

# A Health and Safety Improvement Roadmap for the Construction Industry

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**Abstract:** *Comparatively, the construction industry has, on average, a higher rate of fatal and major injuries, work induced ill-health and damage to properties than other industrial sectors; and this is a source of concern to industry stakeholders. The study showed that although subcontracting could be contributory to an increase in workplace accidents in the construction industry, contractual aspects of subcontracting arrangements (such as the power imbalance that exist along the client-customer interface) also present opportunities for improvements in health and safety management (HSM) practices in organisations. This conclusion was reached after an analysis of a questionnaire survey (with a 27% response rate) that assessed the attitudes and perception to health and safety issues.*

**Keywords:** *health and safety, network, performance improvement, small and medium-size enterprise, sub-contracting, supply chain management*

## I. INTRODUCTION

The poor performance of the construction industry in some key areas has been lamented [1]. One of such areas is health and safety, which is regarded as a key performance indicator in the construction industry [2]. Although health and safety statistics in countries such as United Kingdom (UK) suggest a steady improvement in the accident-incident statistics of the construction industry over the years (Figure I), the frequency and severity of these occurrences are still higher than in most other sectors [3].

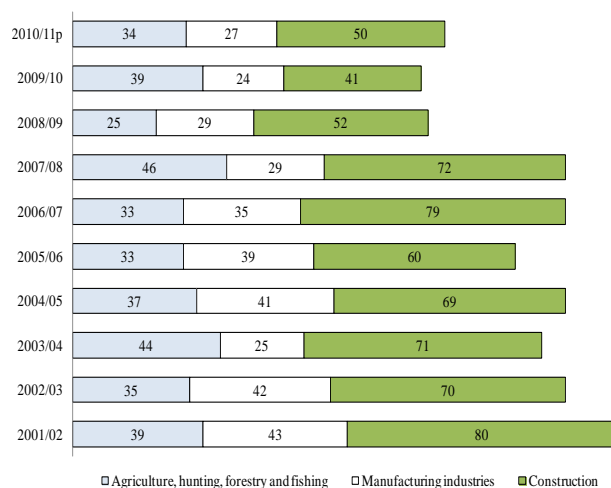


FIGURE I  
 FATAL INJURIES TO WORKERS, 2001/02 - 2010/11P  
 (SOURCE: HEALTH AND SAFETY EXECUTIVE, 2012)

The impact of accidents and injuries in the construction industry's performance is well documented. For instance, there are about 6,300 fatalities per day; over 330 million recorded occupational accidents and work-related diseases annually; and a financial cost that is equivalent to 4% of annual global gross domestic product (GDP) [4]. In the UK, it accounts for 27% of fatal injuries, 9% of reported major injuries, and 6% of over 3-day injuries to employees [5]; as well as a greater percentage of prohibitions and notices [6]. Again, about 40% of the occupational cancer deaths and cancer registrations in UK is traceable to the industry [7].

The above statistics suggest that in spite of earlier attempts at improvement [1], more efforts still need be put into managing health and safety in the construction industry. It is believed that the strategic role of the industry to economic development [8, 9], as well as the cost of accidents and ill health to the society are major motivators for these improvement efforts.

In spite of these efforts, the accident-incident statistics of the industry is still not encouraging. Some blame this on the undue emphasis (even in the selection of contractors) that is placed on price instead of quality [10]. This is reminiscent of a market based type of relationship, which has been blamed for the poor safety standard in the industry [11]. Thus, certain management practices in the construction industry that encourage rivalry, and little or no information sharing, may have contributed substantially to the industry's poor health and safety standard. It could thus be concluded that the poor health and safety performance of the construction industry sector over the years is attributable to the nature of activities carried out in the sector [12].

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Although this paper acknowledges that certain aspects of supply chain management practices (e.g. subcontracting) can lead to poor health and safety standard, the strengths inherent in other aspects of it (such as partnering and collaborations) can be effective health and safety improvement tools.

## II. LITERATURE REVIEW

### A. Nature and Causes of Accidents in the Industry

Accidents in the construction industry are generally seen as either direct consequences of the nature of operations performed and materials used, or indirect consequences of prevailing management practices. Immediate causes of accidents, injuries and ill health in the construction industry have been identified [5, 13]. The underlying causes include the temporary nature of construction projects [14], as well as its trade-based nature [11], which characterise the industry as a highly fragmented and adversarial one [15]. It has also been observed that management practices such as contractual arrangements in the industry lead to higher incident rates [1, 16], probably because of the difficulties in assigning responsibilities, occasioned by coordination and communication challenges due to poor relationship management [17]. All these not only promote price competition among contractors, but also contribute to the level of accidents in the sector [18].

### B. Construction Supply Chain Network and Management

This section provides an overview of supply chain networks and management in the construction industry, and how these impact on health and safety standard. A construction supply chain (Figure II) is a group of firms connected through upstream and downstream contractual relationships, together with the associated flow of commodities, cash and information with an aim to delivering product(s) and/or services) related to the core business of a construction project [19].

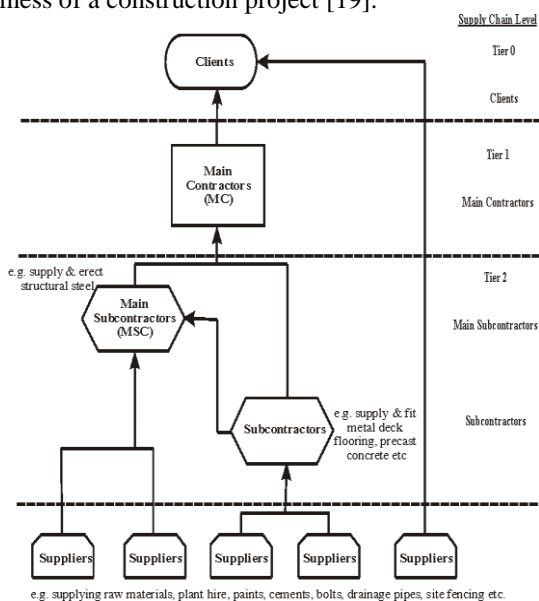


FIGURE II  
A TYPICAL CONSTRUCTION SUPPLY CHAIN (SOURCE: [20])

The chain is dominated by small companies providing services to their larger counterparts [21], hence, portraying it as a fragmented one [22]. The efficiency of the chain is affected by fragmentation [15] because of its impact on the relationship that exist among stakeholders [23]. For instance, it reduces trust [24], and affects information sharing and learning [25]. Apart from creating a contractor-subcontractor relationship that is likely to be affected by the transactional power of the contractor, there is equally a higher chance of an undue focus being placed on costs rather than value by the contracting organisation [22].

These notwithstanding, supply chain management (SCM) principles enhance performance and competitiveness of organisations [26] by promoting total business excellence [27], better management of relationships [28], as well as enhancing the implementation of improvement programmes tailored towards satisfying the peculiar needs of the industry [29].

### C. Implications of Subcontracting on Construction Health and Safety

Indications from literature are that the construction industry is pre-dominated by SMEs [21, 22, 30], with known health and safety challenges [31]. There is, therefore, a fear that this would impact on the health and safety standard of the construction industry. This fear has been corroborated by the positive association between the use of contractors/suppliers and higher accident rates [17].

## III. METHODOLOGY

### A. Research Approach

The analyses in this paper are based on data from [31], which adopted a multi-method approach an area probability sampling techniques [32], in line with suggestions by [33] as a way of enhancing the validity and generalizability of the research output. Data were collected from Birmingham and Coventry cities in the United Kingdom. The questionnaires were distributed to enterprises chosen randomly from the Applegate directory, as well as through organised groups such as the Coventry and Warwickshire Safety Group and the Birmingham Health, Safety and Environment Association. This is because it would have been difficult to survey every business enterprise in the United Kingdom, due the huge number of these [34]. Thus cost, convenience, industrial status and ethnic mix were major factors in this decision.

Although the survey covered a relatively small section of the population, the output would not be affected because for large populations, a small sample would equally produce accurate results [35]. It has also been suggested that for minimal and basic statistical analysis aimed at supporting a more qualitative data analysis, the minimum number (i.e. effective responses) required is about 30 respondents [36]. The minimum number of questionnaires to distribute was determined as follows:

When, minimum sample size is 30, based on [36] and estimated response rate is 10.28%, based on [37],

$$\begin{aligned}
 & \text{No. of Questionnaires to Distribute} \\
 &= \frac{\text{Minimum No. of Respondents}}{\text{Anticipated Response Rate}} \\
 &= \frac{30}{\left(\frac{10.28}{100}\right)} = \frac{30}{0.1028} = 291.8 \approx 292
 \end{aligned}$$

**B. Data Collation and Management**

The administered questionnaire assessed respondents' views on various aspects of HSM, partnerships and collaborations within supply chain networks. The data were compiled and analysed using SPSS statistical software. The study utilized simple statistical analysis (frequency and non-parametric) in exploring relationships and comparing behaviour among groups; this is acceptable in statistical analysis [38].

**IV. RESULTS AND IMPLICATIONS**

**A. Response Rate**

The survey achieved a 27% response rate (121 responses from 450 questionnaires distributed). Although Fogliani [39] notes that low response rates could significantly affect the accuracy of survey results, the rate achieved is acceptable based on results similar surveys [37, 40]. As a construction sector targeted paper, the conclusions and discussions within this paper are based on the analyses of data supplied by respondents from the construction industry only.

**B. Impact of Health and Safety Standard**

There were 38 respondents with 3 from micro enterprises (0-9 employees), 7 from small enterprises (10-49 employees), 14 from medium enterprises (50-249 employees), and 14 from large enterprises (above 250 employees). The above mix makes the conclusions drawn to fairly representative of the construction industry, thus there is minimal bias due to under-representation [35].

Thirty seven respondents, 23 from SMEs and 14 from large enterprises (LSEs) believe that poor health and safety standard impacts on their operations, while 3 felt otherwise. On the perceived impact of this on their image, all 38 respondents (SMEs = 24; LSEs = 24) felt it has an impact.

The relationship among poor health and safety standard, image and operation were tested using a non-parametric chi-square test. The small significance level ( $p < .001$ ), large chi-square statistics of 91.26 (impact on business operations) and 78.89 (impact on business image) suggest a likelihood that these variables affect each other. This impact is manifested in loss of experienced manpower (either through accidents or resignations), or reduced staff turnover due to good health and safety standards [41]. Other possible effects include fewer contracts from health and safety conscious organisations, increase in compensations, cost over-runs, among others. Considering the impact of these direct and indirect costs,

organisations now take proactive steps to eliminate or minimise the impact of these on their reputation [42].

The impact of an accident or ill health may seem localised but this is not always the case. For instance, It has been observed that competition is no longer among individual organisations but among supply chains [43]; therefore a disruption in one chain could have a multiplier effect on the entire chain. This reinforces the need for more capable organisations (often large ones) to assist their less capable associates (often SMEs) as a way of forestalling the negative impact of their performance on them [44].

**C. Sources of Information on Health and Safety**

Table I shows sources of information on health and safety issues.

**TABLE I**  
**SOURCE OF INFORMATION**

(a) Trade Unions						(b) HSE/Website					
Enterprise size					Total	Enterprise size					Total
1-9	10-49	50-249	250+	1-9		10-49	50-249	250+			
Yes	0	0	1	1	2	Yes	2	5	13	14	34
No	3	7	13	13	36	No	1	2	1	0	4
(c) Health and Safety Journals						(d) Local Authority					
Enterprise size					Total	Enterprise size					Total
1-9	10-49	50-249	250+	1-9		10-49	50-249	250+			
Yes	3	3	12	13	31	Yes	0	2	0	2	4
No	0	4	2	1	7	No	3	5	14	12	34
(e) Head Office						(f) Industrial Networks/Groups					
Enterprise size					Total	Enterprise size					Total
1-9	10-49	50-249	250+	1-9		10-49	50-249	250+			
Yes	0	0	1	1	2	Yes	2	4	14	13	33
No	3	7	13	13	36	No	1	3	0	1	5

Table I (a) and (e) suggest that small businesses do not rely so much on trade unions and their head offices for information on health and safety; the use of these sources tend to increase with enterprise size. This may be caused by the sole ownership structure of small businesses which discourage trade unionism. Again, in some countries, the appointment of safety representatives is not mandatory for all organisations. For instance, the Safety Representatives and Safety Committees Regulations 1977 in UK, only mandatorily stipulates this for organisations with organized trade unions. Thus, insistence on appointment of safety representatives in organisations without organised trade union may be over-stepping the bounds. The above observations and the limited success recorded with this form of intervention [45] do not project trade unions as the best route through which health and safety improvement initiatives in organisations (especially non-unionized ones) could be pursued.

Again, Tables I (b, c, f) above suggest that preference for HSE (directly or through their websites), health and safety journals, industrial networks and groups, as sources of information increases with enterprise size. In spite of this poor performance, SMEs feel reluctant approaching safety regulators for help and advice due to

the fear of being punished [46]. Thus, relying wholly on this source for improvement in SMEs may not be a good strategy. Although information and communication technology (ICT) makes information more accessible to a large number of people, lack of ICT infrastructure (especially in developing countries), as well as the level of proficiency [47, 48] affect this. Thus, safety regulators (either directly or through their portals) may neither be suitable nor effective improvement medium, especially for SMEs. Rather, intensive advisory systems based on mutual trust, which is deemed more efficient than high volume gateway information should be utilized [49].

Furthermore, factors such as accessibility and cost affect the effectiveness of safety journals as sources of information and guidance on health and safety issues. First, a certain level of awareness of HSM is expected before one can read and understand safety issues without guidance. This basic level of awareness is affected by limited fund, which hinders both the subscription to safety journals and participation in further training [31]; thus, a considerable level of help would still be required if small organisations were to effectively interpret and utilise information contained in these journals.

Improvements in organisations (including health and safety) are either internally or externally induced. An analysis of motivators of improvement shows that customer requirement/encouragement leads to improvement more than legislative demand (Table II). Instances of the influence of external motivators, such as supply chain pressure, on the desire to improve abound [37, 50].

TABLE II  
LEGISLATION AND CUSTOMER REQUIREMENT AS MOTIVATORS

Level of influence	Enterprise Size	Percentage of Total Response	
		Legislation	Requirement/encouragement
Small extent	1-249	8	13
	250+	0	0
Moderate extent	1-249	13	26
	250+	3	13
Great extent	1-249	42	24
	250+	34	24

It has been observed that clients' demand a strict adherence by their suppliers to some laid down requirements [51]; and compliance with these requirements becomes a pre-requisite to remaining on the preferred suppliers list [52].

#### D. Interest in Supply Chain Improvement Activities

Table III tabulates the attitude of respondents' organisations to HSM in their supply chains, while Table IV below contains responses on specific activities.

TABLE III  
HEALTH AND SAFETY MANAGEMENT STRATEGIES

	Yes	Total responses	%
Formal assessment of suppliers' health and safety performance	26	29	90
Health and safety performance forms part of our sub-contract conditions	25	28	89
Part of network that shares good practice	32	38	84
Interested in supply chain improvement initiative	28	36	78
We set health and safety criteria for our suppliers	21	27	78
Informal assessment of suppliers' health and safety performance	22	28	77
Part of industry specific partnership that shares good practice	27	38	71
We rate health and safety performance as highly as cost	19	29	66
Educate our suppliers through written materials	18	29	62

While the data shown on Table III connote an active engagement in improvement activities by organizations; however, data on Table IV contradict this. The contribution(s) of these factors to organisational improvement have been highlighted [53-55].

TABLE IV  
SPECIFIC PARTNERSHIP IMPROVEMENT ACTIVITIES

	Yes	Total	%
We go into our suppliers' companies to help them improve health and safety	9	29	31
Benefited from improvement workshops and education from customers	12	37	32
Run workshops/seminars to educate our suppliers	13	29	45
Part of supply chain initiative involved in active dialogue with suppliers /stakeholders	18	38	47
Have received guidance from customers	21	38	55
Interested in participation in supply chain improvement initiative	18	27	67
Communicate to suppliers our health and safety criteria for goods and services we buy	29	29	100

This section has highlighted that organisations recognize the impact of poor health and safety standard on image and operations; and many are sceptical about seeking help and advice from safety regulators. Although information can be accessed through trade unions, websites, industrial networks, journals, etc, industrial networks seems to be the best option because SMEs, which constitute a substantial part of the target industry, regard social networks as good sources of information [56]. In doing this, they are likely to benefit from the competencies (resources) of other organisations that may help improve their standards.

## V. HEALTH AND SAFETY IMPROVEMENT ROADMAP

Organisations in outsourced environments are prone to risk importation [57], and their operations could suffer as a result of this. The proposed roadmap would provide for a better safety needs assessment by construction companies/supply chains operating in this type of environment, and establishing measures aimed at minimizing the impact of these risks, or forestalling their importation. In spite of this perceived increased susceptibility to health and safety risks inherent in such relationships, it is only through the implementation of programmes that strengthen organisational structures and practices (e.g. collaborations and partnerships), that the construction industry can become truly proactive in managing health and safety [58], perhaps due to better communication and information sharing among stakeholders [34].

Consequently, the supply chain, described as a major facilitator of change [59], could be used to initiate the attitude needed to facilitate better performance. Furthermore, it could be inferred from the result of the survey presented in Table II that contractual obligations and pressure from customers have greater influences on improvement in smaller organisations than regulatory requirements. Thus, supply chain pressure becomes a route and an opportunity for encouraging or inducing smaller organisations into better HSM.

Although [59] see the supply chain as a major a facilitator of change which can be used to initiate the attitude needed to influence better performance [60], it may not be feasible to involve every supply chain member in every initiative due to resource constraints. Therefore, the targets of an improvement programme should include strategic and high spend suppliers. It is imperative to note that as organisations usually spend considerable percentage of their annual sales turn over purchasing materials and services [61], neglecting this category of associates could increase chances of risk importation. It is also important that laggards/stagnant performers are included to offer them opportunities to improve and attain competitive advantages through improvement in their organisational capabilities.

While it was shown in [31] that lack of management commitment and support affect HSM in organisations, others, for instance, [62], observe that the success or otherwise of initiatives in organisations depend on the level of commitment and support from management and employees. There is, therefore, a need to gain stakeholder support for the improvement initiative planned. However, the level of commitment is determined by the strategy of engagement – persuasive or coercive. While imposition affects the level of commitment and participation [63], successful collaborations can only be achieved when partners work co-operatively [64].

The need to tailor intervention programmes to the specific needs of intended beneficiaries is recognised [65]; hence the need for a proper needs assessment to be carried. The benefits of this include the facilitation of a structured approach to management which ensures that

risks are fully assessed, and that safe methods of work are introduced and adhered to. Ideally, it should be carried out by those familiar with the needs of the target [66], as this increases the chances of identifying majority of the needs and causes of poor performance. However, it may entail a re-alignment of inherent cultures/practices, as improvement in performance is only achievable if structural changes are implemented alongside cultural transformations [67].

The management of available human resource, just like in the wider organizational management, is strategic to any safety improvement plan. Thus, the establishment of strategic interface teams is an important aspect of any partnership implementation strategy [68]. The implementation team ensures that activities are implemented as planned; and the different professional backgrounds of members enhance cross-fertilization of ideas, thus guaranteeing programme effectiveness. To attain the desired performance standard, it is desirable team members be open to new, and be willing to learn. Desirable qualities of team members include adequate knowledge of issues at hand, and the ability to work as part of a team.

The success of safety improvement initiative can be affected by the efficiency with which duties are discharged. There are observations that the effectiveness of a safety management system is enhanced by an organisational structure that details responsibilities, practices, procedures, processes and resources for determining and implementing accident prevention policies [69], because it reduces the confusion about who should do what [70]. This is unarguably, an important element of a safety management system because it improves accountability.

Additionally, there is a need for proper control, which when lacking impacts on the level of coordination and collaborations in supply chains [71]. It has been suggested that for maximal effectiveness, the responsibility to control and coordinate improvement programmes in supply chains should reside with the final decision maker (usually the client or main customer) [72]. This is mainly because of the transactional power of the main contractor in the contractor-subcontractor relationship; thus, this could be used positively in ensuring that sub-contractors and suppliers become committed to improvements in their safety standards.

Several factors can influence the success of an improvement programme. For instance, the extent to which individuals/organisations feel empowered to act affects the desire to improve on existing practices [73]. This increases commitment [74] and involvement of stakeholders. While clarity in programme aspects could increase the overall acceptance of any initiative by stakeholders, the inability to understand the motives behind initiatives often leads to failure of such initiatives [55].

Collaboration and partnerships among organisations are built and sustained by trust [20]; lack of trust can affect performance improvement [75]. This relationship between improved performance and trust could be

because it encourages mutual risk sharing [76]. According to [77], level of trust affects the willingness of an organisation to participate in, or seek help from certain sources. This implies that the ability of organizations to leverage on the resources of each other and compete effectively is affected by the level of trust.

Again, the outcome of an improvement programme could also be affected by its mutuality of purpose. Thus, there is a need for jointly defined agenda, such that the individual needs of the stakeholders can be addressed in a way that does not compromise the overall outcome [78]. It would be recalled that a typical construction supply chain is highly fragmented, adversarial and market based in nature [15, 79]. Therefore, for any improvement initiative to succeed there must be a forum for discussion and brainstorming, as well as mechanisms for dissemination of health and safety policies [80]. One of such mechanisms is scheduled meetings, during which stakeholders are briefed about planned actions, and allowed to comment on matters of importance to them. Ensuring that stakeholders are properly informed and abreast with relevant information, would most likely translate to improved performance as opined by [81], thus improving their performances [82]. Regularly scheduled meetings is an effective tool for addressing performance issues with suppliers, communicating expectations, as well as sharing information [53].

At the heart the improvement roadmap is the evaluation and review process which assesses how available resources were used during the implementation of the initiative; makes a judgement on the level of implementation and the effectiveness of the arrangements that have been put in place to control risk and improve safety performance. An effective health and safety implementation strategy must include clearly defined procedures for collation and evaluation of performance related data [80]. This process helps in the identification of shortcomings and ensures that standards are in line with set objectives and are achieved [83]. It also offers opportunities to proffer advice on how existing implementation plan can be modified (if necessary) in order to enhance it. However, review and audit of performance can only be an indispensable aspect of performance improvement if stakeholders were adequately given the power and opportunity to ensure that standards achieved in practice are in line with established objectives.

#### *A. Implementation of the Roadmap*

The roadmap was tried using the supply chain of a construction company in UK. The programme involved the auditing of suppliers, assessment of existing structures for managing health and safety, assessment of needs in areas such as training, enrolment of their employees in Construction Skills Certification Scheme (CSCS) programmes, organisation of awareness days, and health and safety week in conjunction with two other major construction companies. The company reported improvements in their relationship with their suppliers, the willingness to discuss health and safety problems, as

well as monetary savings by the initiating organization (see Appendix 1). The above notwithstanding, there is need for further refinement of this roadmap and its extended trial in more supply chains to arrive at a better conclusion on its effectiveness.

The evaluation of the effectiveness of the roadmap was guided by the extent to which it satisfied the identified needs of the company as highlighted in the statement of intent which emerged during an assessment of needs interview with its Purchasing and Supply Chain Manager. It is recognised that an evaluation of the effectiveness of this framework, in the manner suggested here, may be questioned in certain quarters. However, the measurement of effectiveness or efficiency of an activity is based mainly upon the ability of the activity to meet the needs of the stakeholder and not necessarily upon a pre-determined view or notion of what should or should not have been achieved. Although it is further recognised that the use of quantitative data in assessing the effectiveness of a programme may be preferred in certain quarters, it is also acknowledged that an evaluation can rely on qualitative data to measure and express progress made in the implementation of agreed plans.

A common trend in all these assessments is the issue of the length of time between the implementation of the activities and the time that assessment or evaluation was carried out. Much as this may have an implication on the eventual outcome, it is to be noted that final outcomes of any improvement initiative may take several years to become visible or realised. This is especially true in this instance. Furthermore, as an academic exercise, it was carried out within peculiar academic constraints of time and resources. Subsequently, the evaluation of the effectiveness of this framework has been based on the feedback received at the end of the events organised, as well as the appraisals by the Health, Safety, Environment and Quality Manager and the Purchasing and Supply Chain Manager of the case study organisation (Appendix 1).

## VI. HEALTH AND SAFETY IMPROVEMENT ROADMAP

This paper reviewed HSM in the construction industry, and established that indeed, health and safety standard in the construction is not encouraging. It further established that this has been caused by the nature of the industry and activities carried out. Specifically, lack of trust, fragmentation, market-based nature, and outsourcing practices have contributed to this poor standard. Again, as an industry predominated by SMEs, limited success in improvement initiatives that relied on trade unions, regulatory authorities, electronic and print media, was not surprising. However, literature findings reinforced by empirical evidence show that the desire by organisations to collaborate with their business associates could bring about substantial improvements in health and safety standards of organisations, especially SMEs.

In view of the foregoing, the paper recommends that rather than rely solely on regulatory influences to drive forward health and safety improvement in construction companies, there is the need to explore the use of

customer influences. First, these organisations know each other very well, and the fear of being punished as is the case with the regulators, is highly minimised. Secondly, and perhaps a very significant factor is that the mere thought of lost revenue, that may arise from being dropped from ‘preferred suppliers’ list, may have a greater impact than just paying fines (which in most cases, have lower financial implications).

The roadmap proposed here can help stakeholders (regulators and business associates) in reaching out to, and helping organizations with poor health and safety standards to improve. This would reduce substantially the cost of accidents, ill health, injuries, etc, to the society.

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