IMPROVING PROJECT DELIVERY IN SOUTH AFRICAN CONSTRUCTION

Emuze, F.A. and Smallwood, J.J.[1]

Department of Construction Management, Nelson Mandela Metropolitan University, PO Box 77000, Port Elizabeth, South Africa.

Empirical findings advocating performance improvement have continued to populate the international construction management literature in a bid to address the sub-optimal performance of the industry. A common theme among the publications is the seemingly lacklustre performance recorded on construction projects in terms of a range of performance indicators such as cost, environment, H&S, quality, and time. Similarly, South African construction is reportedly contending with a range of project performance issues, which led to this empirical research. Through the review of related literature and a quantitative survey, this paper reports on research conducted with the overall aim of identifying issues contributing to performance impediments, and their effects in South Africa. The survey was undertaken among general contractor (GC) members of the South African Federation of Civil Engineering Contractors (SAFCEC). Selected findings include: a range of issues contribute to inadequate capture and transfer of knowledge, and inappropriate organisation culture, and poor management of site logistics are either collectively or individually marginalising the realisation of project objectives in South Africa. These issues in turn may manifest in the form of client dissatisfaction, delays, and rework in South African construction. However, there appears to be major scope for improvement if project stakeholders can proactively apply interventions / practices such as optimum management of quality, logistics, and organisational culture, in their quest to improve project delivery.

Keywords: contractors, performance, South Africa.

BACKGROUND

Soetanto *et al*. (2001) suggest that in terms of contractor performance, the performance parameters of cost, quality, time, and collaborative working were ranked high by clients in the United Kingdom (UK), though the performance may vary based on project types and / or locations. For instance, an international comparison of contractor performance revealed disparities in contractors' quality performance (Xiao and Proverbs, 2002). The survey that addressed performance measures in Japan, the UK, and the United States of America (USA) indicates that Japanese contractors' performance relative to quality is superior to that of western contractors, and that western contractors tend to attach more importance to cost and time. Regardless of the disparity, a project may not meet its performance objectives if one or more of these indicators fail to measure up to the required standard.

In fact, Butcher and Sheehan (2010) suggest that many of the traditional performance measures such as cost, H&S, quality, and time are treated as required performance in the current construction environment in the UK rather than indicators of excellence.

[1] John.Smallwood@nmmu.ac.za

Emuze, F A and Smallwood, J J (2011) Improving project delivery in South African construction *In:* Egbu, C. and Lou, E.C.W. (Eds.) *Procs 27th Annual ARCOM Conference*, 5-7 September 2011, Bristol, UK, Association of Researchers in Construction Management, 921-930.

Therefore, they contend that in order to improve performance, contractors may have to exhibit excellence in relationships and innovation through top management commitment, high levels of trust and respect, effective communication, contractor team satisfaction, outstanding cultural alignment between customer and contractor, and the ability to value manage projects.

In particular, published Construction Industry Development Board (CIDB) Construction Industry Indicators (CII) indicates that a number of performance related lapses are taking place in South African construction. As indicated in Table 1, clients' neutrality / dissatisfaction with respect to contractor performance, level of defects recorded in projects, and construction schedule have consistently been estimated to occur on projects surveyed in 2007, 2008, and 2009; and though improvement can be seen in clients neutrality / dissatisfaction relative to quality of works delivered, the improvement is however marginal between 2008 and 2009 (CIDB 2008; 2009; 2010).

Table 1: Areas of performance concern according to CIDB CII reports

Key focus areas	Response (%)		
	2007	2008	2009
Clients were neutral / dissatisfied with contractor performance	24.0	21.0	18.0
Clients were neutral / dissatisfied with quality of works delivered	33.0	20.0	19.0
Clients were neutral / dissatisfied with level of defects in projects	24.0	18.0	12.0
Clients were neutral / dissatisfied with construction schedule	24.0	22.0	21.0

Source: CIDB (2008; 2009; 2010)

As a result of the reported performance gaps, this paper addresses issues relative to performance impediments in South African construction. The research is underpinned by the need to investigate the perceived slow project performance improvement being recorded in the industry. Specifically, issues contributing to performance impediments, and the effects of these poor performance issues were examined with a view to providing more insight into project performance improvement initiatives in South African construction. It is instructive to note that previous research findings indicate that a lack of concern for the environment, late information, poor management of design activities, poor planning, low skills level, rework, poor productivity, and poor quality are some of the causes of poor contractor performance in South Africa (Smallwood, 2000). The findings that were based on clients' perceptions are also corroborated by the research findings of Dlungwana *et al*. (2002), which identified causes of performance problems in South African construction to be cost overruns, rework, late completion, poor H&S, poor consideration of environmental issues, poor work practices, and adversarial relationships related.

Therefore, in South Africa, the potential exists not only to improve industry performance relative to a range of performance measures such as labour productivity, H&S, and rework, but also to engender multi stakeholder interventions such as benchmarking, constructability of design, implementation of quality management systems (QMSs), and workers / foreman / supervisor development (Smallwood, 2002).

THE RESEARCH

The mixed-mode quantitative survey was used to elicit information from respondents through a structured questionnaire that, *inter-alia*, requested information relative to project performance impediments in South African construction. The survey instrument was designed with closed ended questions so that respondents can identify performance impediments, and their effects based on the literature reviewed.

Respondents were able to identify performance impediments using five scales: (1) Minor extent; (2) Near minor extent; (3) Some extent; (4) Near major extent; (5) Major extent. And in order to score the effects of the impediments, respondents were provided with five scales: (1) Strongly disagree; (2) Disagree; (3) Neutral; (4) Agree; (5) Strongly agree.

Upon completion of the questionnaire design, the survey, which constitutes a phase of a large empirical study, was conducted among GC members of the SAFCEC. Fifty-six (56) questionnaires were posted to the sample stratum and thereafter e-mailed in an attempt to enhance the response. At the end of the survey period that spanned approximately twelve weeks, only 15 valid responses were received, which equates to a response rate of 26.8%.

The Findings

Table 2 indicates the respondents' perceptions of the extent that practices contribute to inadequate documentation and transfer of knowledge in South African construction in terms of percentage responses to a scale of 1 (minor) to 5 (major), and a mean score (MS) ranging between 1.00 and 5.00. It is notable that all the MSs are above the midpoint of 3.00, which indicates the respondents are of the opinion that the practices contribute more of a major than a minor extent to inadequate documentation and transfer of knowledge. The findings indicate that poor allocation of resources to knowledge capture contributes the most to inadequate documentation and transfer of knowledge, followed by poor information management, and lack of detailed databases relative to past projects. Though, lack of mentorship programmes and lack of project reviews are ranked 4th and 5th, the fact that the majority of the respondents perceive their contributions to inadequate documentation and transfer of knowledge to be between 3 (some extent) and 5 (major extent) suggest that they should be considered important contributors.

Table 2: Contributors to inadequate documentation and transfer of knowledge

Practices	Response (%)							
		Minor……Major						
	Unsure	1	2	3	4	5	MS	Rank
Poor allocation of resources to knowledge capture	0.0	0.0	6.7	13.3	53.3	26.7	4.00	1
Poor information management	0.0	0.0	13.3	13.3	40.0	33.3	3.93	2
Lack of detailed databases relative to past projects	0.0	0.0	6.7	46.7	26.7	20.0	3.60	3
Lack of mentorship programmes	0.0	0.0	26.7	33.3	26.7	13.3	3.27	4
Lack of post project reviews / reports	0.0	13.3	13.3	33.3	20.0	20.0	3.20	5

Table 3 indicates the respondents' perceptions of the extent that situations occur due to inadequate documentation and transfer of knowledge in South African construction in terms of percentage responses to a scale of 1 (strongly disagree) to 5 (strongly agree), and a MS ranging between 1.00 and 5.00. It is notable that all the MSs are above the midpoint of 3.00, which indicates the respondents, can be deemed to agree as opposed to disagree that the situations occur in South African construction.

With 26.7% of the respondents strongly agreeing (5), and 46.7% of the respondents agreeing (4), poor response to organisational and project changes was ranked 1st among situations that could occur due to lack of proper documentation and transfer of

knowledge. Based on the respondents' perceptions, the inability to disseminate 'best practices', repetition of past project mistakes, ineffective problem solving capabilities, inability to innovate and respond to clients' needs, lost opportunities to improve project performance, inability to tackle risks / uncertainties effectively, and the loss of contractors' supply chain track record that are ranked from 2nd to 8th, could manifest due to lack of proper documentation and transfer of knowledge.

Table 3: Effects of lack of proper documentation and transfer of knowledge

Situations	Response (%)							
		Str. Disagree……..Str. Agree						
	Unsure	1	2	3	4	5	MS	Rank
Poor response to organisational and project changes	0.0	0.0	0.0	26.7	46.7	26.7	4.00	1
Inability to disseminate 'best practices'	0.0	0.0	6.7	33.3	33.3	26.7	3.80	2
Repetition of past project mistakes	6.7	0.0	0.0	40.0	33.3	20.0	3.79	3
Ineffective problem solving capabilities	0.0	0.0	6.7	40.0	26.7	26.7	3.73	4
Inability to innovate and respond to clients' needs	6.7	0.0	0.0	46.7	33.3	13.3	3.64	5
Lost opportunities to improve project performance	13.3	0.0	0.0	40.0	40.0	6.7	3.62	6
Inability to tackle risks / uncertainties effectively	0.0	0.0	13.3	26.7	53.3	6.7	3.53	7
Loss of contractor, subcontractor / supplier track record	0.0	6.7	6.7	46.7	20.0	20.0	3.40	8

Table 4: Contributors to unacceptable coordination and regard for H&S

Practices	Response (%)							
		Minor……Major						
	Unsure	1	2	3	4	5	MS	Rank
H&S competence of project participants	0.0	0.0	0.0	21.4	42.9	35.7	4.14	1
Inadequate knowledge relative to nature of work	0.0	0.0	7.1	7.1	57.1	28.6	4.07	2
H&S management procedures / systems	0.0	0.0	14.3	28.6	28.6	28.6	3.71	3
Collective organisational values relative to H&S	7.1	7.1	14.3	28.6	14.3	28.6	3.46	4
Poor comprehension of project characteristics	0.0	7.1	28.6	7.1	42.9	14.3	3.29	5

Table 4 indicates the respondents are of the opinion that the identified practices can be deemed to contribute more of a major than a minor extent to unacceptable coordination and regard for H&S in South African construction. The respondents can be deemed to consider that H&S competence of project participants, and inadequate knowledge relative to nature of work, to be contributing the most to unacceptable coordination and regard for H&S in South African construction. Also notable is the respondents' observations that H&S management procedures / systems, collective organisational values relative to H&S, and poor comprehension of project characteristics, which are ranked 3rd, 4th and 5th on the table, could contribute to the sub-optimal performance of H&S during project delivery in South African construction.

Table 5, which indicates the respondents' concurrence with the extent that identified situations occur due to unacceptable coordination and regard for H&S, suggests the respondents can be deemed to agree more than disagree that these situations could occur in South African construction. An examination of the findings suggests that the respondents sense that work stoppages, injuries, and fatalities; poor status of H&S within the construction process; and ineffective H&S monitoring and inspection are important possible effects of unacceptable coordination and regard for H&S in South Africa.

Table 5: Effects of unacceptable coordination and regard for H&S

Situations	Response (%)							
		Str. Disagree…….Str. Agree						
	Unsure	1	2	3	4	5	MS	Rank
Work stoppages, injuries, and fatalities	0.0	6.7	20.0	13.3	26.7	33.3	3.60	1
Poor status of H&S within the construction process	0.0	6.7	20.0	13.3	26.7	33.3	3.60	2
Ineffective H&S monitoring and inspection	0.0	6.7	13.3	26.7	26.7	26.7	3.53	3
Lack of project specific H&S specification	6.7	6.7	33.3	13.3	20.0	20.0	3.14	4
Lack of project specific H&S plan	6.7	6.7	33.3	13.3	20.0	20.0	3.14	5

Table 6: Contributors to inadequate management of quality in construction

Practices / Situations	Response (%)							
		Minor……..……Major						
	Unsure	1	2	3	4	5	MS	Rank
Poor understanding of quality	0.0	0.0	0.0	6.7	53.3	40.0	4.33	1
Poor work procedures / methods	0.0	0.0	0.0	13.3	53.3	33.3	4.20	2
Poor project specifications	0.0	0.0	0.0	26.7	46.7	26.7	4.00	3
Poor exchange of project information	0.0	0.0	0.0	26.7	53.3	20.0	3.93	4
Poor project cost and schedule data	0.0	0.0	6.7	33.3	26.7	33.3	3.87	5

The MSs in Table 6, indicate that the respondents are of the opinion that identified practices can be deemed to contribute more of a major than a minor extent to inadequate management of quality in construction. Out of these practices, the respondents are of the opinion that poor understanding of quality, poor work procedures / methods, and poor project specification could contribute the most to project quality dilemma. Table 7 in turn indicates the effect of inadequate quality management. Given that the MSs are all above the midpoint of 3.00, the respondents can be deemed to agree more than disagree that client dissatisfaction, defects and rework, increased project duration and cost, high built asset maintenance cost, and injuries and fatalities could occur in South African construction due to lapses relative to the management of quality during project delivery. Arguably, the ranking of client dissatisfaction first, and defects and rework second, underscores recent CIDB CII research findings in South Africa (CIDB, 2008; 2009; 2010).

Table 7: Effects of inadequate management of quality in construction

Situations	Response (%)							
		Str. Disagree…….Str. Agree						
	Unsure	1	2	3	4	5	MS	Rank
Client dissatisfaction	0.0	6.7	6.7	0.0	26.7	60.0	4.27	1
Defects and rework	0.0	6.7	0.0	13.3	40.0	40.0	4.07	2
Increased project duration and cost	0.0	6.7	6.7	6.7	40.0	40.0	4.00	3
High built asset maintenance cost	0.0	0.0	20.0	26.7	40.0	13.3	3.47	4
Injuries and fatalities	0.0	13.3	26.7	20.0	20.0	20.0	3.07	5

Table 8: Contributors to inappropriate organisational culture in construction

Practices	Response (%)							
		Minor……Major						
	Unsure	1	2	3	4	5	MS	Rank
Lack of trust within project teams	0.0	0.0	0.0	40.0	13.3	46.7	4.07	1
Poor analysis of issues and their impact	0.0	0.0	13.3	6.7	46.7	33.3	4.00	2
Apathy toward idea generation and evaluation	0.0	0.0	6.7	33.3	26.7	33.3	3.87	3
Non-inclusive decision-making within project teams	0.0	0.0	0.0	46.7	26.7	26.7	3.80	4
Improper worker motivation and empowerment	0.0	0.0	6.7	46.7	20.0	26.7	3.67	5
Closed one-directional communication mediums	6.7	0.0	20.0	33.3	20.0	20.0	3.43	6

Table 9: Effects of inappropriate organisational culture in construction

Situation	Response (%)							
		Str. Disagree…….Str. Agree						
	Unsure	1	2	3	4	5	MS	Rank
Poor problem identification and resolution	0.0	0.0	0.0	26.7	53.3	20.0	3.93	1
Inadequate site relationship management	0.0	0.0	6.7	33.3	26.7	33.3	3.87	2
Poor harnessing of skills within project teams	0.0	0.0	6.7	33.3	53.3	6.7	3.60	3
Increased resistance to change	0.0	0.0	13.3	46.7	26.7	13.3	3.40	4
Organisational stagnation / failure	0.0	13.3	6.7	33.3	20.0	26.7	3.40	5
Customer / Client dissatisfaction	0.0	0.0	40.0	20.0	6.7	33.3	3.33	6
Poor handling of social issues associated with project	0.0	6.7	6.7	60.0	20.0	6.7	3.13	7
Employee dissatisfaction	0.0	13.3	20.0	20.0	33.3	13.3	3.13	8

Table 8 indicates that the respondents opine that a range of practices contribute to inappropriate organisational culture in South African construction. It is notable that of these practices, lack of trust within project teams, and poor analysis of issues and their impact are perceived to contribute the most to inappropriate organisational culture in South Africa. In brief, the respondents are of the opinion that apathy toward idea generation and evaluation, non-inclusive decision-making within project teams, improper worker motivation and empowerment, and closed one-directional communication could also contribute more of a major than a minor extent to the incidence of inappropriate organisational culture in South African construction.

Table 9 in turn indicates the effects of such inappropriate organisational culture. Given that all the MSs are > 3.00, the respondents can be deemed to agree as opposed to disagree that poor problem identification and resolution, inadequate site relationship management, poor harnessing of skills within project teams, increased resistance to change, organisational stagnation / failure, client dissatisfaction, poor handling of social issues associated with project, and employee dissatisfaction could occur due to inappropriate organisational culture in South African construction.

Table 10 indicates that the respondents perceive that unequal design expertise, change in personnel during the project duration, behavioural tendencies within project teams, and commitment to different project objectives can be deemed to contribute between some extent to a near major extent to the amount of poor multi-disciplinary interface between consultants in South African construction. In addition, though ranked fourth and fifth, the respondents are of the opinion that commitment to different project objectives, and paper based transmission of project information could also contribute to poor multi-disciplinary interface between consultants.

Table 10: Contributors to poor multi-disciplinary interface between consultants

Practice	Response (%)							
		Minor……Major						
	Unsure	1	2	3	4	5	MS	Rank
Unequal design expertise	15.4	0.0	0.0	15.4	53.8	15.4	4.00	1
Change in personnel during the project duration	0.0	0.0	7.7	23.1	53.8	15.4	3.77	2
Behavioural tendencies within project teams	0.0	0.0	0.0	38.5	46.2	15.4	3.77	3
Commitment to different project objectives	15.4	0.0	7.7	23.1	38.5	15.4	3.73	4
Paper transmission of project information	7.7	0.0	23.1	23.1	38.5	7.7	3.33	5

Table 11: Effects of poor multi-disciplinary interface between consultants

Practice	Response (%)							
		Str. Disagree……Str. Agree						
	Unsure	1	2	3	4	5	MS	Rank
Delay and rework on site	7.1	0.0	0.0	14.3	28.6	50.0	4.38	1
Unclear design and specification	7.1	0.0	0.0	14.3	28.6	50.0	4.38	2
Extensive revisions of design	7.1	0.0	0.0	14.3	28.6	50.0	4.38	3
Constant RFIs from site management	14.3	0.0	0.0	21.4	28.6	35.7	4.17	4
Costly design changes	14.3	0.0	7.1	14.3	28.6	35.7	4.08	5

Table 11 indicates the respondents' concurrence relative to the extent that delay and rework on site, unclear design and specification, and extensive revisions of design, constant RFIs from site management, and costly design changes could occur as a result of poor multi-disciplinary interface between consultants in South African construction. The nature of the three MSs > 4.20 ≤ 5.00 are notable, namely the link between design, delay and rework. In general, the findings indicate that the respondents agree as opposed to disagree that these practices could occur due to poor multi-disciplinary interface between consultants.

In terms of logistics related problems (Table 12), the respondents can be deemed to perceive that lack of site management competence, lack of formal training, poor site material flow management, poor work schedule control, poor material supply, storage, and handling, and poor infrastructure and equipment location contribute more of a major than a minor extent to the incidence of inadequate management of logistics in South Africa. The findings further reveal lack of site management competence relative to logistics is perceived to contribute the most, while poor site layout is perceived to contribute the least to inadequate management of logistics. In particular, with the exception of poor site layout, the respondents are of the opinion that other identified practices contribute, albeit at varying degrees, to inadequate management of construction logistics.

Table 12: Contributors to inadequate management of logistics in construction

Practices	Response (%)							
		Minor……Major						
	Unsure	1	2	3	4	5	MS	Rank
Lack of site management competence relative to logistics	0.0	0.0	0.0	15.4	23.1	61.5	4.46	1
Lack of formal training relative to logistics	0.0	0.0	7.7	15.4	46.2	30.8	4.00	2
Poor site material flow management	0.0	0.0	0.0	28.6	50.0	21.4	3.93	3
Poor work schedule control	0.0	0.0	0.0	28.6	57.1	14.3	3.86	4
Poor material supply, storage, and handling	0.0	7.1	14.3	28.6	21.4	28.6	3.50	5
Poor infrastructure and equipment location	0.0	0.0	7.1	42.9	42.9	7.1	3.50	6
Poor site layout	0.0	0.0	64.3	7.1	14.3	14.3	2.79	7

Table 13: Effects of inadequate management of logistics in construction

Situations	Response (%)							
		Str. Disagree……Str. Agree						
	Unsure	1	2	3	4	5	MS	Rank
Poor quality and time management	0.0	0.0	0.0	7.1	42.9	50.0	4.43	1
Added cost in the project	0.0	0.0	7.1	7.1	35.7	50.0	4.29	2
Under utilisation of construction vehicles	0.0	0.0	0.0	21.4	42.9	35.7	4.14	3
Material loss due to defects and theft	0.0	0.0	14.3	7.1	35.7	42.9	4.07	4
High level of construction waste on site	0.0	0.0	7.1	14.3	42.9	35.7	4.07	5
Added risks relative to H&S	0.0	0.0	14.3	35.7	21.4	28.6	3.64	6
Poor image of the industry in terms of climate change	21.4	0.0	14.3	35.7	7.1	21.4	3.45	7
Long material off-loading time on site	0.0	7.1	21.4	21.4	35.7	14.3	3.29	8

Furthermore, the respondents notice that a range of issues may eventuate due to inadequate management of logistics in construction as indicated in Table 13. Poor quality and time management, and added cost in the project, which are ranked first and second respectively on the table, are perceived to be the most likely effects of the failure to manage construction logistics properly in South African construction. Equally important is the respondents' perceptions that under utilisation of construction vehicles, material loss due to defects and theft, and high level of construction waste on site could eventuate due to poor construction logistics practices. To be succinct, the respondents are in agreement that added risks relative to H&S, poor image of the industry in terms of climate change, and long material off-loading time on site could

manifest as a result of inadequate management of logistics in South African construction.

Therefore these findings suggest that in order to satisfy clients and other project stakeholders, contractors need to improve their overall performance measured in terms of cost, quality, time, and other considerations as postulated by Xiao and Proverbs (2003).

CONCLUSIONS

Clearly, major contributing issues to project performance impediments such as poor understanding of quality, lack of site management competence relative to logistics, unequal design expertise, lack of trust within project teams, H&S competence of project participants, and poor allocation of resources to knowledge capture identifiable through the study should be addressed in order to avoid the occurrence of a range of situations that can marginalise the realisation of project objectives.

In this context, situations such as poor quality and time management and added cost in the project, client dissatisfaction, rework and defects, and poor response to organisational and project changes that could engender poor performance should be prevented from occurring during project delivery in South African construction. Furthermore, based on the fact that the majority of the variables relative to issues contributing to performance impediment identified in this empirical survey achieved MSs above the midpoint score of 3.00, issues associated with inadequate capture and transfer of knowledge, inappropriate organisational culture, poor management of site logistics, unacceptable coordination of H&S, inadequate management of quality, and poor management of multi-disciplinary interface between consultants can be deemed to deserve the attention of all project stakeholders concerned with project performance improvement in South Africa. Therefore, in order to improve project delivery in South African construction, embracing perspectives and / or interventions such as optimum H&S practices, quality management practices, logistics management practices, and organisational culture are arguable a way forward for project stakeholders especially contractors.

However, given the limited nature of the sample size and response rate that provided the basis for the findings presented in this paper, it is important to note that the paper is more insightful as opposed to definitive in terms of project performance issues in South African construction. In other words, a larger sample size and a higher response rate in a future research may provide more reliable and definite findings.

REFERENCES

Butcher, D.C.A. and Sheehan, M.J. (2010), "Excellent contractor performance in the UK construction industry", *Engineering, Construction and Architectural Management*, **17**(1), 35-45.

Construction Industry Development Board, (2008), *The CIDB construction industry indicators summary results 2007*, Construction Industry Development Board (CIDB), Pretoria, South Africa.

Construction Industry Development Board, (2009), *The CIDB construction industry indicators summary results 2008*, Construction Industry Development Board (CIDB), Pretoria, South Africa.

Construction Industry Development Board, (2010), *The CIDB construction industry indicators summary results 2009*, Construction Industry Development Board (CIDB), Pretoria, South Africa.

Dlungwana, S., Nxumalo, X.H., van Huysteen, S., Rwelamila, P.D. and Noyana, C. (2002), "Development and implementation of the South African construction excellence model", in *1st International Conference on Construction in the 21st Century (CITC2002)-Challenges and opportunities in Management and Technology*, 25-26 April 2002, CITC, Miami, USA, 8-15.

Smallwood, J. J. (2002), "Performance improvement in South African construction", in *Annual proceedings of the RICS Foundation construction and building research conference*, 5-6 September 2002, RICS, Nottingham Trent University, UK, 1-12.

Smallwood, J. J. (2000), *A study of the relationship between occupational H&S, labour productivity and quality in the South African construction industry*, Unpublished PhD Thesis, Department of Construction Management, University of Port Elizabeth, South Africa.

Soetanto, R., Proverbs, D.G. and Holt, G.D. (2001), "Achieving quality construction projects based on harmonious working relationships: clients' and architects' perceptions of contractor performance", *International Journal of Quality & Reliability Management*, **18**(5), 528-548.

Xiao, H. and Proverbs, D. (2003), "Factors influencing contractor performance: an international investigation", *Engineering, Construction and Architectural Management*, **10**(5), 322-332.

Xiao, H. and Holt, G.D. (2002), "The performance of contractors in Japan, the UK and the USA: An evaluation of construction quality", *International Journal of Quality & Reliability Management*, **19**(6), 672-687.