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Towards Zero Fatalities, Injuries, and Disease in Construction

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Abstract

This study explores the 'holy grail' of health and safety (H&S) - zero fatalities, injuries, and disease! Although, the logic of pursuing such a goal is obvious there are many 'non-believers' in the sense that they do not believe it is achievable. However, the literature indicates that such a goal is an integral part of H&S culture, and is complementary to the vision of fatality, injury, and disease free construction. Furthermore, it is the only 'transparent' goal.
A study conducted among a convenience sample of 'better practice H&S' general contractors determined that client contributions, 'designing for construction H&S', integration of design and construction, appropriate procurement, contractor planning, risk assessment, an optimum interface between H&S, quality, and the environment including the respective management systems, H&S education and training for all stakeholders, core competencies, and consciousness and mindfulness, will contribute to the realisation of 'zero'.
Conclusions and recommendations include the achieving of 'zero' requires a multi-stakeholder effort on a project basis, including a partnering type process, and synergy between groups of actions / beliefs / interventions / practices / states i.e. the requisite 'cocktail' of factors must be in place and to an optimum extent.

Keywords: Construction, Fatalities, Health and Safety (H&S), Injuries, Zero

1. Introduction

Industrial safety research defines a 'safe' work site as one where injuries and fatalities constitute 'zero' sum [1]. According to Wilkins [2], in construction, contractors have adopted such targets in order to keep their workers safe and abide with regulations in a compliance-based H&S environment.

However, case studies indicate that zero targets are goals that are difficult to attain. A New Zealand hazardous industrial plant study assessed the effects of such a target and noted that even though a firm adopted and focused on a 'zero target' for decades, attainment has been vague for various reasons that manifest through hazard misunderstandings and misinterpretations [1]. Although the firm has recorded an astonishing reduction in lost time injuries (LTIs) owing to the use of the target, minor incidents have deprived the firm of success.

The Construction Industry Development Board (cidb) [3] 'Construction Health & Safety Status & Recommendations' report regarding H&S in South African construction records that Department of Labour inspections determined that 52.5% of contractors were non-compliant, and the disabling injury incidence rate (DIIR) is 0.98 i.e. 0.98 disabling injuries per 100 workers, and a fatality rate of 25.5 per 100 000 workers. Clearly, the goal of zero fatalities, injuries, and disease is not 'current reality' in South African construction, and therefore interventions beyond compliance-based H&S are required. However, 'current reality' should not be accepted as a *fait accompli*, and therefore
this paper is premised on the need to realise continuous improvement in construction H&S, and the goal of 'zero' and the role thereof should be explored. The objective of this paper is to report on a study that explored the perceptions of contractors regarding the use of goals / targets to improve H&S performance in South African construction. The research reported on explored 'How important are the following actions / beliefs / interventions / practices / states in terms of achieving zero accidents, injuries, fatalities, and disease in construction', and 'to what extent do you disagree / agree with statements relative to construction H&S'.

2. Review of the Literature

2.1. *The zero target debate*

Zwetsloot et al. [4] argue that while the use of goals has been advocated because of improved H&S performance, a range of challenges exist in various contexts where such goals are supposed to eliminate hazards and accidents. Socio-technical work environment and negative effects of such goals constitute reported challenges.

In terms of the socio-technical work environment, multiple incident and accident causations are a major hurdle in an industrial setting similar to the one on a construction project. The British Petroleum (BP) Deepwater Horizon accident in 2010 in an industry that appears to have superior H&S programmes constitutes an example. In essence the report concluded that a complex and interlinked series of mechanical failures, human judgements, engineering design, operational implementation, and team interfaces collectively triggered the initiation and escalation of the accident i.e. no single action or inaction caused the accident [5]. The BP accident occurred in an industry where large organisations are committed to goals in the form of 'zero harm', and 'zero accident vision (ZAV)', to mention a few. Such goals are often seen in company reports, policies, H&S manuals, and even websites where construction companies in the United Kingdom (UK) (and elsewhere, including South Africa) also indicate their commitment to higher standards of H&S [6]. Dekker et al.[7] note that goals may not necessarily mean a commitment to 'no accident' at all levels of severity and in fact, goals may conceal severe accidents and imply that near-misses and minor accidents are inevitable and required for making learning happen from everyday work and failures in a complex socio-technical system. Excessive measurement, erudite data computations, and high bureaucratic systems backed up by regulations from compliance-based safety regimes are some of the reported negative effects of setting goals [8; 9). Although bureaucratic accountability within organisations has manifested in gains in the form of a reduction in harm, Dekker [8] reports that it is generating concerns that run counter to the original goals. Such effects include, *inter alia*, the inability to predict unexpected events, the so called 'number games', and the creation of new H&S problems. A Finnish construction study in turn determined that there is a strong negative correlation between incident rate and fatalities, which implies that the fewer incidents that are reported, the higher the fatality rate [10].

The practical realities of 'zero targets' in the United Kingdom construction industry were investigated by Sharratt [11]), and based on the information collected from five large contractors operating 'zero target' H&S programmes, concluded that 'zero' was viewed as a philosophy and a target with different interpretations in practice.

2.2. *The role of zero targets*

Yi Man Li and Wah Poon [12] state that accident rates in Hong Kong have reduced significantly over the past few years. Many of the systems and approaches are locally developed, with large numbers of systems and technology being imported. Of significance is the use of the Total Quality Management (TQM) based H&S Management Systems (H&SMS), where the goal is zero accidents. H&S is built into the work as it commences, H&S conformance is required; all employees are required to be involved, and a continuous improvement approach accepted as part of the TQM systems approach, based on the theory of TQM based SMS, namely that all accidents are avoidable [12].

2.3. *Are zero targets achievable?*

A United Kingdom (UK) construction company, namely Frank Haslam Milan (FHm), which already had an above average H&S record in 2002, achieved its target of a zero accident rate through a training and awareness initiative involving its employees [13]. The Human Resources Manager, Irene Liddle, states that they realised they had to raise H&S awareness throughout the company and ensure that everyone, from director to subcontractor, was highly competent in general H&S issues. Furthermore, she states that employees are increasingly contributing their own ideas to improve H&S, as opposed to simply following management's H&S instructions, which amplifies the value of worker participation in H&S [13].

According to Shiplee, Waterman, Furniss, Seal and Jones [14], the workforce on the Olympic Park site in east London peaked at 12 000 and a total of 30 000 people will have worked on the project through its lifetime. Through careful planning, implementation of strategies with a proven track record and clear leadership, the Olympic Delivery Authority (ODA) managed to achieve an accident frequency rate comparable to the average for all British employment, significantly better than the construction sector, and zero fatalities. There were five key elements to the H&S programme, as follows. Safety – clear policies, risk assessments, method statements, common standards, visual standards, daily activity briefings. Health – pre-employment medical checks, prevention programme, assessment and control, health surveillance, training, emergency response. Well-being – advice, well man / woman

clinics, good food strategy, campaigns, sexual health clinics, partnerships. Competence – induction, training, supervisor academy, briefings, apprenticeships, checks and records. Culture – leadership, action plans, near-miss reporting, communications, reward and recognition, climate tool. The aforementioned, in particular the elements of health and well-being, reflect 'respect for people'.

Current reality in the form of accidents is frequently referred to as a counter to the 'zero target' initiative. Schwartz [15] maintains unsuccessful people suffer from a mind deadening thought disease called 'excusitis'. Every failure has the disease in its advanced form. However, the more successful the individual, the less inclined he / she is to make excuses. Schwartz also cites a traffic engineer's contention that there is no such a thing as a true accident. An accident is a result of human or mechanical failure, or a combination of both – nothing happens without a cause.

3. Research

3.1. *Research method*

An exploratory survey was conducted to determine the importance of actions / beliefs / interventions / practices / states in terms of achieving zero accidents, injuries, fatalities, and disease in construction and perceptions related there. A convenience sample consisting of twelve general contractors was used for the survey based upon their commitment to H&S and hence willingness to facilitate the survey. The managing director or H&S coordinator in the respective organisations circulated the questionnaire and returned the completed questionnaires to the lead researcher / author. The questionnaire consisted of two close-ended five-point Likert scale type questions, and one open ended question. At the end of the survey period, 92 responses were received, which were included in the analysis of the data.

In terms of demographic information, the mean age of respondents is 39.8 years, the mean years worked for current employer is 5.5 years and in construction is 14.5 years, and 91.1% are male 8.9% are female. A total of 46 qualifications and 31 occupations were recorded. 64.8% of respondents were qualified with either a diploma or a degree. Contracts manager (17.9%) and H&S Officer (10.9%) predominated among occupations.

3.2. *Research findings*

Respondents were requested to indicate the importance of thirty-eight actions / beliefs / interventions / practices / states in terms of achieving zero accidents, injuries, fatalities, and disease in construction relative to a five point scale of 1 (least) to 5 (very). Mean scores (MSs) between 1.00 and 5.00, based upon the percentage responses, were computed to produce a measure of central tendency and enable ranking of the actions / beliefs / interventions / practices / states. It is notable that all the MSs are > 3.00, which indicates that the actions / beliefs / interventions / practices / states are very as opposed to least important. Furthermore, 27 / 38 (71.1%) MSs are $> 4.20 \leq 5.00$, which indicates that the importance is between more than important to very / very important. The remaining 11 / 38 (28.9%) MSs are $> 3.40 \leq 4.20$, which indicates that the importance is between important to more than important / more than important. Due to the need for paucity, only the first third (13 / 38) of the actions / beliefs / interventions / practices / states have been presented in Table 1 and discussed hereafter.

People are our most important resource is ranked first, followed by zero harm, which should be the goal if people are the most important resource. A goal of 'Zero harm' is also accompanied by a goal of 'Zero accidents' ranked fourth, and a goal of 'Zero incidents' ranked fifth. A mission of 'continuous improvement' is ranked third, which is imperative in terms of the journey towards 'zero'. Consciousness and mindfulness ranked sixth is critical as the former implies cognising in terms of actually observing the environment and mindfulness in terms of realising the implications of the status quo or actions or omissions. H&S management system, and respect for people are ranked seventh and eighth respectively. The former provides the framework for H&S in an organisation, and the latter is necessary if 'people are our most important resource'. Design and construction hazard identification and risk assessments (HIRAs) are ranked ninth and tenth respectively and highlight the role of risk assessments in achieving 'zero'. Furthermore, in the case of the former it is the highest ranked designer action. A vision of a 'Fatality, injury, and disease-free work place' is ranked eleventh, and influences the achievement of 'zero'. Core competencies is ranked twelfth, which influence the achievement of 'zero'. Conformance to requirements, ranked thirteenth, relates to quality, and is a prerequisite for the achievement of 'zero'.

Table 1: Importance of actions / beliefs / interventions / practices / states in terms of achieving zero accidents, injuries, fatalities, and disease in construction

Action / Belief / Intervention / Practice / State	U	Least. ……Very					MS	Rank
		1	2	3	4	5		
People are our most important resource	0.0	0.0	1.1	4.3	8.7	85.9	4.79	1
A goal of 'Zero harm'	0.0	0.0	0.0	3.3	20.7	76.1	4.73	2
A mission of 'continuous improvement'	0.0	0.0	0.0	4.4	19.8	75.8	4.71	3
A goal of 'Zero accidents'	0.0	0.0	1.1	3.3	25.0	70.7	4.65	4
A goal of 'Zero incidents'	0.0	1.1	1.1	3.3	21.7	72.8	4.64	5
Consciousness and mindfulness	1.1	0.0	0.0	6.6	27.5	64.8	4.59	6
H&S management system	0.0	0.0	0.0	3.3	35.2	61.5	4.58	7
Respect for people	0.0	0.0	1.1	8.8	20.9	69.2	4.58	8
Design hazard identification and risk assessments	0.0	0.0	0.0	4.3	34.8	60.9	4.57	9
Construction hazard identification and risk assessments	1.1	0.0	1.1	3.3	33.7	60.9	4.56	10
A vision of a 'Fatality, injury, and disease-free work place'	0.0	2.2	0.0	5.4	26.1	66.3	4.54	11
Core competencies e.g. values, aptitude, and integrity	1.1	0.0	2.2	7.7	29.7	59.3	4.48	12
Conformance to requirements	0.0	1.1	0.0	7.6	34.8	56.5	4.46	13

Table 2 indicates the extent to which respondents concur with statements relative to construction H&S on a scale of strongly disagree to strongly agree, and MSs between 1.00 and 5.00. It is notable that 18 of the statements have MSs > 3.00, which indicates that in general, the respondents agreed with the statements. Two untrue statements, namely 'Accidents are unplanned events' and 'Construction is inherently dangerous' attracted mostly agreement. The only 'true' statement that attracted mostly disagreement is 'accidents occur by default i.e. planned' i.e. it should have attracted mostly agreement as when accidents are reviewed, invariably acts or omissions resulted therein, thus they are planned by default as they could have been prevented. Two 'untrue' statements, namely 'accidents are part of the job' and 'accidents are project requirements (especially on complex projects)' attracted mostly disagreement, which they should have. The MSs of the first five statements tabled are > 4.20 ≤ 5.00, which indicates that the concurrence is between agree to strongly agree / strongly agree. 'H&S does not happen by chance, it must be planned' achieved the highest MS, namely 4.53. This is followed by 'The goal of 'Zero fatalities, injuries, and disease' is an integral part of H&S culture', which amplifies the importance of a 'zero' agenda. This in turn is followed by 'The goal of 'zero fatalities, injuries, and disease' complements the vision of 'A fatality, injury, and disease free workplace', which further amplifies the importance of a 'zero' agenda, and its role. The 'zero' agenda is further motivated by the MS (4.36) of 'The vision should be 'A fatality, injury, and disease free workplace'. A notable finding is the MS of 'Zero fatalities is achievable' – notable in terms of the concurrence that such a goal is actually achievable.

The MSs of the next thirteen statements are > 3.40 ≤ 4.20, which indicates that the concurrence is between neutral to agree / agree. The goal of 'zero fatalities, injuries, and disease is a pre-requisite for optimum H&S performance' amplifies the role of such a goal. Firstly, in terms of zero being the measure of optimum, and secondly, it being a motivator as it rallies people around the goal. 'Zero accidents is achievable' and 'Zero injuries is achievable' underscore 'Zero fatalities is achievable' addressed above. However, they are perceived to be 'less achievable' than zero fatalities. 'Accidents are unplanned events' is as per international definitions, however, current perspectives are that they in fact are not, as if actions or omissions, which are invariably 'knowingly' taken or occur, then in fact they are planned, hence 'Accidents occur by default i.e. planned' which is discussed hereafter. The aforementioned argument is supported by Schwartz (1995) who cites a traffic engineer's contention that there is no such a thing as a true accident. An accident is a result of human or mechanical failure, or a combination of both – nothing happens without a cause. 'Hazards and associated risk can be quantified' is acknowledged in the literature and hazard identification and risk assessment (HIRA) is required in terms of H&S legislation and regulations worldwide. 'Excusitis (the proffering of excuses) marginalises H&S' is a contention expressed by Schwartz (1995). 'Zero incidents is achievable', 'Zero fatalities, injuries, and disease is achievable', 'Zero disease is achievable', and 'Zero deviations is achievable' further underscore the 'zero agenda'. However, they are perceived to be 'less achievable' than zero fatalities, zero accidents, and zero injuries. 'The focus on cost, quality, and time marginalises H&S' is widely accepted worldwide. However, the concurrence relative to 'Construction is inherently dangerous' is notable as in fact it is not the case as firstly, it implies that nothing can be done to mitigate 'danger' i.e. hazards, which is not the case. Secondly, strategies, systems, procedures, and protocol can at least

mitigate, and in cases eliminate hazards and risk. 'H&S is a value not a priority' is an important contention as priorities change, hence H&S should be a value.

Only two statements' MSs > 1.80 ≤ 2.60 (strongly disagree to disagree / disagree), namely 'Accidents occur by default i.e. planned' and 'Accidents are part of the job'. As discussed above, the former is untrue as when accidents are reviewed, invariably acts or omissions resulted therein, thus they are planned by default as they could have been prevented. Accidents are certainly not part of the job, as construction is not inherently dangerous.

'Accidents are project requirements (especially on complex projects)' achieved a MS ≥ 100 ≤ 1.80 (strongly disagree to disagree). This may sound obvious, however it is notable that there was not universal 'strongly disagree'.

Table 2. Extent to which respondents concur with statements relative to construction H&S.

Statement	Response (%)						MS
	Unsure	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
H&S does not happen by chance, it must be planned	1.1	2.2	0.0	1.1	35.2	60.4	4.53
The goal of 'Zero fatalities, injuries, and disease' is an integral part of H&S culture	0.0	0.0	0.0	3.3	48.9	47.8	4.44
The goal of 'zero fatalities, injuries, and disease' complements the vision of 'A fatality, injury, and disease free workplace'	2.2	0.0	0.0	1.1	57.1	39.6	4.39
The vision should be 'A fatality, injury, and disease free workplace'	0.0	0.0	2.2	3.3	50.5	44.0	4.36
'Zero fatalities' is achievable	0.0	0.0	5.6	1.1	53.3	40.0	4.28
The goal of 'Zero fatalities, injuries, and disease' is a pre-requisite for optimum H&S performance	0.0	0.0	2.2	10.0	53.3	34.4	4.20
'Zero accidents' is achievable	0.0	0.0	11.1	4.4	56.7	27.8	4.01
'Zero injuries' is achievable	0.0	0.0	10.0	6.7	57.8	25.6	3.99
Accidents are unplanned events	0.0	5.5	6.6	5.5	50.5	31.9	3.97
Hazards and associated risk can be quantified	0.0	3.3	4.4	12.1	57.1	23.1	3.92
'Excusitis' (the proffering of excuses) marginalises H&S	8.0	3.4	8.0	6.8	52.3	21.6	3.88
'Zero incidents' is achievable	0.0	1.1	12.2	6.7	60.0	20.0	3.86
Construction is inherently dangerous	0.0	4.4	12.2	11.1	44.4	27.8	3.79
'Zero fatalities, injuries, and disease' is achievable	0.0	1.1	13.2	17.6	47.3	20.9	3.74
'Zero disease' is achievable	0.0	1.1	17.0	13.6	46.6	21.6	3.70
The focus on cost, quality, and time marginalises H&S	1.1	3.4	16.9	9.0	50.6	19.1	3.66
'Zero deviations' is achievable	1.1	2.2	22.5	7.9	49.4	16.9	3.57
H&S is a value not a priority	2.2	16.9	13.5	7.9	24.7	34.8	3.48
Accidents occur by default i.e. planned	3.3	36.3	37.4	8.8	11.0	3.3	2.05
Accidents are part of the job	0.0	48.9	27.8	11.1	12.2	0.0	1.87
Accidents are project requirements (especially on complex projects)	0.0	59.3	27.5	6.6	3.3	3.3	1.64

4. Conclusions

A sound foundation in the form of 'people are the most important resource' and 'respect for people' must be provided for the 'zero target' journey; journey as current reality manifests itself in the form of fatalities, injuries, and disease and therefore continuous improvement is necessary to achieve the vision and goal of 'Zero fatalities, injuries, and disease'. The literature confirms the importance of TQM and that the goal is achievable. The empirical findings in turn indicate that the 'zero fatalities' zero target is more achievable than the other targets. However, a multi-stakeholder effort is required. Therefore, at the very least, H&S must be a 'project value' as opposed to a contractor responsibility', and ideally a partnering approach which focuses the efforts of all project stakeholders on H&S should be adopted. Furthermore, hazard identication and risk assessment during design and construction, conformance to requirements, and conciousness and mindfulness are critical. Then, the issue of competencies, not solely surface competencies, but core competencies such as values, aptitude, and integrity are pre-requisites for maintaining focus on H&S, ensuring compliance, and realising of 'zero targets'. Finally, given that there are pre-

requisites there is clearly synergy between the various actions / beliefs / interventions / practices / states i.e. the requisite ‘cocktail’ of factors must be in place and to an optimum extent.

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