By the observation at the steel factory and from the data received by Company, the health hazards at steel mill and recommended measures taken was identified (Table 4.8).

2.6.2 Hazard Assessment

There are two levels of hazards assessment which include the formal-level and field-level. The formal hazard assessment is a complex undertaking, used as an important step in developing an OSHMS specific to a Company and the field-level hazard assessment is performed as unusual hazards that may be introduced into the employee's work. According to the OSH legislation, employers are required to assess a work site for existing potential hazards. Both processes of hazard identification and hazard assessment are important as impacted the OSHMS' elements.

Hazard Analysis is a process used to identify hazards and assess risk where the results are the identification of unacceptable risks and selection of means in controlling or eliminating. Alternative definitions include the identification, studies and monitoring of any hazard to determine its potential, origin, characteristics and behavior (Center for Chemical Process Safety, 1992). For the early design phases, Kietz (1976) have mentioned that, introduction of "inherent safety" concept, has brought into focus a lot of methods with a different approach in minimizing and attenuating process hazards.

The hazards analysis and hazards identification could occur at each step in the process and implementation of the measures to be taken for control (Kletz, 1999). These well-established methods are in the normal case of the process design procedure, especially in early operation phases. According to Wells in his study in 1993 and 1996, Hazard Analysis is performed during the concept and early design stages that require the process flow diagram, with any main add-on safety systems.

2.6.3 Hazard and Risk Controls

Communication and policy enforcement provide opportunities for management to show its commitment to OSHMS and the wellbeing of employees.

i) Develop Hazard Controls

When the hazard assessments are completed to eliminate or reduce the risk of harm, the process will continue by the implementation of control measures that covered under OSH legislation, as part of an OSH system. It can be done by details method;

- a) Qualitative analysis uses words to describe the magnitude of potential severity and the likelihood that those severities will occur. In determining likelihood and severity category, this method uses expert knowledge and experience
- b) Quantitative analysis uses numerical values for both severity and likelihood using data from a variety of sources
- c) In semi-quantitative analysis, qualitative scales such as those described above are given values, to produce a more expanded ranking scale than is usually achieved in qualitative analysis, not to suggest realistic values for risk

ii) Implementation of Controls

The methods of control; (1) Engineering controls, as the first option and the best method hazard control, involves engineering out or substitution (2) An administrative control is the second most effective method that involves the rules, practices and procedures (3) The PPE method is often the easiest control, usually the least effective.

iii) Review and Revise

Hazard assessment and hazard controls should be reviewed soon after controls are implemented to monitor for effectiveness.