

THE ROLE OF HEALTH AND SAFETY IN PROJECT MANAGEMENT

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ABSTRACT

Inadequate or the lack of occupational health and safety not only negatively affects the traditional construction project parameters of cost, quality and schedule, but the sustainability of the environment.

Occupational fatalities, injuries and disease constitute defects as they are not project requirements. They also contribute to the cost of construction and development as workers' compensation insurance is included as a labour overhead and the cost of accidents is integrated into the cost structure of contractors.

Total Quality Management (TQM) is the strategy that links the processes of occupational health and safety, productivity and quality; health and safety providing the catalyst for realising the synergy between the three processes.

Although each member of the client, design and construction teams influences occupational health and safety, project managers in their capacity as project leaders and co-ordinators are uniquely positioned to integrate occupational health and safety into all aspects of the design and construction process.

To this end the findings of a descriptive survey will be presented which indicate, among others: inadequate or the lack of occupational health and safety increases project risk, and negatively affects cost, productivity, quality, schedule, the environment, and client satisfaction; procurement systems, project duration, design, detail and specification influence occupational health and safety, and project managers influence occupational health and safety during all phases of a construction project.

Increasing worldwide concern for healthy and safe workplaces and work processes amplifies the need for the inclusion of occupational health and safety and the environment as best practice criteria benchmarked against, among others, zero injuries, disease and defects, and ultimately client satisfaction.

Keywords: Construction, health and safety, project management, client satisfaction



LITERATURE SURVEY

Introduction

Occupational fatalities, injuries and disease result in considerable human suffering and affect not only the workers directly involved, but their families and communities and contribute to the national cost of medical care and rehabilitation.

However, occupational disease, fatalities and injuries also contribute to variability of resource which increases project risk. This risk is manifested in increased cost of construction, damage to the environment, non-conformance to quality standards and schedule overruns. Another aspect is that of contractor and client image which is negatively affected by accidents.

As each member of the client, design and construction teams influences and contributes to occupational health and safety, project managers, in their capacity as project leaders and coordinators, are uniquely positioned to integrate health and safety into all aspects of the design and construction process.

Statistics

The nature and scope of fatalities and injuries in South African construction is scheduled in Table 1 below.

Class of injury	Total	Number per class of injury	
		Per working day	Per R100m Turnover
Fatalities	203	0.88	1.08
Permanent disablements	657	2.86	3.50
Temporary disablements	5 038	21.90	26.84
Medical aid cases	9 808	42.64	52.25

Table 1 Total number of injuries, number of injuries per working day and per R100m (1990 prices) construction completed in South African for the year 1994 (computed from South African Reserve Bank, 1998 and Compensation Commissioner, 1999).

Other salient statistics according to the Compensation Commissioner (CC), Federated Employers Mutual Assurance (FEM) (1994) and the South African Reserve Bank (SARB) (1998) are:

The disabling injury incidence rate (DIIR) of 2.03 in 1990 means that 2.03 workers per 100 received disabling injuries (CC, 1995).

When the severity rate (SR) of 1.93 in 1990 is multiplied by 2 it means 3.86 (1.93 x 2) days were lost per worker (CC, 1995). The severity rate is relative to 1000 hours worked, whereas the average worker works 2000 hours per year. Hence the multiplier of 2.

The total of 1 620 046 days lost as a result of fatal and non-fatal accidents in 1990 is the equivalent of 6 983 work days lost for every work day (FEM and CC, 1994).

The fatality rate in 1990 was 53.51 per 100 000 workers.



Cost of accidents

The cost of accidents can be categorised as being either direct or indirect. Direct costs tend to be those associated with the treatment of the injury and any unique compensation offered to workers as a consequence of being injured and are covered by workmen's compensation insurance premiums. Indirect costs which are borne by contractors include: reduced productivity for both the returned worker(s) and the crew or workforce; clean-up costs; replacement costs; stand-by costs; cost of overtime; administrative costs; replacement worker orientation; costs resulting from delays; supervision costs; costs related to rescheduling; transportation, and wages paid while the injured is idle (Hinze, 1994). Various studies have realised differing ratios between the indirect and direct costs: 1,67 times for non-minor injuries and more than 5 times for minor injuries with direct costs less than US\$50 (Hinze, 1992), & 20 times (Grossman, 1991). Research indicates the total cost of accidents to constitute, inter alia, 6.5% of the value of completed construction (The Business Roundtable, 1991) and approximately 8.5% of tender price (Anderson, 1997).

Cost of health and safety

According to The Business Roundtable (1991) data collected from a significant sample of contractors working at various construction sites in the United States of America in 1980 indicated that the cost of administering a construction health and safety programme usually amounts to about 2.5% of direct labour costs. These costs include: salaries for health and safety and certain administrative personnel; health and safety meetings; inspection of tools and plant and equipment; site inspections; personal protective equipment (PPE); health and safety programme, & miscellaneous supplies and equipment.

Based on two South African construction projects direct labour costs constitute 10.64% of project value in which case the cost of administering a health and safety programme of 2.5% of direct labour cost is equivalent to 0.266% ($0.025 \times 10.64\%$) of project value i.e. R2 660 per R1m.

More extensive research conducted in South Africa (Smallwood, 1992) determined the actual cost of health and safety to be 0.22% of project value based on 16 projects which either had, or would have qualified for a BIFSA Star Grading status of between 3 and 5 stars.

Risk

According to Oosthuizen (1994): "The Project Manager must be wary not to be trapped in the popular conviction that we are already doing everything possible to reduce risk," and realise the reduction of risk like any other project management function is a perpetual process during the total project life cycle.



Health and safety is quality

Occupational fatalities, injuries and disease constitute defects as they are not project requirements. In fact, completing an activity without injury or disease constitutes successful completion.

As health and safety also complements the successful completion of a project which includes completion on schedule, within budget, to quality requirements without damaging the environment and without incurring disease, fatalities or injuries, it is an indispensable project parameter.

The performance standard for health and safety is 'zero injuries' as with 'zero defect' for quality. Any other performance standard would indicate that accidents and rework is acceptable.

The system for health and safety and quality is prevention, as medical care, rehabilitation, pensions payable in the case of fatalities, and rework, all result in increased cost of resources.

The system of measurement for quality is the cost of non-conformance (CONC), the cost of doing things wrong, and for health and safety, the cost of accidents. A Rand value has a greater impact on all levels of management and can be integrated into accounting systems as opposed to percentages and incidence rates. The cost of accidents includes both the direct costs which are covered by insurance, and the indirect costs which are incurred by the contractor, and ultimately the client.

Synergy

The Associated General Contractors of America (AGC) (1992) defines synergism as “the interaction of different entities so that their combined effect is greater than the sum of individual efforts.” To facilitate TQM and to enable it to proliferate in the organisation, requires that quality efforts be linked to, among others, health and safety and productivity.

Numerous construction health and safety practitioners maintain that a healthy and safe workplace complements productivity, quality, schedule and the sustainability of the environment (Smallwood, 1995a).

Customer satisfaction

Shenhar, Levy & Dvir (1997) maintain the meeting of budget, schedule and technical goals are important in the early stages of a project. However, the criteria to determine the success of a project include: technical performance; efficiency of execution; managerial and organisational implications; personal growth, and manufacturability and business performance.

According to Levitt & Samelson (1993) health and safety conscious contractors are more efficient, and health and safety complements quality, which in turn complement technical performance and efficiency of execution respectively. Levitt & Samelson (1993) also maintain that health and safety conscious contractors are more attractive to clients. A further aspect is that improved morale as a result of health and safety complements the practice of management, and consequently the organisation.

Shenhar, Levy & Dvir (1997) also maintain that customer satisfaction should be reviewed relative to four stakeholders: client; developer; project team and end user.



Benefits to the four stakeholders include, inter alia, reduced construction cost and completion on schedule and to quality requirements (clients, developers and end user), and less complications and enhanced constructability (project team).

With respect to 'best practice' which engenders customer satisfaction, the Outstanding Professional Excellence in Building Award, Australia recognised the importance of the construction process, the ability to think laterally, and to provide solutions that not only satisfy customers' requirements, but which exceed them. All the projects involved unique and special challenges, inter alia, health and safety which was included as a criterion (Chartered Building Professional, 1996).

Total Quality Management (TQM)

The Associated General Contractors of America (AGC) (1992) says TQM is a continuous improvement process to meet customer requirements and corporate expectations - a philosophy of doing the right thing the first time, and is the linkage of the processes that deal with health and safety, productivity and quality, the real benefit being the synergy between them. According to Eccles (1994) the methodology of putting health and safety, productivity and quality in place is common: vision; strategy; planning; measurement and involvement of all stakeholders. The Business Roundtable (1991) maintains the principles of achieving management control relative to health and safety, productivity, quality, and even cost and schedule are the same.

Client influence

Clients influence health and safety both positively and negatively, either directly or indirectly. Indirectly through: project documentation; optimising project schedule; requiring of quality management systems (QMS's), and pre-qualifying contractors on health and safety. Directly through: imposition of permit systems; conducting health and safety audits; educating and training the personnel of contractors and referring to health and safety throughout the construction process (Smallwood, 1997).

Influence of designers

Designers evolve the concept, execute the detailed design, provide details and specify materials all of which dictate the materials, methods and processes used during construction and consequently influence occupational health and safety.

This view is shared by Schneider and Susi (1994) who maintain "Constructing a new building is by its very nature a problem in ergonomics. Installing floors and ceilings requires work at floor and ceiling height, which by definition is ergonomically hazardous since ceilings have to be above shoulder level and floors below knee height. Building materials are necessarily heavy and present manual materials-handling problems."

A further role identified for designers is that of optimal interaction with clients, as according to Jeffrey and Douglas (1994) clients play a critical role in construction health and safety. Site health and safety is complementary to the requirement of the client, completion on time, to cost and specification. Successful projects tend to be healthy and safe projects. The client must know exactly what he requires and needs to develop a detailed comprehensive brief for the design team. The brief is a critical stage in ensuring site health and safety. Deviations from it at a later date can



be the catalyst that triggers a series of events from designer through to workers that culminate in a site accident.

Constructability management

Constructability management is a system for achieving optimum integration of construction knowledge and experience in planning, engineering, procurement and site operations, and the balancing of various project and environmental constraints to achieve overall project objectives. 'Design for safe construction' is one of 16 constructability design principles listed by Adams and Ferguson (McGeorge & Palmer, 1997). However, most of the other 15 principles are indirectly related to, and consequently influence, health and safety.

The benefits of applying constructability management on the Toyota Car Manufacturing Facility at Altona, Australia include: completion ahead of schedule; below budget; to quality and health and safety standards (McGeorge & Palmer, 1997).

Procurement systems

According to Dreger (1996) the form of construction delivery affects contractual relationships and the development of mutual goals. Within the context of sustainability the Design-Build contract form, which establishes one entity to provide both design and construction, has the greatest potential for success as it creates common project goals.

Generally, although references are made to health and safety in standard South African contract documentation, it is indirect, hardly coercive, and depending upon the level of commitment, contractors continue to address health and safety to varying degrees. With the exception of indirect references to the construction environment, no references are made to the environment per se. Procurement systems are such that contractors frequently find themselves in the iniquitous position, that should they make the requisite allowances for health and safety, they run the risk of losing a tender or negotiations to a less committed competitor (Smallwood, 1996).

Pre-qualification

The purpose of pre-qualification in the health and safety sense is to provide a standardised method for selecting contractors on the basis of demonstrated safe work records, health and safety commitment and knowledge and the ability to work in a healthy and safe manner. Pre-qualification engenders the selection of health and safety conscious contractors (Levitt & Samelson, 1993).

Partnering

Partnering brings the various stakeholders involved in a project: client; designers; general contractor; subcontractors, and suppliers together and entails inter alia, developing mutual goals and mechanisms for solving problems, which effectively complements health and safety (Levitt & Samelson, 1993).



According to the AGC (1991) the partnering process attempts to establish working relationships through a formal strategy of commitment and communication.

Levitt and Samelson (1993) maintain that partnering improves health and safety, firstly as a result of reduced pressure and tension, and secondly as a result of a specific objective, usually 'zero injuries'.

Project duration

Project duration can influence health and safety as a shortened project period invariably results in an increase in the number of workers; the number of hours worked per worker, or even a combination of the two; the amount of plant and equipment, and the number of subcontractors simultaneously undertaking work per period of time. This intensification increases the possibility of incidents (Smallwood, 1996).

The role of project managers

Oosthuizen (1994) maintains project managers will be successful in their endeavours if they adopt a holistic approach, as health and safety, productivity and quality are all inextricably intertwined.

Project managers are in a unique position as they influence health and safety indirectly in their capacity of project leaders and coordinators, and also through architects, engineers and designers who design and detail, and specify materials and processes.

Haddon (Smallwood, 1995b) a South African project manager says: "Project Managers should not turn a blind eye, and if necessary issue site instructions as safety is an integral part of working on site" He recommends that project managers refer to health and safety during:

- design due to its influence on accessibility and work methods;
- initial site inspections and site handovers due to the effects of the project on the immediate environment;
- site meetings if the contractor or subcontractors are not addressing it, and
- site inspections and discussions as "health and safety is the most important aspect on site."

Tools and techniques

According to Kerzner (1984) oral communication which is preferred by most people in the construction industry is a major source of communication breakdown.

Oosthuizen (1994) maintains this problem can be circumvented by formalising the process of communication and recommends the use of checklists and the implementation of a Quality Management System (QMS).

Hood (1994) contends that problems related to health and safety, productivity and quality can frequently be traced to substandard, inconsistently applied or non-existent operating procedures and practices. Standard operating practices and procedures are the core component of quality management and health and safety management systems as they guarantee uniformity of operation throughout an organisation. They effectively ensure that each time a task is performed it is done consistently, correctly and safely.



Ultimately the implementation of a QMS on a project will ensure that construction conforms to specified requirements in all respects as it identifies the procedures, checklists, resources, activities and responsibilities.

RESEARCH

47 project managers (PMs) who are members of the Project Management Institute of South Africa (PMISA) responded to the written survey 'The role of project managers in construction occupational health and safety'. This constitutes a response rate of 21.2%. The salient findings relative to this paper are tabulated below.

Just over half of the PMs stated that health and safety is negatively affected by short project periods (Table 2).

Response	Response (%)
Yes	51.1
No	42.5
Don't know	6.4
Total	100.0

Table 2 Is health and safety negatively affected by short project periods?

Of those PMs that responded in the affirmative, general pressure was identified most frequently as the manner in which health and safety is negatively affected (Table 3).

Aspect	Response (%)
More workers	25.0
Overtime	20.8
More plant	8.3
More subcontractors	16.7
Less time per activity	37.5
Inadequate information	29.2
Variations	8.3
General pressure	79.2
Other	4.2

Table 3 Ways in which health and safety are negatively affected by short project period.

General pressure, less time per activity and inadequate information can result in a shift from an equitable focus on cost, health and safety, quality and schedule, to prioritisation of schedule, cost and quality to the detriment of health and safety. The negative effect of the aforementioned approach is compounded by more workers, inter alia, being introduced into the workplace and the incidence of overtime which can result in loss of concentration.



The majority of PMs stated that competitive tendering does not negatively affect health and safety (Table 4).

Response	Response (%)
Yes	66.0
No	27.7
Don't know	6.3
Total	100.0

Table 4 Is health and safety negatively affected by competitive tendering?

Productivity and quality were the aspects identified most frequently as being negatively affected by inadequate health and safety (Table 5).

Aspect	Response (%)			Total
	Yes	No	Don't know	
Cost	72.3	19.2	8.5	100.0
Environment	66.0	23.4	10.6	100.0
Productivity	87.2	10.6	2.2	100.0
Quality	80.8	17.0	2.2	100.0
Schedule	57.4	29.8	12.8	100.0
Client perception	68.1	19.1	12.8	100.0

Table 5 Aspects negatively affected by inadequate health and safety.

Health and safety is a prerequisite for productivity and quality as, housekeeping, inter alia, complements access and ergonomics. Accidents result in increased cost, damage to the environment and can substantially retard progress. Clients' requirements include not only completion on time, to quality standards, within budget, but also without fatalities and injuries which can have a negative effect not only on the contractor's image, but on the clients' as well.

The majority of PMs stated that there should be health and safety prequalification (Table 6).

Response	Response (%)
Yes	68.1
No	23.4
Don't know	8.5
Total	100.0

Table 6 Should there be health and safety prequalification?

Prequalification will ensure that healthy and safe contractors are engaged. A contractor's commitment to health and safety is also an indication of their approach to management in general.



Just less than half of the PMs stated there should be a provisional sum for health and safety (Table 7).

Response	Response (%)
Yes	46.8
No	42.6
Don't know	10.6
Total	100.0

Table 7 Should there be a provisional sum for health and safety?

A provisional sum would ensure that all tenderers allocate an equitable amount of resources to health and safety.

Table 8 indicates PMs considered health and safety to varying frequencies at various occasions, but most frequently when evaluating constructability and preparing project documentation.

Occasion	Response (%)					Total
	Always	Often	Seldom	Never	Don't know	
Conceptual phase	27.7	12.8	38.3	19.1	2.1	100.0
Deliberating project duration	10.6	23.4	51.1	12.8	2.1	100.0
Preparing project documentation	34.1	31.9	17.0	14.9	2.1	100.0
Prequalifying contractors	25.5	25.5	25.5	23.5	0.0	100.0
Evaluating tenders	25.5	25.5	29.8	19.1	0.0	100.0
Evaluating constructability	27.7	38.3	25.5	6.4	2.1	100.0

Table 8 Occasions and frequency of deliberating health and safety.

Health and safety should be considered on all occasions commencing during the conceptual phase, and in particular when preparing project documentation, prequalifying contractors and evaluating tenders to ensure commitment and allocation of resources to health and safety and the engagement of healthy and safe contractors. When evaluating constructability, health and safety should be considered at all times to ensure that what is designed and detailed can not only be constructed, but constructed without affecting the health and safety of workers during the construction process and maintenance of the built environment.



The PMs that evaluated constructability relative to health and safety considered various aspects to varying degrees (Table 9).

Aspect	Response (%)					Total
	Always	Often	Seldom	Never	Don't know	
Mass of material	28.6	33.3	28.6	9.5	0.0	100.0
Size of material	26.2	40.5	26.2	7.1	0.0	100.0
Surface of material	21.4	33.3	23.8	21.4	0.0	100.0
Edge of material	33.3	26.2	19.0	19.0	2.5	100.0
Content of material	38.1	40.5	11.9	9.5	0.0	100.0
Area of components	23.8	31.0	33.3	11.9	0.0	100.0
Position of components	28.6	45.2	21.4	4.8	0.0	100.0
Method of fixing	50.0	33.3	11.9	4.8	0.0	100.0
Design	46.3	34.2	14.6	4.9	0.0	100.0
Details	31.7	41.5	19.5	7.3	0.0	100.0
Other	40.0	20.0	10.0	20.0	10.0	100.0

Table 9 Aspects considered when deliberating constructability relative to health and safety.

All aspects of materials and components, design, details and methods of fixing, should be considered when reviewing constructability relative to health and safety as downstream actions, inter alia, the wearing of personal protective equipment (PPE) can be avoided by simply specifying healthy and safe materials. A reduction in risk can also be achieved.

The majority of PMs always or often made reference to health and safety during site handovers, site meetings, site inspections and site discussions (Table 10).

Occasion	Response (%)					Total
	Always	Often	Seldom	Never	Don't know	
Design meetings	29.8	25.5	27.7	17.0	0.0	100.0
Site handovers	49.0	29.8	10.6	10.6	0.0	100.0
Site meetings	53.2	36.2	8.5	2.1	0.0	100.0
Site inspections	46.8	36.2	14.9	2.1	0.0	100.0
Site discussions	27.7	55.3	10.6	6.4	0.0	100.0

Table 10 Occasions and frequency of reference to health and safety.

Reference should be made to health and safety on all occasions to ensure that the macro environment is conducive to and complements health and safety. It is critical that reference be made to health and safety during design meetings due to the critical influence designers have on health and safety during the construction process and maintenance.



Most PMs stated that health and safety should be included in project management programmes and courses (Table 11).

Response	Response (%)
Yes	89.4
No	4.2
Don't know	6.4
Total	100.0

Table 11 Should health and safety be included in project management programmes and courses?

As project managers influence health and safety during the construction process and maintenance of the built environment they need to receive the requisite education.

Nearly all PMs stated that the lack of health and safety increases overall project risk (Table 12).

Response	Response (%)
Yes	95.8
No	2.1
Don't know	2.1
Total	100.0

Table 12 Does inadequate or the lack of health and safety increase project risk?

Accidents and disease result in variability of resource which in turn increases project risk. However, as health and safety complements the environment, productivity, quality and schedule, health and safety should be prioritised.

More than sixty percent of PMs had comments regarding the role of project managers in occupational health and safety (Table 13).

No. of responses	Response (%)
0	36.2
1	44.7
2	17.0
4	2.1
Total	100.0

Table 13 Do you have any comments regarding the role of project managers in occupational health and safety?

Responses include, inter alia:

- "Project managers need to ensure that it is adequately dealt with during design and construction in order to reduce project risks."
- "You must be fully aware of your direct and indirect responsibilities in occupational health and safety."
- "Project managers must recognise and understand the need in terms of achieving cost, time and quality requirements, and therefore build it into their approach, philosophy and team."
- "Project managers should make it their business to give occupational health and safety the highest priority on any project."



- "A project manager who considers occupational health and safety has a well balanced view of management."
- "Project managers have to give a very high priority to occupational health and safety for a successful project in today's environment."
- "It is important that project managers have knowledge of health and safety so that they can advise their clients of the risks (if any) of the project. There are many legal implications."
- "It should be a part of Project Manager's Body Of Knowledge (PMBOK)."
- "They are custodians of good management on a site."
- "The Occupational Health and Safety Act should be a mandatory requirement of a client's brief as well as a requirement incumbent on the project management profession. - The returns greatly recompense the pain."
- "Project managers must enforce health and safety considerations and ensure the client is aware of the cost and the client co-responsibility."
- "Project managers should consider occupational health and safety an integral part of his management function. It is just another criteria / activity / consideration."

CONCLUSIONS

Based on the findings of both the literature and descriptive surveys, the following conclusions are drawn.

The level of construction fatalities and injuries in South Africa in construction is unacceptable, and a partnering approach is likely to have a positive effect due to the holistic effort of all project stakeholders, project managers included.

Health and safety complements cost, environment, productivity, quality, schedule and customer satisfaction.

Health and safety reduces variability and consequently project risk.

Health and safety should be both an organisational and project value, as opposed to a priority, as priorities may change.

Various processes, strategies, systems and practices, such as suitable procurement systems, constructability management, pre-qualification, partnering, and TQM complement health and safety.

PMs are in a unique position as they influence health and safety both directly in their capacity as project leaders and coordinators, and also indirectly through design, detail and specifications.

PMs currently contribute to health and safety, which contribution can be used as a foundation for increased consideration.



RECOMMENDATIONS

Health and safety should be specifically identified and addressed in detail in the PMBOK.

Health and safety should be included in both the tertiary and post graduate curricula of PMs.

Project pre-qualification criteria should include health and safety.

PMs should refer to health and safety during the conceptual, development, implementation and termination phases of projects, particularly during constructability reviews, site inspections, at site handover, during site meetings, visits and discussions in general.

Contractors should include health and safety in progress and other reports.

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THE ROLE OF HEALTH AND SAFETY IN PROJECT MANAGEMENT

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INTRODUCTORY CV

John obtained a BSc (Building Management) from the University of Port Elizabeth in 1984. As a bursary holder he worked for Murray and Roberts (EP) (Pty) Ltd during his fourth and fifth years of study and continued to do so till he left their employ in 1990.

Thereafter he joined the Department of Construction Management at the University of Port Elizabeth where he is currently an Associate Professor in Construction Management and Materials and Methods.

He obtained a MSc (Construction Management) in 1995, the dissertation entitled: 'The influence of management on the occurrence of loss causative incidents in the South African construction industry'. He is registered for a PhD (Construction Management), the thesis entitled: "A study of the relationship between occupational health & safety, labour productivity & quality in the South African construction industry".

Research interests include construction management in general, but predominantly construction health and safety in which field he publishes, presents papers nationally and internationally, consults, judges, chairs various committees and forums at both regional and national level. He has visited construction sites on six continents and has also visited regulating, academic and research organisations/agencies involved with construction health and safety world-wide.

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