

Research Article

Safety Challenges in Construction Industry - A SHEQ Out

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A B S T R A C T

This paper evaluates essentially the safety challenges to the construction industry reviewing instances of failures and desperation from ground realities. Towards abatement of risks and safety hazards the preventive practices as per ISO 45001 are suggested in preference to the control documentation as prescribed in OHS&MS 18001. The process of Management of Change to a situation of total abatement is reviewed, for which competency need for learning has been prescribed. The need for managing processes and alignment w.r.t handling of safety issues using an ab-initio approach has been modeled, maintain due focus on Leadership, Strategies, and Customer, around the system thinking paradigm.

Analyzing the processes, it is recommended to appropriately evaluate the preventative options, as governed by should- can-will- do approach to strategically plan the responses, and considered potent will be attempted for successful consummation.

Keywords: SHEQ-PDCM, Conscientiousness, Learning for Risk Abatement, Improvement of people focus for safety

The Bigger Scenario

The Indian construction sector is the second largest activity, next to agriculture in India,¹ There are about 8.5 million workers employed in the construction sector in India.² Moreover, Construction sector in India has been on a high growth path³ lately, it still remains a dangerous job.⁴ Some construction site jobs are: industrial buildings, power plants, metro /underground railways, multistoried building including infrastructure facilities, flyovers/ bridges, roads & tunnels, footings & foundations, ports & waterway development, and nevertheless their repairs and their maintenance. They most works encounter problems such as working with height, excavation, involving use of power tools and critical equipment, and in an environment of noise, dust, and health and safety hazards.⁴ The list may be made more exhaustive with both minor risks⁵ and major hazards⁶ by referring to these exemplars. In light of general

definition of a hazard in OHSAS 18001 standard, which is a "source, situation, or an act with a potential for harm in terms of human injury or ill health, or a combination of these."⁷ The prevention is the objective. For example how alarming the statement from Head of Loughborough's Construction Health and Safety Research Unit, Alistair Gibb, made in his TEDx Loughborough talk in 2013 could be? "We kill about a person a week in construction" as Gibb cited the poor record of construction worker deaths. For example, during Olympic stadium building, which resulted in 29 fatalities in construction for the five games from Barcelona in 1992 to Beijing in 2008 which planned to be abated (to zero) during construction of London's Olympic stadium.⁶

Studies show the nature of the construction industry is hazardous world over⁸, and statistically, most common injuries and deaths are caused by the fatal four :which are shocks, fall, caught in machine and collapse [4]. However

the level of effectiveness differs from country to country; industry to industry and from company to company. The involvement of diverse behavior and styles of people⁹ with disparate work environments causes such complexity¹⁰ as exhibited in some pictures.

It is in this light that CIRIA contends the 'construction' industry, involving diverse and many people, tends to be complex and dynamic. Such activities require understanding¹¹, and applying, Safety Imperatives.

The British Safety Council (BSC) which set up its India office in November 2017 indicate that in India, over 80% of the estimated 465 million-strong workforce is not protected by the health and safety legal framework, which includes the workforce employed in construction sector.¹² Thus there is an expedient need for an effective safety management system which aims at forestalling the risks and hazards inherent on sites Olutuase⁸ along with strengthening of applicable laws. Concur, Indian Council of Medical Research (2003)¹³ who recommend that construction firms adopt safety system that seeks to prevent the occurrence of accidents, and the preventive measures will save on post-accident expenses, like reimbursement of medical bills and compensations. In light of these issues the subject of this paper drives large significance.

The International Labour Organization estimates over 7600 people die each day from work-related accidents or diseases - that's over 2.78 million every year.¹⁴ Heinrich stipulates 88% of accidents caused due to unsafe act as reported in his book of 1931, "Industrial Accident Prevention: A Scientific Approach".¹⁵ BSC, based upon their industry analyses of construction sector, further stipulates that the overall workplace deaths are 20 times higher in India than in the UK (contradiction in exhibit 1) and 24% of these are in the construction sector.

Reportedly, with 80% of the workforce still employed in unsafe environments, followed by poor implementation of laws and no infrastructure available for workers, it's high time the much-overlooked construction safety management sector was overhauled [BSC]. Notwithstanding research and developments, over the years, principles applied remain status quo, though these have become more complex and

demanding with respect to time, cost constraints. Albeit these are becoming more and more risky in terms of time, money and the predominant risk factors which reduce safety.⁴ The increasing pressure points are say, early and timely completion of projects within cost constraints while maintaining stipulated quality.¹⁶

The key concern sustains the attitude of operators and workers who do not deploy there wise counsel and code of conduct¹⁸, in a scenario where there is a pressure of Maximizing of efficiency and profitability³, and they continue to exhibit and further ground on the bad work practices. The International Organisation of Standardisation (ISO), Geneva has developed a few standards that will help organizations to improve employee safety, reduce workplace risks and create better, safer working conditions, all over the world. The two standards linked to safety are Occupation, Health and Safety Management System Standard (OH&S-MS 18001) for hazard control and the ISO 45001 which takes a proactive approach to risk control that starts with the incorporation of health and safety in the overall management system of the organization.

Safety in a Righteous Perspective

Safety is defined as Relative freedom from danger, risk, or threat of harm, injury, or loss to personnel and/or property, whether caused deliberately or by accident [19]. The popular adage "Prevention is better than cure" is the recommendation that underlies the intention to implement Safety. For designing any potent initiative it is necessary to plan, for which a complete understanding is required. Hence, we need to understand safety in a larger perspective and also its constituents Hazards and Risks.

Incidentally, Hazard was defined above – that is a "source, situation or act with a potential for harm in terms of human injury or ill health, or a combination of these.", the Risk is defined as the "combination of the likelihood of an occurrence of a hazard event or exposure and the severity of injury or ill health that may be caused by the event or exposure."²⁰

Since the understanding and predicting of Risk are a prerequisite for their eventual control, the final process of controlling risk are fundamental to success in construction

Exhibit 1 Comparison of accidents rates in construction of year 1992 and 1993

Accident Rates for the year 1992 and 1993, given by construction Wing of NPC, India are reported as 10.05 and 12.06 respectively. This indicates that our construction accidents are 5 to 14 times less than those of foreign (developed) countries. Similarly Fatality Rates for 1992 and 1993, given by the same NPC, India are 0.124 and 0.120 respectively and again these figures when compared with ILO figures, indicate that Fatal construction accidents in our country are 75 to 320 times less than those in western countries. The reasons of this anomaly, as stated in the article are as under: 1.Gross under-reporting of accidents by Indian industry. 2.ILO figures include first aid injuries while ours are reportable accidents. 3.ILO figures are told when safety efforts in western countries were poor.

Ref HSE India¹⁷

projects. Hence Risk assessment is considered vital for management and protection of all activities and parties in a project. It covers various considerations from health and safety to contractual commitments. All of the information on hazards, risks, and controls needs to be kept up to date and taken into account in the ISO's OH&S management system. There is a need to have a current and pertinent data environment, which is organization wide and covers all domains of safety, health, environment, quality and productivity to store, share, and collaborate with information used by teams across the entirety of a project is key.²¹

Risk assessment is formally defined in the standard as the "process of evaluating the risks arising from a hazard, taking into account the adequacy of any existing controls, and deciding whether or not the risk is acceptable." It includes processes to establish, implement, and maintain a procedure for ongoing hazard identification, risk assessment, and determining the necessary controls to manage the OH&S hazards, so as to meet the requirements of clause 4.3.1, the OH&S management system.

The Section 4.3.1 of erstwhile British Standard OHSAS 18001 (Hazard Assessment, Risk Assessment & Determining Controls) section now sets out additional details on both the inputs to be considered and the methodology to be used for the hazard identification and risk assessment process and determining controls. In addition, specific requirements have been added related to "management of change" and for determining appropriate controls to reduce the OH&S risks that are identified, and operate as schematically described in figure 1.

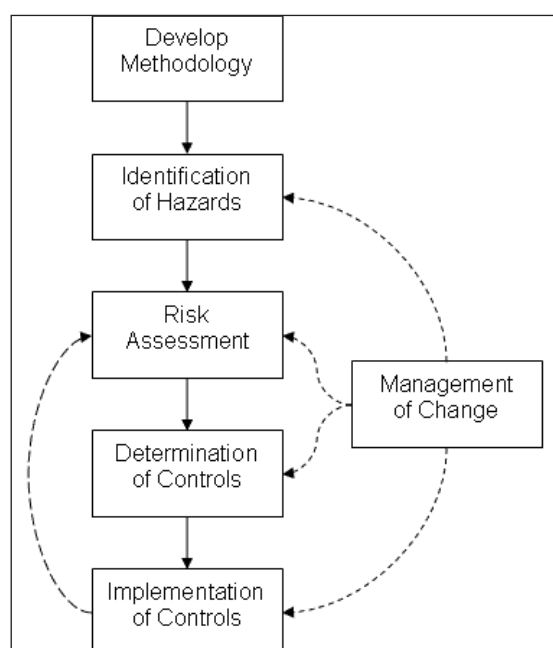


Figure 1. The process of identification of risks/ hazards and exercising of control with management of Change²⁰

Further to evaluate the hazards and risks and remedy them a preventative process is defined in ISO standards. Namely, ISO 45001 that prescribes a proactive approach to risk control incorporating the explicit consideration of safety and health in the overall management system of the organization. This can be now complimented (integrated) with that of Quality, Environment and Information, thus driving top management to have a stronger leadership role in the safety and other programs. This helps identify potential hazard risks before they cause accidents and injuries. The process of Audits, job safety analyses and monitoring of workplace conditions is rather more critical and challenging in this proactive standard in contrast to the reactive one which emphasis hazard control, under OHSAS 18001.²²

Challenges in Construction

While, Construction workers constitute a major portion of the unorganized labour and are characterized by their casual nature of employment.² The general business climate is getting more and more challenging, with both public and private budgets being cut.²³ Customers are increasingly seeking 'more for less'. The retrenchments and turnover rates are high and the preparedness levels to combat hazardous environments levels are getting lower and lower. Consequently, there are delayed handovers, budgets are exceeded, and thus changed requirements and the resulting unplanned work gets more and more complicated. All this leads to increasing challenges.

In 1999, Sir John Egan published his challenge to the construction industry to do better, titled Rethinking Construction.²⁴ A decade later, after assessing the progress, he has only scored the sector '4/10'. The revolution that he called for has not yet arrived nor the public perception of the industry has improved for the better. The gravity of challenges like completion of projects within the stipulated time and maintaining costs³ is continually increasing, in a scenario of total disruption of technology, and with increasing awareness to respond to meet appropriate quality²⁵ and standards of safety, that have been amply objectivized in the last two decades.²⁶ The key concerns have been Maximizing of efficiency and profitability.³

From a survey, commissioned by UdeMy, a company, reported by Harvard Business Review (HBR) that provides online training courses, it was seen that 61% of employees feel that there is a skills gap, Though the construction industry has not been served, but it can be argued that the priority of such skills associated with SHEQ are a part of other 9.6%. (Fig 2).²⁷

The public perception of the industry can't be improved until the construction firms adopt safety system that seeks to prevent the occurrence of accidents argue many researchers²⁸⁻³⁰ which is not easy, seen in light of the total

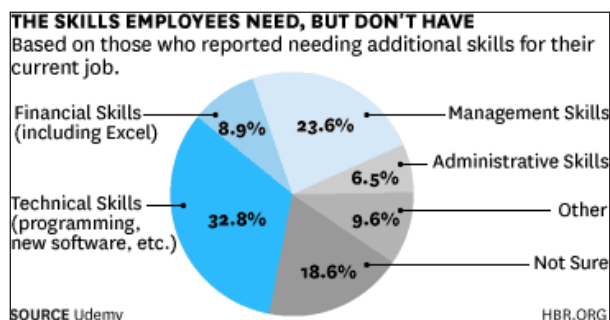


Figure 2. The skills employees need, but don't have

inadequacy of workers in a system where the relationship with the employer is just temporary, even in prolonged working hours which are quite uncertain and in the general lack of inadequacy of basic amenities and welfare facilities, and safety and health measures.² Thus the safety systems versus the ground reality are becoming more and more divergent. Some of the issues have been identified and collated in table 1.

The remarks column in the table exhibit the darker side of India's \$140 billion construction industry, where a pervasive lack of safety, as well as lack of government oversight places

Table 1. The Safety Principles V/S Ground Reality

S.No	Mandatory Requirements	Safety Principle	Ground Reality	Remarks
1	Statutory and Regulatory requirements	Ensuring safety at construction sites is mandatory requirement as it is directly related to welfare of staffs and contractors' workers.	Many sites don't have the necessary safety equipment such as safety harness vest while working at heights.	Need to strengthen the permit system, monitoring methods, and law and order system
2	planning and thorough implementation of safe practices	All accidents and occurrences of near-misses can be avoided by proper planning and thorough implementation of safe practices at work place.	Planning is generally done by the labors or less experience supervisors as per their suitability and ease, without considering the risk involved.	Quality education and improvement of project management competency
3	safety consciousness of the people through continuous training and motivation	To increase the safety consciousness of the workforce and the supervisory staffs through continuous training and motivation towards safe practices.	It is only reputed builders and contractors that have adopted such practices.	Skill Training, improved awareness through Quality education and improvement of performance Audits
4	Safety training and skill level of workers	Skill development competencies are implied and programmes arranged by National Skill	The organization are not committed and job seekers are not attuned to undertaking such Skill development courses	Making competencies or documented skill, education and training requirements mandatory
5	Regular monitoring, inspections and safety audits	Regular monitoring, inspections and safety audits will form an integral part of the safety programs at the worksite.	Many sites do not follow such audits and monitoring to avoid the extra cost and effort.	Conformance to safety standards as a Statutory and Regulatory requirements for tendering etc.
6	Total Conformance of rules and recommendations	Right use of PPE & Total Conformance to basic principles	PPE are deployed but not with sincerity and integrity.	E.g. the worker who died in the accident was wearing a safety belt but it wasn't connected to where it was supposed to be connected."

millions of workers at grave risk.³¹ We would see some case examples in next section.

Some Safety Risks, Cases and Assessment

Safety is first and foremost.³² This has been the paradigm of development of acronym SHE – namely safety, health and environment, as the collective impact of these³³ together with the Quality (Q) and Productivity (P) leads to the consummation (Delivery, D) of any activity at least costs (C). The larger acronym assumes as a collective paradigm of SHEQ-PDCM, where M is the resultant benefit and is known as Morale. Any lapse in morale can lead to a safety risk including to the operators health and also environment and Quality.

Another researcher varied this Thareja's acronym SHEQ-PDCM by changing Morale to learning. The alternative style of SHEQ-PDCL implies learning leads to an iterative process of improvement and maintenance of Morale.

Albeit safety risks causes human tragedies, and consequently loss of manhours both temporarily and permanently causing construction delays and productivity losses, they lower the morale of people and consequently quality and performance levels of work, such that the construction process itself gets disorganized. In table 2, some case examples are collated, showing safety lapses that caused loss of lives and resources. Bekdik gives a deliberate study of Improving Productivity in Building Construction.³⁴

Generically seeing, the reasons for failure were insufficient leadership, and insufficient guidance on the specific actions, which ultimately led to failures.

Most of the cases above denied any neglect of safety requirements, and rather accused the victims were at fault, even when the safety lapses were clearly evident at the site as reported in case 3 above.³¹ The accused officers were arrested, and released. While on bail they are back again on the construction site. Thus part of the infirmity is with the law itself.

The lacuna in law is the regulation of competence and the capacity. Viz there were only six labour inspectors to cover a district 147 sq km in size, bustling with construction activity In Thane, as elsewhere, even if the inspectors were trained, they are too few.. One officer defended the checks for security and safety measures at construction sites is “technical matter” yet concurred their “inspectors are not trained” for it.

Further, the infirmity in the law places greater emphasis on inspections to monitor social welfare measures on construction sites - registration of workers with labour board, minimum wages, clean drinking water, toilets, creches and so on - as opposed to safety.

It is the poor concern and conscientiousness of the political and bureaucratic system in India that the erring businessmen get scot free despite the various ills committed

Table 2. Some typical accidents at construction sites

S. No	Name of the Project	Accident occurred	Preventive Measures Taken	Remarks	Ref.
1.	Aditiya Trade Centre, Hyderabad, India (CBR process)	Worker slipped during plastering of the lift pits. Head injured during fixing of the glass sheets.	Include provision of Safety belts. Temporary walls constructed at the entrance of the lift pits to prevent accidental slipping.	Included 300 Unskilled Labor; and 100-Skilled labor,	[35]
2.	TCS Building at Hiranandani estate Thane	2 dead in accident at TCS construction site and several others trapped laying the foundation of a new building			[36]
3.	Bhumi project (an industrial park) In Thane	the multiple fatalities that struck it	Nil- The bustling site bears little indication of the fatalities .No safety nets at any of the buildings.	open wires, men walking up temporary, slippery planks on a height without hand railing or other support could be seen	[31]
4.	Hospital building at Kandanchavadi in Perungudi Jul 23, 2018.	1 dead and 32 labourers were injured on July 22 when a structure under construction crumbled			[37].

and non standard materials/ resources/ people deployed on construction sites. The construction injuries will always have broad and adverse impact,³⁵ which includes the personal suffering of the injured workers, and crisis situations facing the construction contractor. In the cases of eventualities the losses are borne by both governments, insurance companies and the families of victims. It is widely understood that Non conformances in general become possibly a preamble to the liability suits for all parties involved in the project,³⁵ that may sometimes put a stop to the progress of projects, leading to costs of inflation consequent both of work stoppages and idling costs. Evidently, any prevention of progress and even marginal reduction in their cost will have significant human and financial impact.³⁵

The safety costs are greatly lowered as the contractors who were supposed to incur higher insurance premiums to take care of the eventualities that result from costly injuries, are now at greater freedom to provide for better worker benefits that must reduce risks by design.

Though eliminating risk will increase efficiency and decrease cost, in the long term these impacts tend to achieve exponential behavior when evaluated from the present state, seeing without compounding and which does not asymptote. It is so because the learning gets slowly, but amply, rewarded in response to the larger transformation of people.³⁸

The end objectives include fulfilling SHEQ-PDCM, Customer satisfaction (as a part of Quality imperatives), and also achievement of revenue goals; the alignment of which is strategically planned ab initio. All one needs is a Chak De (breakthrough) motivation.³⁹ The triple need is to Invest (e.g. in construction 4.0), Innovate (say, processes), and Incubate (people).

Improvement of Risk Conscientiousness

The goal to improve quality and safety, despite decades of effort, feels increasingly elusive.⁴⁰ This was though referred to health care, where the people are generally educated in contravention to that of construction industry, the statement is more valid to latter. In addition, while successful examples of improvement are infrequently replicated,⁴⁰ the individual cases are unique,³¹ and hence the attempts are generally futile. The only solution is to equip operators with the know how and know why. The focus on quality and safety improvement only reinforce the premise of learning theory that makes use of leadership, environment and processes experientially. It is seen that the awareness of safety in the organization is improved by both active experiences from 1st hand brushes and reflective activities/ observations.

These also come from the elite learning shared from mistakes of others, including use of learning resources,

and the abstract conceptualization. Hence “ [The operators] need to be skilled communicators who know how to identify, prevent and manage adverse events and near misses, how to use evidence and information, how to work safely in a team, how to practise ethically, and how to be workplace teachers and learners”.⁴¹ Specifically, Singer et al. research learning for quality and safety improvement includes experimentation (including deliberate experimentation, improvisation, learning from failures, exploration, and exploitation), internal and external knowledge acquisition, performance monitoring and comparison, and training.⁴⁰ Such initiatives are governed as per Kobe’s (1984) model, which is schematically shown as in figure 3.⁴²

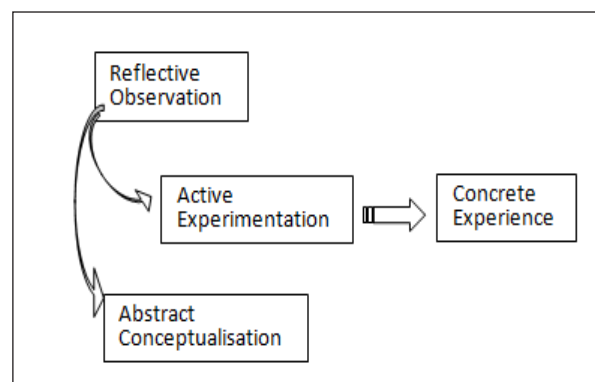


Figure 3. Kolbe's (1984) model of learning [42, adapted]

Learning needs and promises a behavior change, without which one can neither learn, nor be able to apply or demonstrate learning.²⁵ Since Human error is complex topic and is directly linked to the cognitive process.³⁵ and one's ability to judge risks and responsibility, a special learning focus needs be launched. The experience shows that “[a]ny minor incidents that was saved of causing due injury is generally overlooked and so is the realisation of a possible drift in the practice”.³² Thus, as a corollary it can be extrapolated that the number of injuries and fatalities can be reduced by encouraging and reinforcing behavioral change, which includes identifying clearly the risks, its main elements, which all receive dedicated focus for Risk Management, assigning to the process map so as to target major decision points.

Deshpande et al.⁴³ argue the team/ people must have the ability to make decisions at the last responsible moment. It should be ensured that exceptions are reported and reviewed immediately. The learning are adequately applied to ensure smooth running of day to day Risk Management. To ensure quality of such actions the audits should necessarily include these processes/ activities.⁴³

The domain of learning should be ‘Total’. ‘HSE India’ summarises crisply the domain of learning for safety which includes ‘four’ sets of Fundamentals, each composing five elements.¹⁷ These are:

Five “E’s” – Education, Engineering, Enforcement, Enthusiasm & Example setting

Five “L’s” – Learning, Leadership, Loyalty, Labour protection, and Lawfulness.

Five “M’s” – Man, Machine, Materials, Money and Management

Five “P’s” – People, Protection, Productivity, Prosperity and Proficiency.¹⁷

Consequently, we need a Change of Focus to Safety Risks, managing the processes, with a potent strategy maintaining emphasis on scientific learning, ensuring best of Leadership guidance and an austere focus on the customer. The governance of such imperatives require a system thinking. These attributes are schematically governed as in figure 4.

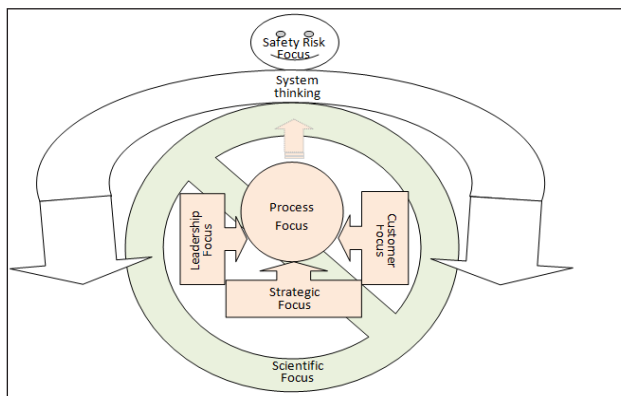


Figure 4. The rudiments of focus to safety risks, composing of processes, strategy, Leadership guidance for the benefit of customer

System thinking is designed for integrative qualities. Since the eradication of risks and hazards must form strategic objective with associated goals and actions, the need is to empower a holistic approach which integrated the key concepts, as above, to create synergies so as to maximize output. System thinking advises that the core of safety management system is strategically processed with outcomes in mind. The component includes “systematic identification of hazards, assessment and control of risks, evaluation and review of risk control measures” to ensure that they are effectively implemented and maintained, as is concurred by Bluff.²⁸ It further involves skills in planning (e.g., design and implement interventions), organising (arranging tasks, people and other resources), leadership (inspiring and motivating people) and control (e.g., evaluating policies, programmes and action plans).^{44,45}

This calls for commitment and continual improvement. Since the organizations are obsessed with outcomes (say, SHEQ-PDCM), which in turn get driven by effective application of appropriate processes, all activities viz assessment of performance, to development and control of processes must be aligned for achievement of outcomes.⁴⁶

For their effectiveness the appropriate people behavior of individuals must be improved with a scientific focus (e.g. SHOULD-CAN-WILL-DID), that bases on ‘Factual approach to decision making’ using evidence and data.⁴⁷ This is supported by appropriate deployment of analytical tools towards maximizing SHEQ-PDCM. All are driven with system thinking as shown in the graphical model.

System thinking encompasses the ability to identify and analyse, understand and reflect upon all relevant (sub) systems across different domains (people, planet, profit) and disciplines, including their boundaries including the interdependency of these (sub)systems, including cascading effects, inertia, feedback loops and accompanying cultures.⁴⁴ The Synergy integrative product of subsystems is seen as a stage where the sum of parts is much greater than the mathematical whole.

The tools for eradication are governed by strategies even before the work starts.⁴⁸ Viz the hierarchy of controls governs through the following,

1. Elimination (such as eliminating a chemical cleaning step with a harsh chemical),
2. Substitution (using something less hazardous in your process that can produce the same results),
3. Engineering controls (viz. protective shields on machinery), and Signage/warnings and/or
4. Administrative controls (such as marked areas to keep people away from a hazardous part of a machine), and
5. Use of Personal protective equipment (PPE. such as gloves, goggles, coats, etc. to dealing with the hazard). During various audits we observed the Availability & adequacy of first aid, and tie up with hospitals etc; availability of Functional Fire Extinguishers; and Clarity of Emergency Exit have improved. Evidently while the performance level infrastructural elements tend to exceeded the minimum standards, the wearing of PPE’s is quite deficient. The reasons are (i) poor designs of PPEs, as these are uncomfortable to wear, until the operators are habitualised(ii) lack of cognizance which is behavioural, (ii) possible deficient upkeep and provisions.

The holistic (Total) approach to SHEQ-PDCM

Dentoni et al.⁴⁹ argue the people have right competencies such that they can combat with the possible risks and issues with SHEQ or work environment. For this the people/ team should have the ability to actively involve themselves irresponsible actions for the improvement of the sustainability of social-ecological systems.⁴⁵⁻⁴⁶

The people must be able to spot issues, and recognise the legitimacy of other’s viewpoints and maximize the exchange of ideas and learning across different groups. This includes the requirement of learning behavior such that they can

positively respond to Safety, environmental, social Quality and/or economic issues.^{45,51-52}

There is thus a need to create and maintain the right climate, and a focus on learning and the underpinning thinking, not tools; the ability to widely distribute engagement, all monitored and guided by potent leadership that knows what to do. All in all it needs a holistic approach.

It is noted that construction is not a business of great repetition, unlike manufacturing.⁵³ Construction generally refers to the creation of physical structures while Manufacturing typically refers to the production of finished goods. In case of manufacturing the direction our “technology will steer to, and anticipate how these endeavours should integrate in producing a system of manufacturing excellence. Because the process of change duly set-in, in motion, in last few years confirms the benefits of increasing quality – productivity and environmental awareness, the trend is likely to sustain with attendant inputs in technology, improvements in methodology, culture and system conscientiousness”.⁵⁴ Similar is the style in which the construction activities may operate, given the projects are broken down, as many constituent parts are made berepeated processes and activities as in former.

It is seen that when the improvements are made in the ‘manual’ mode, it is none but the People initiate these improvements, who are in turn taught by their individual motivation. So their morale should be high. Thus with

collective bargain: over the process demands, over the product quality optimization, over the lean-ing of organization to efficiency and the cost effective and continual Learning. Moreover, they organize the improvement stimulus where the environment is none but their steady learning.⁵⁵ In a way in steps of broken stages, the cognizance to the constituent steps are governed by sustainability paradigm equally in both the cases.⁵⁶

For each broken down activity the SHOULD-CAN-WILL-DID approach may be used independently, for initiating a proactive approach to risks and hazards. First a risk abatement opportunity is evaluated for the need of a proactive solution, and planned for undertaking various contingencies. If feasible (‘Can’), it is evaluated on the measures and provides of ‘SHEQ-PDCM’. The activities are now undertaken, and processed (Will). The outcomes are measured for effectiveness, and audited for corrective and preventive actions. The risk approach is generally designed for latter (preventive actions), and subject to ‘fail safe’ solutions/ processes. The implementation provides are schematically illustrated in figure 5. The term SHOULD is considered as: Hopefully; CAN means: Probably; and WILL means: Absolutely. For developing such competencies the workers need be given adequate skills.⁵⁷ A reliable assignment determines what WILL be done, after considering what SHOULD and CAN get done based on the situation at hand.

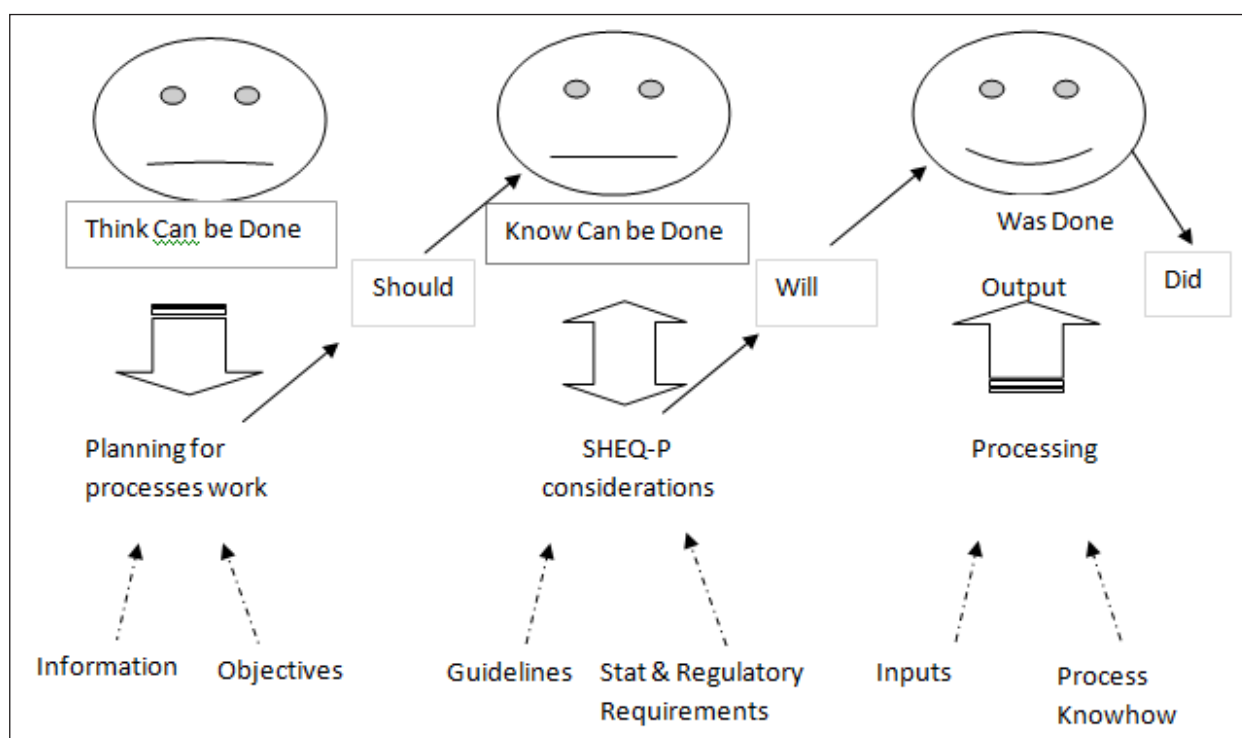


Figure 5. The SHOULD-CAN-WILL-DID approach for initiating proactive approach to risks and hazards

In non repetitive situations, some projects, some activities will require a more tailored approach. In such a scenario only a holistic or 'Total' approach will lead to achievement of desired outcomes. For this reason the system approach has been advised in previous sections, so that higher levels of productivity can be harnessed in each of broken down activities and yet the results can be augmented such that the combined effects are SHEQ-P oriented.

Conclusion

The construction industry is greatly obsessed with safety threats, many of which go unreported or under-reported. There could be several causes, partly due to infrastructural constraints, more because of workers' errors in judgement of impending hazards, and maximum due to the bottlenecks at the hands of the management. This paper collates some of the errors and handicaps of construction industry.

After defining risks and hazards, this paper calls upon practicing a proactive approach to risk prevention and control, for which a conscientious approach to the understanding of risks, and their apt handling would be needed.

Apart from safety, the other issues viz. occupational health issues, environment, and Quality need to be catered into the projects / sites, which can also be monitored for productivity, to assure timely delivery at lowest costs. The operator needs to maintain learning of high order while maintaining high morale. Any lapse in morale can lead to a safety risk including to the operators health and also environment and Quality.

The need for learning, that tends to follow the Kobe's learning model, encompasses for safety a 'four' sets of Fundamentals, each composing of five elements - E's, L's, P's and M's viz Education, Leadership, People and Management. The preventive or control options for risks and hazards are Elimination, Substitution, Engineering Controls, Administrative Controls and use of PPE's.

It is recommended that a total or holistic approach is applied to combat the safety challenges and the risk control is exercised with system thinking, duly accenting on processes, maintaining the leadership and strategic focus. It is also recommended that the various activities are broken down to smaller sets which may be repetitive in style and operation and are concurrently analysed by agile and equipped operators deploying SHOULD-CAN-WILL-DID approach.

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