Health and safety and the environment as project parameters

J. J. Smallwood
Department of Construction Management, University of Port Elizabeth, Port Elizabeth, South Africa

Abstract
Traditionally, cost, quality and time have constituted the parameters within which projects have been procured and managed. This traditional approach has been perpetuated by inter alia: tertiary construction education, clients, designers, project leaders and the construction industry. However, the traditional approach has not been successful with the greater percentage of contracts not being completed within budget and to schedule and quality requirements. This non-realisation of the traditional project parameters (requirements) is largely attributable to the exclusion of health and safety and the environment which complement cost, productivity, quality and schedule as the result of the synergy between them. This synergy in turn is the essential catalyst for Total Quality Management (TQM) – the continual improvement of the construction process.

To this end the findings of various descriptive surveys conducted among general contractors and project managers will be presented which substantiate the synergy, inter alia: positive influence of health and safety on productivity, quality and the environment.
Keywords: Project parameters, health and safety, environment
1 Introduction

The traditional concern of designers and constructors has been the protection of constructed items from the effects of the environment. However, recently it has been realised that construction projects may have environmental implications from: the materials used; the nature of the design; the method of construction; the location and layout; the physical structure itself or the use to which it is put, and the effect of construction operations and products on the environment [1].

Occupational disease, fatalities and injuries are not project requirements and result in an increase in the cost of resources as a result of medical care, rehabilitation, compensation insurance, pensions payable in the case of fatalities and ancillary rework [2].

2 Statistics

Table 1 indicates the nature and extent of the injury problem in South African construction. It should be noted that occupational health and safety statistics are only available six years in arrears in South Africa.

<table>
<thead>
<tr>
<th>Class of injury</th>
<th>Total No.</th>
<th>No./Class of injury/</th>
<th>Working day</th>
<th>R100m Construction completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatalities</td>
<td>189</td>
<td>Q5</td>
<td>0,8</td>
<td></td>
</tr>
<tr>
<td>Permanent disablement</td>
<td>946</td>
<td>4,1</td>
<td>4,0</td>
<td></td>
</tr>
<tr>
<td>Temporary disablement</td>
<td>7 645</td>
<td>33,0</td>
<td>32,1</td>
<td></td>
</tr>
<tr>
<td>Medical aid cases</td>
<td>10 108</td>
<td>43,6</td>
<td>42,5</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Injuries per working day and per R100m (US$20,83m) construction completed in South Africa for the year 1990 [3] and [4].

Other salient statistics according to the Compensation Commissioner [4], Federated Employers Mutual Assurance (FEMA) [5] and the South African Reserve Bank (SARB) [3] are:

- The Disabling Injury Incidence Rate (DIIR) of 2,03 in 1990 means that 2,03 workers per 100 received disabling injuries [4].
- The Severity Rate (SR) of 3,86 in 1990 means 3,86 days were lost per worker [4].
- 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 [4] and [5].
- The Fatality Rate in 1990 was 53,5/100 000 workers [4]. This does not compare favourably with the rates of selected countries for 1992: Japan (19); United States of America (18,6); Germany (14); Australia (11); Canada (7,4); Sweden (6), and The Netherlands (3,3) [6].

3 Reasons for considering health and safety

The reasons for considering health and safety are: the human factor; legislation; financial issues, inter alia, fines, cost of accidents and benefits of health and safety;
client pressure; cost of training replacement personnel; pending Construction (Design and Management) Regulations which will link clients and designers to site health and safety; attitudes of the court relative to liability of stakeholders in terms of common law in the event of accidents, and the costs of reinstating the environment as a result of accidents [7].

4 Reasons for considering the environment

There are three reasons the industry needs to act: to pre-empt unfavourable consequences as a result of the increasing array of environment-related statutes, regulations and policies; to prepare for the changed nature of items it will be required to design, construct and manage, the new materials it might have to use and the processes it will have to adopt, and to contribute to overall environmental related efforts and issues [1].

Pitney [8] maintains the perception exists that the construction industry is insensitive to the environment, profit motivated and destroyers of the environment rather than protectors.

5 Health and safety and the environment

Environmental concerns are often interrelated with construction health and safety issues [9]. Unhealthy and unsafe practices, inter alia, concrete run-off or spillage, fires, oil spillage, waste and uncontrolled sanitation impact negatively on the environment. Generation of dust, hazardous materials and the release of non-biodegradable material into the environment contribute to the impact [10].

6 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 workman’s compensation insurance premiums. Historical records can be reviewed to determine the amount of expenditure attributed to each particular injury. The indirect costs are those which are hidden and for which no historical record is kept. However, indirect costs are identifiable, but only ‘hidden’ in that they are not attributed to injuries in a bookkeeping sense [11]. Indirect costs 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. 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 [12], and 20 times [13]. Research indicates the total cost of accidents to constitute, inter alia, 6,5% of the completed construction [14] and approximately 8,5% of the tender price [15].
7 Environmental cost

The environmental cost resulting from the construction process and the built environment is substantial [1]. Much energy is used: in the production of materials such as cement, steel, aluminium, wood products, plastics and paints; the movement of materials and components to sites; the running and operating of plant and equipment on site and in the heating or cooling, or running of the machinery in completed buildings.

About 50% of atmospheric carbon dioxide is emitted from buildings and about 50% of all CFC’s, which contribute to the long term depletion of stratospheric ozone as well as global warming, are used in building services as well as in insulation materials.

Sick Building Syndrome (SBS), where poor air quality, lighting and airborne pollution lead to various ailments and ultimately lost productivity among office workers. The annual loss in The Netherlands is estimated to be in excess of US$1 billion.

Construction and human waste resulting from the construction process and the built environment respectively, result in, inter alia, the waste of land resources and contamination of natural resources and ecologies.

8 Synergy

A healthy and safe workplace complements cost, productivity, quality and the environment [10]. Hinze [16] maintains outstanding projects are: either ahead of or on schedule; within budget and reflect exemplary health and safety.

9 Benefits of health and safety

According to Pomfret [17] benefits include: less injuries; less property damage; less down time; improvement in morale; enhanced industrial relations; increased productivity; reduced cost, and enhanced quality. Other benefits include: less compensation insurance; fewer hidden costs; improved supervisor morale; increased efficiency, and improved marketability [18].

10 Project requirements/goals

According to Hinze [16] health and safety is vitally important, not just cost, quality and time because if a worker has been permanently disabled or killed, then a project is not a success. Total quality includes health and safety and all requirements are achievable concurrently. Levitt and Samelson maintain quality includes productivity and health and safety [18].

Successful project goals include environmental sustainability [19] and Ofori contends that the environment should be the fourth goal on construction projects [1]. Research conducted in the United Kingdom determined health and safety to be one of the five main criteria for contractor selection [20].
All the projects which received awards in the Australian Third Natural Excellence Awards for ‘best practice’ involved unique and special challenges, inter alia, stringent cost and time constraints, sensitive environmental issues and health and safety [21].

11 Research

The salient findings of a number of descriptive postal surveys conducted nationally among various survey populations in South Africa are presented.

11.1 General contractors

78 metropolitan area based general contractors who are members of the Building Industries Federation of South Africa (BIFSA) or the South African Federation of Civil Engineering Contractors (SAFCEC) responded to this survey to determine the influence of management on health and safety.

11.1.1 Most contractors viewed health and safety to be important (Table 2).

<table>
<thead>
<tr>
<th>Importance of Health and Safety</th>
<th>Response (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very</td>
<td>42.9</td>
</tr>
<tr>
<td>Important</td>
<td>44.1</td>
</tr>
<tr>
<td>Fairly</td>
<td>10.4</td>
</tr>
<tr>
<td>Not</td>
<td>2.6</td>
</tr>
<tr>
<td>Total</td>
<td>100,0</td>
</tr>
</tbody>
</table>

Table 2: Importance of health and safety

11.1.2 The benefits of health and safety improvement were both quantitative and qualitative (Table 3).

<table>
<thead>
<tr>
<th>Nature of improvement</th>
<th>Response (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced accident costs</td>
<td>41.4</td>
</tr>
<tr>
<td>Increased productivity</td>
<td>37.9</td>
</tr>
<tr>
<td>Fewer complications</td>
<td>37.9</td>
</tr>
<tr>
<td>Workmen’s compensation rebates</td>
<td>20.7</td>
</tr>
<tr>
<td>Other</td>
<td>10.3</td>
</tr>
</tbody>
</table>

Table 3: Benefits of health and safety improvement

11.2 Project management practitioners

47 members of the Project Management Institute (SA Chapter) responded to this survey to determine the role of project managers in contractor health and safety.

11.2.1 95.8% responded that inadequate or the lack of health and safety increased project risk. Accidents and disease result in variability of resource which in turn increases project risk.
11.3 General contractors

71 metropolitan area based general contractors who are members of BIFSA and SAFCEC responded to this survey to determine the influence of clients on contractor health and safety.

11.3.1 Table 4 schedules the project priorities of clients as perceived by contractors. The environment, and health and safety were identified least and second least frequently respectively.

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Priority Ranking (%)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very</td>
<td>Fairly</td>
</tr>
<tr>
<td>Cost</td>
<td>90,1</td>
<td>5,6</td>
</tr>
<tr>
<td>Environment</td>
<td>11,6</td>
<td>63,3</td>
</tr>
<tr>
<td>Health AND safety</td>
<td>25,7</td>
<td>45,7</td>
</tr>
<tr>
<td>Productivity</td>
<td>46,4</td>
<td>27,5</td>
</tr>
<tr>
<td>Quality</td>
<td>90,0</td>
<td>5,7</td>
</tr>
<tr>
<td>Schedule</td>
<td>66,2</td>
<td>25,0</td>
</tr>
</tbody>
</table>

Table 4: Client project priorities as perceived by contractors.

11.4 Project management practitioners (PMP) and general contractors (GC)

11.4.1 Relative to the aspects negatively affected by inadequate health and safety, the consolidated responses emanating from the surveys presented in 11.2 and 11.3 above are presented in Table 5.

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Yes Response (%)</th>
<th>PIMP</th>
<th>GC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>72,3</td>
<td>81,2</td>
<td></td>
</tr>
<tr>
<td>Environment</td>
<td>66,0</td>
<td>58,5</td>
<td></td>
</tr>
<tr>
<td>Productivity</td>
<td>87,2</td>
<td>87,1</td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td>80,8</td>
<td>82,4</td>
<td></td>
</tr>
<tr>
<td>Schedule</td>
<td>57,4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Client perception</td>
<td>68,1</td>
<td>77,6</td>
<td></td>
</tr>
<tr>
<td>Contractor image</td>
<td>*</td>
<td>86,8</td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Aspects negatively affected by inadequate health and safety.

* Not asked

12 Conclusions

Accidents result in fatalities, injuries, disease and damage to the environment and do not constitute project requirements.

The traditional project requirements of cost, quality and schedule are marginalised by inadequate health and safety and concern for the environment. The benefits of prioritising health and safety and the environment include reduced cost, enhanced productivity and quality, earlier completion and customer satisfaction.
13 Recommendations

Health and safety and the environment should be included as project parameters. Inclusion as project parameters implies that: they be considered during all phases of a project; procurement systems be suitably structured, and practices are implemented to engender health and safety and sustainability of the environment.

14 Acknowledgements

The author wishes to acknowledge Danie Venter, Director, Institute for Statistical Consultancy and Methodology, University of Port Elizabeth for the statistical processing of data and the General Contractors and Project Management Practitioners who responded to the various surveys.

15 References