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Kommunikasie-volwassenheidsmodel vir die meting van bourekenkundige kommunikasie en kommunikasie-instrumente

Peer reviewed

Abstrak

Alhoewel die bourekenaar reeds vir 'n eeu aanspraak op die konstruksiebedryf maak, bestaan daar steeds 'n behoefte aan verdere wetenskaplike analises met betrekking tot die bourekenaar se kommunikasievermoë en kommunikasie-instrumente wat in die bedryf beskikbaar gestel word. As gevolg van die funksie wat die bourekenaar verrig, word daar van die professionele verdrag om op die voorgrond van huidige tegnologie van kommunikasie en kommunikasie-instrumente te wees.

Die doel van hierdie artikel is om die determinante van 'n kommunikasie-volwassenheidsmodel ten opsigte van die kommunikasievermoë van die bourekenaar te bepaal. Die voorgestelde belangrikste determinante wat gebruik word, vloei voort uit navorsing oor volwassenheidsmodelle en projekbestuur wat deur die Universiteit van die Vrystaat in samewerking met die Wirtschafte University in Vienna, Oostenryk in 2005/6 gedoen is; die finale resultate is in 2008 bekend gemaak.

Die resultate van die tussentydse ondersoek na determinante van kommunikasie-volwassenheid was positief ten opsigte van die bourekenaar se kommunikasie oor die algemeen en kan derhalwe 'n positiewe invloed op die konstruksiebedryf hê met deurlopende voordele vir die eiendoms-ontwikkelingsomgewing.

Die resultate van dié ondersoek dui daarop dat die mondelinge, skriftelike en kontraktuele kommunikasievermoë van die bourekenaar positief ervaar word. Kontraktuele geldigheid as 'n element van die kontraktuele kommunikasievermoë van die bourekenaar word mees positief aangedui. Die respondente dui die instrumente 'beraming' en 'eindrekening' as die belangrikste kommunikasie-instrumente aan. Die duidelikheid en verstaanbaarheid van die instrumente 'eindrekening' en 'betalingsadvies' word met die hoogste waarderingsuitslag aangedui.

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'n Model wat die belangrikste determinante vir effektiewe kommunikasie identifiseer, word voorgestel. Die model kan gebruik word om die volwassenheid van bourekenkundige kommunikasie en kommunikasie-instrumente in die konstruksiebedryf te meet.

Slutelwoorde: Kommunikasie-instrumente, kommunikasie-volwassenheidsmodel, kommunikasievermoë, bourekenaar

Abstract

Although quantity surveyors lay their claim to the construction industry for over a century there still exists a need for further scientific analyses with reference to the quantity surveyor's communication capabilities and communication instruments as presented in the industry.

This article aims to establish the determinants of a communication maturity model with respect to the communication capabilities of the quantity surveyor. The proposed most important determinants used were disclosed through research on maturity models and project management undertaken by the University of the Free State in collaboration with the Wirtschafts University in Vienna, Austria in 2005/6; the final results were issued in 2008.

The results of the provisional survey with regards to the determinants of communication maturity show that respondents were positive with respect to the quantity surveyor's communication in general. This can therefore have a positive influence on the construction industry with continuous advantages for the property development environment.

The survey results also indicate that the verbal, written and contractual communication capabilities of the quantity surveyor are experienced positively. 'Contractual validity' as an element of the contractual communication capability of the quantity surveyor was indicated as the most positive element. The respondents indicated that the instruments of 'estimation' and 'final accounting' are the most important communication instruments. Furthermore, the respondents' assessments regarding clarity and understandability of the instruments 'final accounts' and 'payment advices' were rated the highest.

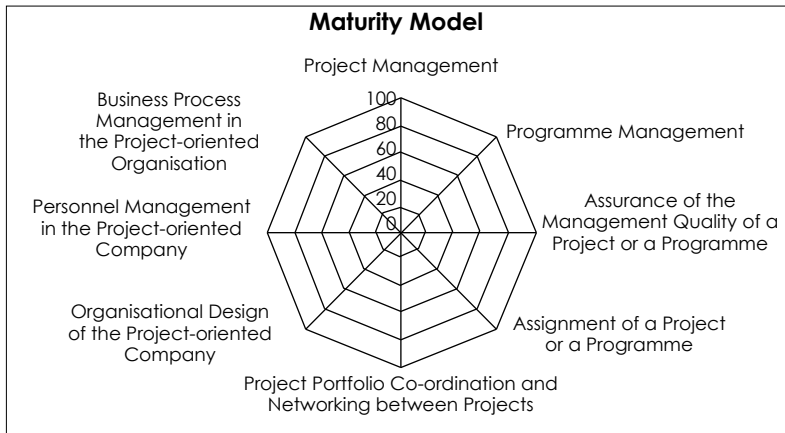
A model with the most important determinants identified for effective communication has been proposed. The model can be used by quantity surveyors to measure the maturity of quantity surveying communication and communication instruments in the construction industry.

Keywords: Communication instruments, communication maturity model, communication capabilities, quantity surveyor

1. Inleiding

Volgens Gasse (2006: Internet) streef nasies, streke, industrieë en maatskappye daarna om meer projekgeoriënteerd te wees. Deur gebruik te maak van projekbestuurstechnieke in die organisering van projekte en programme bied die projekgeoriënteerde sisteme 'n kompeterende voorsprong. Daar is 'n korrelasie tussen die gebruik van projekgeoriënteerde sisteme in projekte en programme, en die bereiking van projekbestuursvolwassenheid binne sulke projekte en programme.

Die projekbestuursvolwassenheid van projekgeoriënteerde maatskappye en nasies kan gemeet word deur die toepassing van volwassenheidsmodelle en kan met die norm wat daarvoor geld, vergelyk word (Garies, 2005: 584).



Figuur 1: Volwassenheidsmodel vir 'n projekgeoriënteerde maatskappy
Bron: Garies, 2005: 516

Figuur 1 verteenwoordig die determinante van 'n volwassenheidsmodel vir 'n projekgeoriënteerde organisasie. Die determinante verteenwoordig elemente waarvolgens volwassenheid gemeet word deur 'n sekere gewig daaraan te koppel om die belangrikheid van elk aan te dui.

Bogemelde volwassenheidsmodel vir projekbestuur is gebruik om die volwassenheid van ander sisteme soos byvoorbeeld bourekenkundige kommunikasie te meet en die toepasbaarheid daarvan op sodanige sisteem te illustreer.

2. Navorsingsmetodiek

Die effektiwiteit van die bourekenaar se kommunikasie asook die gaping in die huidige kommunikasieprosesse word ondersoek en die areas waar verbetering in kommunikasie nodig is of aanbeveel word volgens die respondente se opinie word hiermee ook vasgestel.

Die ondersoek is in 2006 gedoen met die doel om vas te stel wat die posisie van bourekenkundige kommunikasie op daardie stadium in die konstruksiebedryf was. Die vraelyste is aan 22 (twee-en-twintig) prominente professionele persone gegee wat onder andere

12 (twaalf) bourekenaars, 6 (ses) ingenieurs, 2 (twee) argitekke en 2 (twee) konstruksiebestuurders verteenwoordig. Hierdie navorsingsprojek was 'n verkennende ondersoek waar onderhoude met die respondente gevoer is met die versoek om terugvoer te gee op die vraelys ten opsigte van effektiewe kommunikasie en kommunikasie-instrumente van bourekenaars in die konstruksiebedryf. Al 22 (twee-en-twintig) uitgesoekte professionele persone het die vraelys voltooi, wat 'n responssyfer van 100% verteenwoordig. 'n Verdere ondersoek word beplan om sodoende die steekproef meer omvattend en verteenwoordigend te maak en om ook onder andere kliënte, ontwikkelaars en moontlike ander relevante persone in die konstruksiebedryf in te sluit.

Die data is geanaliseer deur gebruik te maak van 'n Excel-rekenaarprogram se sigblad-opsie met standaard statistiese verwerking. Die resultate hiervolgens verkry en wat in die bespreking gebruik word, verwys telkens na die geweegde gemiddeldes van die verwerkte data. Die invloed wat die groter getalle van die bourekenaars op die data het, versteur nie die data nie. Indien die geweegde gemiddeld van net die bourekenkundige groep derhalwe vergelyk word met die geweegde gemiddeld van die totale groep is die resultaat bykans dieselfde. Die beperking van die ondersoek is dat dit gerig is om tendense waar te neem eerder as om klein afwykings in die geweegde gemiddeldes aan te spreek. Verdere navorsing word hiermee gesuggereer.

Die waarde van die vraelys se skaal van meting wissel van 'laag' = 1 na 'hoog' = 5.

3. Bevindinge

3.1 Die kommunikasievermoë van die bourekenaar

Tabel 1 toon respondente se evaluering van die kommunikasie- en begripsvermoë van die professionele bourekenaar in privaatpraktyk in die konstruksiebedryf teenoor dié van ander professionele konsultant op dieselfde vlak.

Tabel 1: Kommunikasievermoë van professies

<i>Respondente: Totale groep Kommunikasievermoë</i>	<i>Geweegde gemiddeld Bourekenaars</i>	<i>Geweegde gemiddeld Professionele konsultante</i>
Mondelinge kommunikasie	4,35	4,25
Skriftelike kommunikasie	4,48	4,33
Kontraktuele kommunikasie	4,43	4,15

Die respondente het al die professionele konsultante se mondelinge, skriftelike en kontraktuele kommunikasievermoëns van goed tot baie goed ervaar. Dit is egter belangrik om daarop te let dat die bourekenaar se kontraktuele kommunikasievermoë noemenswaardig hoër as dié van die professionele konsultant op dieselfde vlak beoordeel word (Berry, 2007).

3.2 Belangrike elemente in effektiewe mondelinge kommunikasie in die konstruksiebedryf

Ten einde gesonde kommunikasie te verwesentlik, is dit belangrik dat die verskillende beginsels wat dit rig, bestudeer moet word. Die uniekheid van die mens het baie te doen met taalkommunikasie, maar dit is nie al nie, want die mens kommunikeer ook deur voorkoms, gedrag, houding en persoonlikheid (Sieff, 1990: 38-39).

Hiermee saam is taalkundige vermoë ook 'n baie belangrike element om effektiewe uitdrukking aan kennis te gee. Dit is nodig om elke woord reg in te span en die boodskap eenvoudig, verstaanbaar en logies oor te dra. Indien 'n taal nie bemeester is nie, kan die kennis waaroor 'n mens beskik ten opsigte van 'n spesifieke vakgebied en/of aangeleentheid nie die nodige impak hê op die toehoorder daarvan nie (Himstreet & Baty, 1973: 13-14).

Die bourekenaar se mondelinge kommunikasie vind hoofsaaklik in terrein- en konsultantevergaderings plaas.

Tabel 2: Elemente vir mondelinge kommunikasie

<i>Respondente: Totale groep</i>	
<i>Elemente</i>	<i>Geweegde gemiddeld</i>
Integriteit	4,52
Geloofwaardigheid	4,30
Kennis	4,20
Selfvertroue	4,05
Oorredingsvermoë	4,00
Taalvermoë	3,90
Voorkoms	3,89
Algemene indruk	3,75
Dinamiese/uitgaande gedrag	3,63

Die bourekenaar het in alle aspekte van effektiewe mondelinge kommunikasie 'n hoë beoordeling behaal. Dinamiese/uitgaande gedrag is die mins positiewe (3.63) beoordeel, terwyl integriteit (4,52) en geloofwaardigheid (4,30) die hoogste geag is. Die hoë waarderingsuitslag van integriteit en geloofwaardigheid kan baie

positief vir die konstruksiebedryf wees aangesien dit waarskynlik daarop dui dat die bourekenaar hoë etiese waardes handhaaf (Berry, 2007).

3.3 Belangrike elemente in effektiewe skriftelike kommunikasie in die konstruksiebedryf

'n Vorige studie deur Bowen, Cattell, Michell & Kabayanondo (2006: 26) het ook bevind dat die afwesigheid van skriftelike kommunikasie die verstaan van gegewe inligting negatief beïnvloed. Die studie het ook verder bevind dat die bourekenaar die belangrikheid van skriftelike kommunikasie in die konstruksieproses verstaan.

Die notule van 'n terreinvergadering is 'n belangrike skriftelike kommunikasiemedium in die konstruksiebedryf en voorsien gewoonlik belangrike ondersteunde inligting ten opsigte van besluite wat op vorige vergaderings geneem is. Die betrokke partye wat nie die notule opgestel het nie moet derhalwe seker maak van die akkuraatheid daarvan en of enige teenstrydighede daarin bestaan, sodat die regstellings op skrif in die daaropvolgende notule opgeneem kan word (Chappel, Powell-Smith & Sims, 2006: 153).

Die bourekenaar se skriftelike kommunikasie vind hoofsaaklik in beramings, kosteplan, betalingsadvies en briefwisseling plaas.

Tabel 3: Elemente vir skriftelike kommunikasie

<i>Respondente: Totale groep</i>	
<i>Elemente</i>	<i>Geweegde gemiddeld</i>
Kwaliteit	4,36 =
Professionaliteit	4,36 =
Stiptelikheid	4,32
Netheid	4,10
Taalgebruik	4,05
Algemene indruk	4,00
Doel- en opdraggerigheid	3,95
Wetenskaplikheid	3,77

Die respondente het die bourekenaar deurgaans met 'n hoë waarderingsuitslag in skriftelike kommunikasie beoordeel met die elemente professionaliteit, stiptelikheid en kwaliteit wat die beste gevaar het en wetenskaplikheid wat die mins positiewe beoordeel is (Berry, 2007).

3.4 Belangrike elemente in effektiewe kontraktuele kommunikasie in die konstruksiebedryf

Die hoeveelheidslysdokument as kommunikasie-instrument het in die Verenigde Koninkryken elders as verkrygingsdokument in belangrikheid toegeneem. Die suksesvolle kontrakteur se hoeveelheidslys word die instrument wat as basis vir die finansiële administrasie van die projek gebruik word. Hierdie dokument vorm die basis om tenders te selekteer, dit bevat die verbintenis tot pryse en word vir die bestuur van die kontrak gebruik (Kirkham, 2007: 124-125).

Die bourekenaar as koste-adviseur het die nodige kennis van konstruksie-ekonomie deur opleiding en ervaring in die konstruksiebedryf ontwikkel. Verder beskik die bourekenaar oor die vermoë om koste-advies te gee, omvang van projekte met die nodige spesifikasies te bepaal, begrotings op te stel en kontrakverkrygingsmetodes aan te beveel. Die bourekenaar stel ook die belangrike kontrakdokument, naamlik die hoeveelheidslys, wat vir tenderdoeleindes in die konstruksiebedryf gebruik word op (Hauptfleisch & Siglè, 2002: 44-45).

Die gesonde kennis van kontraktuele kommunikasie skep 'n uitstekende grondslag om die misinterpretasie van kommunikasie in die konstruksiebedryf tot 'n minimum te beperk (Berry, 2007).

Die hoeveelheidslyste-dokument is dié dokument wat hoofsaaklik deur die bourekenaar gebruik word as 'n effektiewe kommunikasie-instrument.

Tabel 4: Elemente vir kontraktuele kommunikasie

<i>Respondente: Totale groep</i>	
<i>Elemente</i>	<i>Geweegde gemiddeld</i>
Kontraktuele geldigheid	4,41
Betroubaarheid	4,32 =
Ondubbelsinnigheid	4,32 =
Effektiwiteit	4,23
Billikheid	4,05
Onteenstrydigheid	3,62

Die respondente het die bourekenaar se kontraktuele kommunikasievermoë as uitstekend beoordeel, waar onteensrydigheid die mins positiewe en kontraktuele geldigheid as die mees positiewe gevaar het (Berry, 2007).

3.5 Die belangrikheid van die kommunikasie-instrumente wat die bourekenaar vir projekte gebruik

Volgens Ashworth (1992: 210) word die bourekenaar wyd erken as die mees toepaslike persoon om koste-advies in die konstruksiebedryf te gee en hul bekwaamheid in die opname van meetwerk en waardering van konstruksiewerk word nie geëwenaar nie. Verder is dit belangrik dat realistiese koste-advies gegee word aangesien dit bydra tot die totale sukses van 'n projek.

Die kommunikasie-instrumente wat in Tabel 5 getoon word, is instrumente wat deur die bourekenaars self opgestel word en moet dus die verantwoordelikheid daarvoor aanvaar.

Tabel 5: Belangrikheid van kommunikasie-instrumente

<i>Respondente: Totale groep</i>	
<i>Kommunikasie-instrumente</i>	<i>Gewegde gemiddeld</i>
Beraming	4,71
Eindrekening/Finale rekening	4,70
Kosteverslae	4,60
Kosteplan	4,26
Betalingsadvies	4,21
Eskalasierekeningvoorstelling	4,06

Die belangrikheid van beraming, eindrekening/finale rekening en kosteverslae as kommunikasie-instrumente is besonder positief ervaar (Berry, 2007).

Die kommunikasie-instrumente wat in Tabel 6 getoon word, is instrumente wat deur die bourekenkunde professioneel opgestel word en moet dus die verantwoordelikheid daarvoor aanvaar.

Tabel 6: Belangrikheid van kommunikasie-instrumente

<i>Respondente: Totale groep</i>	
<i>Kommunikasie-instrumente</i>	<i>Gewegde gemiddeld</i>
Kontrakvoorwaardesdokument	4,47
Standaardselseldokument	4,00 =
Vorbereidingsdokument	4,00 =
Vakvoorskrifedokument	3,61

Die belangrikheid van die kontrakvoorwaardesdokument as kommunikasie-instrument is besonder positief ervaar (Berry, 2007).

Die belangrikheid van die standaardstelsel-, voorbereidsels- en vakvoorskrifte-dokumente was steeds hoog aangedui maar tog deur die respondente as die minder belangrike kommunikasie-instrumente beoordeel (Berry, 2007).

3.6 Die duidelikheid en verstaanbaarheid van kommunikasie-instrumente wat die bourekenaar normaalweg by projekte gebruik

Die kommunikasie-instrumente wat in Tabel 7 getoon word, is instrumente wat deur die bourekenaars self opgestel word en moet dus die verantwoordelikheid daarvoor aanvaar.

Tabel 7: Duidelikheid en verstaanbaarheid van kommunikasie-instrumente

<i>Respondente: Totale groep</i>	
<i>Kommunikasie-instrumente</i>	<i>Geweegde gemiddeld</i>
Eindrekening/Finale rekening	4,20
Betalingsadvies	4,19
Beraming	4,14
Kosteverslae	3,95
Eskalasierekeningvoorlegging	3,81
Kosteplan	3,70

Die eindrekening/finale rekening en die betalingsadvies se duidelikheid en verstaanbaarheid is deur die respondente hoog beoordeel wat positief vir die konstruksiebedryf is, aangesien die rolspelers tevrede blyk te wees met die auditproses van die bourekenaar om die geldsake goed te bestuur en tot tevredeheid af te handel (Berry, 2008: 45).

Die kosteplan is redelik hoog aangeslaan, maar is tog deur die respondente, relatief tot die ander kommunikasie-instrumente, as minder duidelik en verstaanbaar uitgewys (Berry, 2007). Dit dui moontlik daarop dat praktisyns die kosteplan as instrument duideliker kan voorstel.

Die kommunikasie-instrumente wat in Tabel 8 getoon word, is instrumente wat deur die bourekenkunde professioneel opgestel word en moet dus die verantwoordelikheid daarvoor aanvaar.

Tabel 8: Duidelikheid en verstaanbaarheid van kommunikasie-instrumente

<i>Respondente: Totale groep</i>	
<i>Kommunikasie-instrumente</i>	<i>Gewegde gemiddeld</i>
Vorbereidseldokument	4,11
Kontrakvoorwaardesdokument	3,95
Standaardstelseldokument	3,89
Vakvoorskrifedokument	3,79

Die voorbereidseldokument se duidelikheid en verstaanbaarheid is deur die respondente redelik hoog beoordeel (Berry, 2008: 45).

Die vakvoorskrifedokument is redelik hoog aangeslaan, maar is tog deur die respondente, relatief tot die ander kommunikasie-instrumente, as minder duidelik en verstaanbaar uitgewys (Berry, 2007).

3.7 Die vermoë van die bourekenaar om 'n leidende rol in die uitvoering van projekte te speel

Die aanhaling van Bennis & Nanus (1985: 21) wys op die belangrikheid van leierskap en is eweneens van toepassing op die bourekenaar:

The problem with many organisations, and especially the ones that are failing, is that they tend to be overmanaged and underled. There is a profound difference between management and leadership, and both are important. Managers are people who do things right and leaders are people who do the right things.

Tabel 9: Vermoë om leidende rol in projekte te speel

<i>Respondente: Totale groep</i>	
<i>Professies</i>	<i>Gewegde gemiddeld</i>
Bourekenaar	3,76

Respondente het 'n redelike hoë waarderingsuitslag van die bourekenaars se leierskapsrol. Dit bevestig dat die bourekenaar nie net oor die vermoë beskik nie, maar moontlik ook 'n belangrike skakel in die konstruksieproses is (Berry, 2008: 46).

3.8 Die geskiktheid van die professies om as projekbestuurders op te tree

Emmitt & Gorse (2003: 10) is van mening dat die kommunikasieproses en die tydige oordra van inligting die sleutel tot effektiewe koördinerings- en die beheer van projekte is.

Vir 'n projekbestuurder om effektief en suksesvol te wees, is die bewys van effektiewe administratiewe en tegniese vaardighede nie alleen genoegsaam nie. Daar moet ook 'n aanvaarbare styl van leierskap beoefen word. Die leierskapstyl wat gebruik word, kan 'n invloed hê op die werkers se moraal en produktiwiteit, sodat die sukses van 'n projek direk afhanklik is van leierskap. Die Assosiasie van Projekbestuurders beskryf leierskap as volg:

leadership is about setting goals and objectives and generating enthusiasm and motivation amongst the project team, and stakeholders, to work towards those objectives (Burke, 2003: 309).

Tabel 10: Geskiktheid van professies om as projekbestuurders op te tree

Respondente: Totale groep	
Professies	Geweegde gemiddeld
Bourekenaar	4,06
Argitek	3,41
Strukturele ingenieur	3,12
Elektriese ingenieur	2,44
Siviele ingenieur	3,24
Professionele projekbestuurder	4,35

Die geskiktheid van die bourekenaar om as projekbestuurder van projekte op te tree, word meer positief aangedui as die ander professionele konsultante wat beoordeel is, maar minder positief as dié van die professionele projekbestuurder aangedui (Berry, 2008: 47).

3.9 Die effektiwiteit van die professies ten opsigte van tyd gedurende die dokumentasietydperk

Tabel 11: Effektiwiteit van tydspanning gedurende die dokumentasietydperk

Respondente: Totale groep	
Professies	Geweegde gemiddeld
Bourekenaar	4,41
Argitek	3,41
Ingenieur	3,59
Professionele projekbestuurder	3,69

'n Afleiding wat uit bogemelde resultaat van respondente se opinie gemaak kan word, is dat die professies redelik goed ten opsigte van tydspanning gedurende die dokumentasietydperk aangepas het, alhoewel dit blyk dat die bourekenaar die mees effektiewe is

wanneer dit by kontrakdokumentasie-produksie kom. Die gebruik van voorlopige hoeveelhedslyste kan waarskynlik 'n rol in dié verband speel, aangesien die bourekenaar nie volledige werkstekeninge op daardie stadium benodig nie en dus die kontrakdokumentasie vinnig kan produseer (Berry, 2008; 48).

3.10 Die effektiwiteit van die professies ten opsigte van aanpassing by tegnologiese vooruitgang

Tabel 12: Effektiewe aanpassing by tegnologiese vooruitgang

<i>Respondente: Totale groep</i>	
<i>Professies</i>	<i>Geweegde gemiddeld</i>
Bourekenaar	4,26
Argitek	3,89
Ingenieur	4,00
Professionele projekbestuurder	3,73

'n Afleiding wat uit Tabel 12 van respondente se opinie gemaak kan word, is dat die professies redelik goed vaar ten opsigte van aanpassing by tegnologiese vooruitgang, alhoewel die argitek minder positief as die bourekenaars en ingenieurs beoordeel word (Berry, 2008: 49).

Die respondente was die positiefste rondom die bourekenaar se effektiwiteit van aanpassing by tegnologiese vooruitgang en het die hoogste waarderinguitslag toegeken (Berry, 2008: 49).

4. Determinante in die ontwikkeling van 'n volwassenheidsmodel ten opsigte van die kommunikasievermoë van die bourekenaar

Die beskikbaarheid van ondersteunende standaarddokumentasie as belangrike kommunikasie-instrumente, waarvan die kontrakvoorwaardes-, standaardstelsel-, voorbereidings- en vakvoorskrifte-dokumente sprekende voorbeelde is, is waarskynlik 'n besondere hulpmiddel in die hand van die bourekenaar vir kommunikasie in die konstruksiebedryf. **Ondersteunende dokumentasievermoë** word as 'n determinant vir die model van die kommunikasievermoë van die bourekenaar gereken (Berry, 2008: 124).

Die effektiewe gebruik van die belangrikste elemente wat vir die bourekenaar nodig is ten einde effektiewe kontraktuele kommunikasie te handhaaf, word onder andere omskryf deur kontraktuele geldigheid, billikheid, betroubaarheid, effektiwiteit, ondubbelsinnigheid en onteensydigheid. Dit is onwaarskynlik dat elke persoon ewe

positief ervaar word. **Kontraktuele kommunikasievermoë** word as 'n determinant vir die model van die kommunikasievermoë van die bourekenaar gereken (Berry, 2008: 123).

Die belangrikste elemente benodig deur 'n bourekenaar vir effektiewe skriftelike kommunikasie in die konstruksiebedryf word beskryf deur onder andere netheid, kwaliteit, professionaliteit, algemene indruk, doel- en opdraggerigheid, wetenskaplikheid, stiptelikheid en taalgebruik. Verskillende persone sal waarskynlik verskillend hiervoor geëvalueer word. **Skriftelike kommunikasievermoë** word as 'n determinant vir die model van die kommunikasievermoë van die bourekenaar gereken (Berry, 2008: 122).

Die mate van tegnologiese vordering word beliggaam in die vinnige en effektiewe aanpassing ten opsigte van die tegnologiese vooruitgang in 'n snel veranderende wêreld deur effektief in die konstruksiebedryf te kommunikeer. **Tegnologiese vermoë** word as 'n determinant vir die model van die kommunikasievermoë van die bourekenaar gereken (Berry, 2008: 127).

Kennis wat normaalweg met kwalifikasie gepaard gaan, word in verskeie belangrike elemente ten einde effektiewe mondelinge, skriftelike en kontraktuele kommunikasie te handhaaf, gevind en word onder andere omskryf in kennis, wetenskaplikheid en kontraktuele geldigheid. Dit is onwaarskynlik dat elke persoon ewe positief ervaar sal word. **Kennisvermoë** word as 'n determinant vir die model van die kommunikasievermoë van die bourekenaar gereken (Berry, 2008: 125).

Die belangrikste elemente benodig deur 'n bourekenaar vir effektiewe mondelinge kommunikasie in die konstruksiebedryf word beskryf deur onder andere integriteit, kennis, geloofwaardigheid, selfvertroue, ooredingsvermoë, algemene indruk, voorkoms, taalvermoë en dinamiese/uitgaande gedrag. Meeste individue sal hiervoor waarskynlik in 'n mindere of meerdere mate verskillend geëvalueer word. **Mondelinge kommunikasievermoë** word as 'n determinant vir die model van die kommunikasievermoë van die bourekenaar gereken (Berry, 2008: 120).

Kommunikasie-instrumente wat die bourekenaar normaalweg vir projekte gebruik, is onder andere betalingsadvies, eindrekening/finale rekening, beramings, kosteverslae en dies meer. Die effektiwiteit van 'n bourekenaar se duidelike en verstaanbare gebruik hiervan, kan gemeet en geëvalueer word. Kommunikasie-

instrumentevermoë (duidelikheid) word as 'n determinant vir die model van die kommunikasievermoë van die bourekenaar gereken (Berry, 2008: 128).

Leierskap word beliggaam in verskeie elemente om effektiewe mondelinge, skriftelike en kontraktuele kommunikasie te help verseker. Kennis, taalvermoë, geloofwaardigheid, ooredingsvermoë en selfvertroue is onder andere sprekende voorbeelde hiervan. 'n Bourekenaar se effektiwiteit hier kan gemeet en geëvalueer word.

Leierskapvermoë word as 'n determinant in die model van die kommunikasievermoë van die bourekenaar bepaal (Berry, 2008: 119).

Die resultaat wat voortspruit uit die 2006-studie ten opsigte van die agt determinante word in Tabel 13 uiteengesit. Dit weerspieël die geweege gemiddeld van die totale groep se opinie ten opsigte van die volwassenheid van die kommunikasievermoë van die bourekenaar. Die gemelde agt determinante is alternatiewelik antiklosgewys op die kommunikasie-volwassenheidsmodel in (Figuur 2), beginnend by ondersteunende dokumentasievermoë wat die twaalfuurposisie volgens die nommering van 'n horlosie verteenwoordig tot en met leierskapvermoë wat ongeveer die eenuurposisie inneem.

Volgens Berry (2008: 133) is die rede vir die antiklosgewysposisie gebaseer op die vraelyste wat in 1995 uitgestuur is en die resultate wat daarvolgens in 2008 gepubliseer is. Dié determinante is volgens die 1995-resultate onderskeidelik in dalende orde vanaf die hoogste tot die laagste waarderingsuitslag by die nommering van 'n horlosie aangepas; die hoogste waarderingsuitslag is dus teenoor die twaalfuurposisie en die laagste waarderingsuitslag teenoor ongeveer die eenuurposisie op die kommunikasie-volwassenheidsmodel geplaas.

Tabel 13: Kommunikasievermoë van die bourekenaar

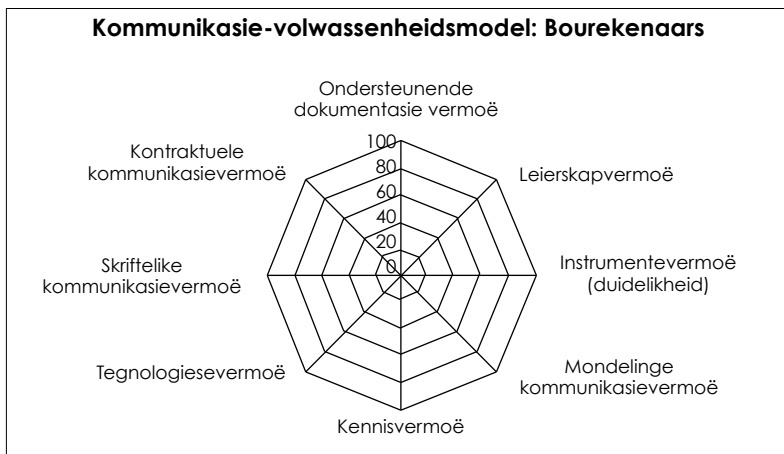
<i>Determinante</i>	<i>Geweege gemiddeld: Totale groep</i>
Ondersteunende dokumentasievermoë	4,26
Kontraktuele kommunikasievermoë	4,43
Skriftelike kommunikasievermoë	4,48
Tegnologiese vermoë	4,34
Kennisvermoë	4,13
Mondelinge kommunikasievermoë	4,35
Instrumentevermoë (duidelikheid)	3,98
Leierskapvermoë	3,91

Bron: Berry, 2008: 131

5. Determinante wat 'n direkte invloed op die bourekenaar se kommunikasievermoë het

Dit word voorgestel dat gemelde determinante (kyk Tabel 13) die kern vorm van die kommunikasie-volwassenheidsmodel, om die kommunikasievermoë van die bourekenaar te bepaal (Berry, 2008: 145).

5.1 Voorstelling van 'n kommunikasie-volwassenheidsmodel ten opsigte van die kommunikasievermoë van die bourekenaar



Figuur 2: Kommunikasie-volwassenheidsmodel vir bourekenaars
Bron: Aangepas uit Garies, 2005: 516

Bogemelde kommunikasie-volwassenheidsmodel ten opsigte van die kommunikasievermoë van die bourekenaar word voorgestel om die ontwikkeling van die totale profesie te ondersteun en sodoende 'n verdere bydrae tot effektiewe kommunikasie en gesonde verhoudinge binne die konstruksiebedryf te lewer (Berry, 2008: 146).

6. Slotbeskouing en toekomsvisie

Die belangrikheid van gesonde kommunikasie binne die konstruksiebedryf kan nie genoeg beklemtoon word nie en die impak wat die bourekenaar in hierdie veld uitoefen, moet deurtlopend aangespreek en verder ontwikkel word.

Die bourekenaar beskik oor die kommunikasievermoë en die kommunikasie-instrumente om 'n leidende rol in die konstruksiebedryf te speel, maar moet deurlopend aandag gee aan die ontwikkelingsareas wat uitgewys is.

Die visie van die bourekenaarsprofessie behoort gerig te wees om kwaliteit leiers vir die toekoms te lewer met die nodige vaardighede en kennisvermoë wat die bedryf in alle moontlike fasette kan oorheers. Die bourekenaar beskik oor die noodsaaklike mengsel van kennis en vaardighede om die projekbestuursfunksies met welslae te hanteer en hierdie geleenthede in konstruksiebedryf derhalwe verder te ontgin.

Die voorgestelde kommunikasie-volwassenheidsmodel wat die bourekenaar se kommunikasievermoë aandui, kan as 'n moontlike barometer dien om die leemtes in die kommunikasievermoëns van bourekenaars uit te wys. Met die effektiewe aanspreek daarvan kan die professie in geheel daarby baat.

Die fokus van die bourekenaarsprofessie behoort gerig te wees om die aansien van die professie binne die konstruksiebedryf dinamies te ontwikkel en verder uit te bou. Sodoende kan die status wat die professie tans in die kommunikasieproses beklee, verseker en uitgebou word.

Die uitdagings gaan eise stel, maar die voordele en moontlikhede is onbeperk. Indien die bourekenaarsprofessie hierdie uitdagings aanvaar en verder ontgin, wag daar 'n nog beter toekoms op hierdie professie.

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The perceived economic impact of the City of Johannesburg's storm water attenuation policy on private property developers

Peer reviewed

Abstract

Over recent years storm water attenuation policy has become a contentious issue for the property development community, both locally and internationally. Increased urbanisation has forced municipal authorities to reconsider the role of storm water management in an evolving urban landscape. It is within this context that the legislative support and municipal policy for storm water management in the City of Johannesburg (CoJ) has been considered, with direct regard to the perceived economic impact of storm water policy on private property developers. Factors considered included the cost, risk, and time factors of policy compliance within the development process.

Research of international policy implementation issues in countries with well-developed storm water management frameworks formed the basis for the design of a questionnaire to evaluate the response of local private property developers to the relevant issues.

Results of the research indicated that developers had a below average level of knowledge with regard to the storm water management policy of the CoJ, as well as of the underlying supporting legislation. The results of the survey further indicated that developers were strongly opposed to the loss of developable area, but indicated a limited financial impact of the current storm water attenuation policy. The risk element inherent in incorporating attenuation facilities within a development was identified as being low, with little perceived impact, while indications highlighted the inclusion of attenuation facilities as a significant contributing factor in the delay of approval and acceptance of new developments. The additional maintenance costs associated with attenuation facility inclusion were indicated to be of a low level of importance to developers.

Keywords: stormwater, economics, attenuation, pond, detention.

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Abstrak

Stormwatervermindingsbeleid het oor die afgelope jare 'n netelige saak vir die eiendomsontwikkelingsgemeenskap nasionaal en internasionaal geword. Verhoogde verstedeliking het munisipaliteitsowerhede gedwing om die rol van stormwaterbestuur in 'n groeiende stedelike omgewing te oorweeg. Dit is binne hierdie konteks dat die wetgewingsondersteuning en munisipale beleid oor stormwaterbestuur in Johannesburg oorweeg word met direkte verwysing na die oorwegende ekonomiese impak van stormwaterbeleid op privaat-eiendomsontwikkelaars. Faktore wat oorweeg word, sluit in: die koste, risiko, en tyd van beleidooreenkoms binne die ontwikkelingsproses.

Navorsing oor internasionale beleidsimplimentering in lande met goed ontwikkelde stormwaterbestuursraamwerke vorm die grondslag vir die ontwerp van 'n vraelys om die reaksie van plaaslike privaat eiendomsontwikkelaars oor die relevante sake te evalueer.

Resultate uit die navorsing dui aan dat ontwikkelaars 'n laer as gemiddeld kennis van stormwaterbestuursbeleid asook van die onderliggende ondersteuningswetgewing van Johannesburg gehad het. Die resultate dui ook aan dat ontwikkelaars sterk teenkanting getoon het teen die verlies van ontwikkelbare gebiede, maar dui 'n beperkte finansiële impak van die huidige stormwatervermindingsbeleid aan. Die risiko element van die inkorporering van vermindingsfasiliteite binne 'n ontwikkeling was as laag aangedui met 'n klein impak, terwyl die insluiting van verminderingsfasiliteite as 'n merkbare bydraende faktor in die vertraging om goedkeuring en aanvaarding van nuwe ontwikkelings te verkry, uitgelig is. Die addisionele instandhoudingskoste wat met ingeslote verminderingsfasiliteite geassosieer word, is aangedui om van min waarde vir ontwikkelaars te wees.

Sleutelwoorde: Stormwater, ekonomie, vermindering, dam, oponthoud.

1. Introduction

The role of the civil engineer is inextricably shaped by the changing face of urban morphology. Fulfilling roles in both private and public spheres, the engineer is compelled to find a balance between the hard sciences and economic limitations particular to each project.

The current storm water management policy adopted by the CoJ through the utilisation of storm water attenuation as a primary control mechanism forms the basis of research undertaken to explore the financial and economic implications of the storm water policy as perceived by private property developers. The research findings may sensitise built environment professionals to the perceived economic impact factors of concern to private developers enabling the adaptation and application of appropriate engineered solutions.

The relevance of the topic to the engineering community arises through the role of the consulting engineer in addressing the needs of the private developer in a cost-effective manner while satisfying legislative requirements and sustainability objectives. The task of guiding storm water management often falls to the

consulting engineer, becoming implicitly faced with balancing client expectations and legislative requirements, while constrained by defined economic parameters.

The research focused on the following developer perceived impact areas of storm water policy:

- Level of policy knowledge;
- Impact on project feasibility;
- Impact on property values;
- Impact on maintenance costs;
- Impact on project delays, and
- Risk profile impact.

2. Literature review

The review of the related literature focused on fundamental storm water best management practices, key motivating factors in support of enhanced levels of storm water management, regulatory support levels, the general economic implications of storm water management, and its impact on private property developers.

2.1 An overview of storm water attenuation principles

The current storm water management policy adopted by the CoJ calls for the attenuation of storm water on- or off-site to predevelopment run-off volumes by means of the inclusion of an open air pond and controlled outlet structure for the purposes of attenuation. A further refined, but fundamentally similar approach is advocated by Brooker (2006) in the proposed Draft Catchment Management Policy (CMP) under consideration by the CoJ. Figure 1 indicates a typical 'dry' storm water pond located North of Johannesburg within a new residential development.



Figure 1: Typical open-air storm water attenuation pond in the Johannesburg area.
Source: Aldous, 2007: own picture



Figure 2: Regional Ponds – Dunfermline, Scotland
Source: Adapted from Apostolaki & Jefferies, 2005: 9

The inclusion of an attenuation pond allows the physical alteration of the timeframe and peak discharge rate of run-off emanating from a catchment area by the incorporation of a temporary storage facility and controlled outlet. Figure 3 is a diagram indicating a typical storm water hydrograph reflecting the mitigation of the post-development peak flow by the inclusion of an attenuation pond.

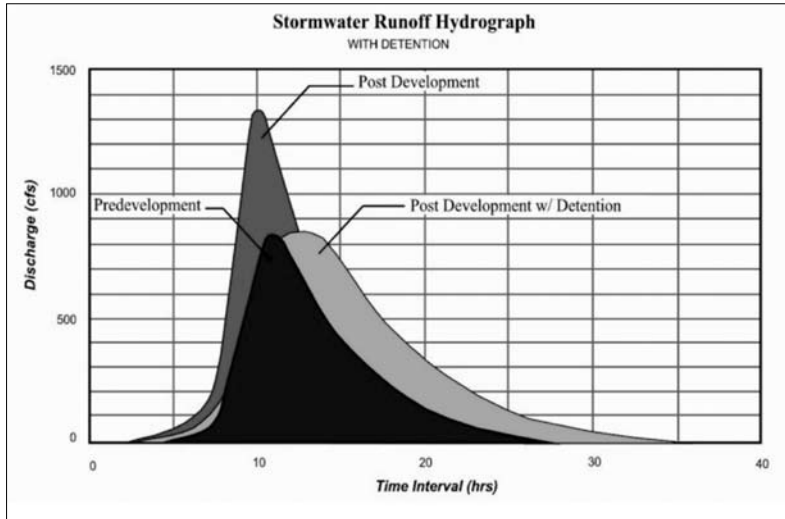


Figure 3: Typical run-off hydrograph for pre-, post- and attenuated storm water flows. Source: Adapted from Pennsylvania (United States). Department of Environmental Protection - Bureau of Watershed Management, 2006: Chapter 2:8.

Pond structures in the local environment may be constructed as 'wet' ponds where a permanent pool of water is present, or alternately as a 'dry' pond that discharges completely over a delayed period subsequent to a storm event. The 'dry' pond approach is currently the more prevalent approach in the CoJ based on an analysis of aerial photography of current development nodes.

2.2 Motivating factors in support of enhanced levels of storm water management

2.2.1 Development pressure on storm water infrastructure

A global trend has emerged in pursuing "... integrated planning for sustainable management of land resources" (South Africa. Ministry of Agriculture and Land Affairs, 2001: online). The integrated approach

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is regarded as a response to the continued failure of conventional land use planning to provide improvements in land management. Schueler (2000) identified land use planning as a major tool in addressing the impact of development on watersheds.

Global trends in urbanisation have led to vast increases in population densities, resulting in the focused densification of relatively small areas, placing the environment under significant stress and, in turn, negatively impacting natural and engineered watercourses. The current trend in Johannesburg is towards the development of smaller erven as a direct result of urban densification policies and economic factors. Decreasing erf size has increased impermeable surfacing coverage, reducing infiltration and fundamentally altering run-off friction coefficients and times of concentration.

The accommodation of high levels of urbanisation can only take place by altering the physical landscape. Large-scale urbanisation of an area has the potential to threaten both the biodiversity and the ecosystem functioning of the affected areas through surface modification of the soils and landscaping, in combination with increased motor vehicle infrastructure (South Africa. Water Research Commission & Department of Water Affairs and Forestry, 2006). Robson, Spence & Beech (2005: 206) identify a clear link between an increasing coverage of impervious surface to a declining biological state of natural watercourses. Further impacts of urbanisation include (Stone, 2004: 102):

- Stream channel erosion;
- Diminished groundwater recharge;
- Impact on regional climate;
- High levels of run-off intensity, and
- Degradation of streams, rivers and lakes.

In light of the above impacts, hard engineered storm water conveyances are no longer viewed as a sustainable storm water management approach in isolation. The South African Water Research Commission & Department of Water Affairs and Forestry (2006) identified the de-canalisation and re-vegetation of water courses in a bid to rehabilitate natural stream courses as a strategic focus point in the operationalisation of the Integrated Water Resources Management (IWRM) strategy.

The issues of storm water management are by no means a locally isolated phenomenon. The EU's Pan-European initiative to develop an Adaptive Decision Support System (ADSS) for the integration of storm

water source control into sustainable urban water management strategies under the 'Project Daywater' initiative, identified by Martin, Ruperd & Legret (2007: 339), serves as an example of the scale of storm water management challenges.

2.2.2 Pollution as an economic impact factor in urban storm water

In addition to the actual flow, volume, and morphological implications, the pollutant loading of a high-density urban environment has a profound impact. Goonetilleke, Thomas, Ginn & Gilbert (2005: 31) identified storm water as having a major influence on water quality as a result of being the primary transport mechanism for the introduction of chemical, biological and physical pollutants to receiving water bodies. Studies into the quality of storm water identify land use as the most significant consideration (Goonetilleke *et al.*, 2005: 40). High levels of toxicity have been specifically attributed to roadway run-off and studies in the San Francisco Bay area identified toxicity in over 90% of highway run-off samples (Kayhanian, Stransky, Bay, Lau & Stenstrom, 2008: 386).

The current CoJ storm water policy seeks only to regulate storm water discharge in terms of peak discharge rates from a development without quality intervention measures and no prescribed pollution limits or quantifiable storm water quality guidelines. The proposed CoJ CMP aims to address the problem of pollution in storm water by introducing chemical, bacteriological and thermal metrics for storm water discharges in future, in line with national legislation, but at present no further implementation details or guidelines exist. This inclusion of pollution control requirements has the potential to notably impact on the private property development sector and the supporting engineering community from a cost perspective.

2.3 Storm water legislation

In order to fully appreciate the potential economic impact of storm water management, the policy framework under which developers operate must be briefly considered. The subsequent overview of the salient points of international and local policies provides invaluable insight into the challenges impacting the accommodation of policy requirements in respect of storm water management inclusion and the potential for a negatively perceived economic impact.

2.3.1 Policy trends

International awareness and intervention in dealing with storm water-related issues can be found in a plethora of regulation aimed at controlling the complexities of urban storm water run-off. Canada, Scandinavia, the United States, New Zealand, the United Kingdom, Australia, Germany and France, among others, have adopted strategies and policies to address storm water issues. A point of commonality is the almost ubiquitous implementation of a financial charge, tax or rebate attributed directly to influencing storm water run-off. Further commonalities exist in the implementation of public education campaigns that form a part of the municipal communications programme. Table 1 provides a summary of selected EU member states storm water policy support mechanisms.

Table 1: Methods applied internationally for the promotion of storm water source control measures

	Pilot projects	Regulatory restrictions	Dis-charge control	Dis-charge fees / penalties	Storm-water fees	Tax breaks / Fee reduction	Public subsidies	Information campaigns
Sweden	✓	✓	✓		✓	✓		✓
Denmark	✓	✓	✓		✓	✓		✓
The Netherlands	✓	✓	✓	✓	✓		✓	✓
Germany	✓	✓	✓	✓	✓	✓	✓	✓
England	✓	✓	✓	✓	✓	✓		✓
France	✓	✓	✓	✓			✓	✓

Source: Adapted from Chouli, Affias & Deutsch, 2007: 66

A notable differentiating factor between current international and local storm water policies is the approach to water quality. Quality measures dictate acceptable pollution and contamination values for urban storm water. The inclusion of quality criteria has been associated with notable increases in the cost of storm water management and facilities construction. Scheuler (2000) attributed over a third of pond construction costs to the provision of quality control measures in research conducted in the United States.

2.3.2 South African storm water policy

The National Water Act (NWA) serves as a key component of water-related legislation and places an onus of responsibility for the management of water resources on the local authority. In addition, section 19(1) of this Act places an obligation on the landowner, or person in control of land on which pollution occurs, to take action in preventing such occurrence (South Africa, 1998a: 32). The *NWA* definition of pollution is broad, and in the context of urban storm water includes alteration to organic load, chemistry, sediment load, temperature, peak flow, total run-off and rate of change of flow. Post-development urban storm water run-off has the potential to affect every one of the abovementioned pollution characteristics if not adequately addressed. Further legislation in the form of *The National Environmental Management Act (NEMA)* places a responsibility on all persons, including the local authority, to minimise disturbance to the ecosystem and avoid pollution and degradation of the environment (South Africa, 1998b: 11). The regulatory backdrop provides a clear responsibility for the control of storm water, placing this responsibility in the hands of the local authority. This, in turn, forms the basis of the storm water attenuation regulations currently implemented, and those proposed in the CoJ CMP.

2.3.3 City of Johannesburg – Storm water management legislative framework

The Integrated Development Plan (IDP) for the Johannesburg Metropolitan Area clearly indicates that the importance of an effectively implemented storm water policy is desirable, while highlighting current deficiencies and direct reference to the inclusion of on-site storm water attenuation (City of Johannesburg, 2004). The *2007/2008 Spatial Development Framework (SDF)* identifies the need to address storm water issues due to the capacity of storm water infrastructure being exceeded (City of Johannesburg, 2007). The responsibility for the implementation and management of storm water control objectives lies with the Johannesburg Roads Agency (JRA) (Johannesburg Roads Agency [Pty] Ltd., 2004: 41).

Property developers are, in terms of JRA legislation, required to allocate land and infrastructure within new developments to limit the run-off peak discharge to a level equal to that of the undeveloped state of the property through the use of attenuation ponds and certain minimum requirements. The owner of the attenuation facility bears full responsibility for the design, construction and maintenance of the facility, in addition to a duty of care in respect of ensuring

the continued functioning of the system, and an obligation to ensure that it does not create a hazard to municipal, or surrounding properties (Johannesburg Roads Agency [Pty] Ltd., 2005).

The proposed CoJ CMP aims to adopt a more stringent storm water management approach, more financially onerous than current legislation, placing additional responsibility on both the developer and local authority. The adherence to, and achievement of the proposed criteria will carry an additional cost in both time and monetary terms within the overall development process, as well as requiring the application of sufficient resources to ensure that policy objectives are met. Brown, Claytor, Debo, Haubner & Reese (2001) identified the establishment of programme goals, requirements, components, priorities, organisational structure, staffing and funding as fundamental pillars in support of successful storm water management systems.

2.4 The economic impact of storm water control

The direct financial impact of the allocation of land to storm water attenuation requirements is a reduction in the total amount of developable land available, resulting in the potential to increase the cost of the remaining units to compensate for lost sales potential. An alternative to the potential increased costs is an increase in the overall development density pursued in compensation as identified by the USEPA (1995: online).

Storm water has long exerted an economic influence on the development environment and is typified by questions asked by developers such as: "How small can I make this detention pond and still meet the stated design requirements?" (Reese, 2006: online). Such questions are indicative of the situation should clear guidelines not be upheld. The need for regulation is further supported by Walker, Weedon & Nicolson (2007), who identify that all developments are a matter of economics, thus invariably giving rise to the issue of minimum allowable standards.

International experience identifies the initial risk premium attached to the implementation of attenuation and associated Best Management Practices (BMP) as unknowns, and have been cited as a limiting factor in widespread BMP adoption. The resistance has also given rise to public questions regarding the community benefits and additional future costs associated with the proposed systems, in combination with the long-term efficacy of the systems (Eason, Dixon, Krausse, Vesely, Sharp & Kviberg, 2005). Research undertaken for the Valley Creek watershed in South Eastern Pennsylvania

indicated that little benefit was achieved at a watershed level as a result of detention pond inclusion, and that under specific instances the inclusion of detention basins exacerbated overall watershed peak flow rates (Emerson, 2003).

The economic impact of attenuation inclusion has relevance, particularly for the private developer in strategic impact areas such as property value, construction costs, land opportunity cost, maintenance costs, altered risk and liability profile as well as the potential impact of delay on project costs.

2.5 Storm water attenuation impact on property values

International research commissioned by the USEPA established that 'wet' ponds may experience the same 'waterfront effect' that is attributed to lakes, streams and other natural water features. The research aimed to quantify the positive increase in property value for units in view of suitably designed storm water facilities, as well as to track the longevity of this premium. The findings indicated a 5% to 30% premium, averaging to an approximately 10% increase in property value. The lifespan of this premium was shown to exceed 20 years based on the available data (Schueler, 2000a: 302). It was also found that in areas of property over-supply, properties with a 'waterfront' effect sold more rapidly, thus improving developer market competitiveness and differentiation, while potentially improving project cash flows.

Further evidence in support of the positive impact of aesthetically optimised 'wet' areas is indicated by USEPA research indicating improved profitability and enhanced sales rates (USEPA, 1995: online). Residents of selected Ontario suburbs indicated that 17% of residents would be willing to pay a premium to live adjacent to a 'wet' attenuation pond while over 50% of those living next to 'wet' attenuation ponds believed it added value to their property (Schueler, 2000b: 453).

Klein (2003) considered the land value implications of attenuation facilities and observed that the 'dry' pond storm water approach had the opposite effect to that of well-designed 'wet' ponds. The negative impact attributed to the immediate vicinity of 'dry' pond attenuation facilities was found to be between 4% and 10% lower than comparable unaffected real estate.

Emmerling-Dinovo (1995) conducted research in Illinois with regard to the impact of storm water detention basins on residential locational decisions. A clear preference and value increase was attributable

to the proximity to a 'wet' pond basin. The perceived value was present even though the 'wet' ponds were poorly landscaped. The inclusion of 'dry' ponds was identified as a negative impact on the value of surrounding properties by between 3% and 10%.

The general trend within the current body of research indicates that a 'wet' pond facility has a positive influence on the value of surrounding properties while 'dry' ponds are associated with a reduction in perceived property value and are considered less desirable in the urban landscape.

2.6 Storm water attenuation pond construction cost factors

The construction of private attenuation facilities is an additional cost element to each new project. The direct pond construction costs include design, approval, geotechnical investigation and professional fees, in addition to actual construction costs.

Detailed studies undertaken at Clemson University, South Carolina, considered the cost of designing, installing, and maintaining storm water pond systems in relation to the level of pollutant removal achieved. The study further incorporated real cost factors other than water quality and volume discharge. These costs were identified as engineering costs, construction costs and landscaping wages in addition to land value. The results identified specialist engineering skills as a high cost factor, and land value as a major influence in total pond cost (Sharma, 2005).

Schueler (2000) identified the construction of ponds as possibly the largest 'out-of-pocket' expense paid by developers in meeting storm water management obligations. The scale at which attenuation facilities were implemented was also shown to have a significant influence on the economic impact of pond construction costs. Smaller ponds serving individual developments of less than five acres (2.02 hectares) had costs per volume between five and ten times higher than large ponds indicating the high level of economic inefficiency of fragmented local pond structures in comparison to that of larger regional or multi-site pond implementations. Figure 4 indicates the relationship between cost and catchment areas as determinants in pond costing for both quality and quantity parameters, a high relevance parameter in light of the proposed CoJ CMP objectives to include water quality criteria as a component of the proposed storm water management system.

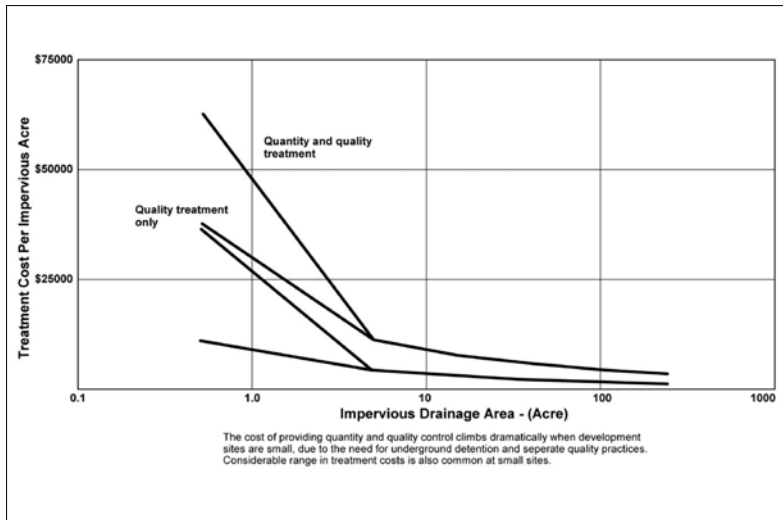


Figure 4: Generalised relationship between unit storm water management cost and site size.

Source: Adapted from Schueler, 2000: 405

The current attenuation policy seeks to manage peak flows without consideration for water quality while the cost variance between constructing a quality influencing 'wet' pond versus that of a 'dry' extended pond structure was found to be marginal (Schueler, 2000). This finding is significant in light of the proposed implementation of quality criteria indicated in the CoJ CMP as a result of the far higher water quality control potential of 'wet' ponds as opposed to the currently preferred 'dry' pond approach. Research indicates that the inclusion of water quality criteria results in one-third of the total storm water construction costs being dedicated solely to quality management, the remainder being attributed to flood and hydraulic control (Schueler, 2000).

Based on the preceding international cost information it would appear that the introduction of storm water quality criteria for urban storm water management locally has the potential to pose a significant economic impact on private property developers.

2.7 Non-construction-related storm water attenuation pond cost factors

Wossink & Hunt (2003) identified the land opportunity cost of the loss of land resulting from the inclusion of storm water BMPs as the most important cost item, with an associated reduction in development profit and a frequent concern area for developer interests.

The current CoJ storm water policy does not allow for a reduction or reimbursement of costs for the construction or maintenance of the mandated private storm water structures or attenuation facilities. The Landcare Research Centre, in conjunction with the University of Auckland, presented an analysis of key economic factors influencing the uptake of storm water management practices. Research highlighted the question of how economically rational the development approach was for private property developers along with the equitable distribution of costs, and the long-term costs associated with the chosen systems (Eason *et al.*, 2005). In a local context a lack of financial incentive appears to be a potential obstacle to the effective uptake and support of local storm water policy. The CoJ CMP draft policy has, in turn, made reference to providing possible credits against bulk contributions for storm water management programmes implemented (Brooker, 2006).

2.8 Storm water attenuation pond maintenance cost factors

Pond maintenance has a significant economic impact in the overall life cycle cost of the attenuation facility and is an area that is not specifically addressed by local legislation. In the current development environment there is no clearly defined maintenance requirement for pond facilities.

As the maintenance of an attenuation facility is paramount to the long-term successful functioning of the system in a manner that achieves the design objectives, the Ontario local government publication *Understanding Stormwater Management: An Introduction to stormwater management and planning* clearly states: "Lack of maintenance is one of the key reasons for poor system performance" (Ontario, 2003: 14). Thus the maintenance component of attenuation is one that results in lifetime costs associated with the benefits of the system. Maintenance considerations also play an important role in the design and specification of the system over and above the initial capital investment costs, as ponds often have a design lifespan in excess of 25 years. The Stormwater Manager's Resource Center places maintenance costs at between 3% and 5% of total pond construction cost per annum (Stormwater Manager's

Resource Center, n.d.: online). Maintenance activities include lawn mowing and landscape maintenance, removal of blockages and debris, clearing of litter, silt dredging and regular structural inspection (Wossink & Hunt, 2003). In the local development environment maintenance costs appear not to be considered; no definitive results or local data in this respect were encountered. The existing JRA Stormwater Attenuation Policy has no specific reference to a controlled or monitored maintenance requirement for new or existing attenuation facilities, thereby allowing the potential for the decreasing efficiency of installed facilities and a reduced utility return on the initial developer investment in meeting the prescribed standards.

Polta, Balogh & Craft-Reardon (2006: 62-69) investigated the contamination levels of pond silt and found contaminant concentrations that exceeded allowable levels, as well as linking the higher levels to increased roadway area within a watershed. The contaminated silt removed from affected ponds locally during maintenance may require specialised disposal in terms of *NEMA* and the *NWA*, incurring additional cost. Current regulations contain no specific guidance on contaminant target values or disposal guidelines for pond silt.

3. Research

3.1 Sample selection and data collection

The study examined a cross-sectional sample of affected developers using a structured, self-administered questionnaire. The sample stratum was based on achieving a diversified sample of the private property development arena by targeting small, medium and large developers within the defined geographic area of the CoJ. The focus sample included commercial, industrial and residential developments undertaken by private developers in the specified geographic area. Respondents were drawn randomly from a sample of companies listed with the South African Property Owners Association (SAPOA), as well as a randomly selected sample of organisations drawn from municipal and engineering consultancy sources, providing a final stratified sample group.

A response rate of 33% was achieved; twenty-one out of sixty-four questionnaires were returned. Responses were typically evaluated on a perceived level of impact based on a 5-point Likert scale.

4. Research findings

4.1 General storm water policy perceptions

Table 2 summarises the current views of private developers in respect of existing storm water policies.

Table 2: Developers' views of current storm water policies – general support levels

Parameter	Response (%)					
	Unsure	Disagree Agree				
		1	2	3	4	5
Consistent level of policy application	23,8	38,1	14,3	14,3	9,5	0,0
Positive environmental impact contribution	4,8	4,8	19,0	23,8	47,6	0,0
Policy adequacy for storm water control	19,0	4,8	9,5	33,3	28,6	4,8

Current policy implementations were viewed with a marked degree of scepticism regarding the perceived consistency of application, with 38.1% of the respondents indicating a value of 1. The implications of this view are the potential undermining of the policy and reinforcement of a negative view of storm water control and the potential to increase policy resistance levels while decreasing the overall impact of storm water management efforts.

47.6% of respondents tended to somewhat agree that the attenuation policy had a positive environmental impact, indicating a level of awareness of the intended benefits of the storm water management and attenuation policy under consideration. In addition, 33.3% of the developers perceived the attenuation policy to impact positively at a moderate level in terms of adequately addressing the issues of storm water control, while a further 28.6% indicated an above moderate level of agreement.

4.2 Levels of developer storm water-related policy knowledge

Storm water policy knowledge extents indicated below average to moderate levels, implying that significant scope remains for the improvement of policy dissemination by the CoJ, and assimilation within the development community. Respondents reporting knowledge levels above the median value may be in a better position to make informed policy decisions and develop a competitive advantage in the development arena. Results indicated that 52.4% of the respondents applied no effort in maintaining a current

knowledge of storm water policy. In addition, results indicated that only 24% had ever received any storm water-related documentation from the CoJ. The results thus indicate a distinct lack of knowledge as a result of poor policy uptake and dissemination.

The low knowledge levels encountered are further supported by the high levels of reliance placed on external sources during the planning and feasibility stages. The levels of external reliance may be related to the lack of documentation available to developers prior to the appointment of a full professional team.

Table 3 shows that civil engineers were identified as the most important external consultants, with 86% of the respondents indicating a major significance, with a mean value of 4.76 (1 = least important, 5 = most important). Results indicated that the roles of the town planner and architect were potentially underestimated in respect of storm water accommodation during the initial spatial and aesthetic planning phases with mean contributory significance values of only 1.90 and 2.55, respectively.

Table 3: Rating of perceived importance of external consultants with respect to storm water attenuation

Parameter	Response (%)					
	Unsure	Least important Most important				
		1	2	3	4	5
Town planner	0,0	57,1	19,0	9,5	4,8	9,5
Architect	4,8	42,9	4,8	19,0	9,5	19,0
Civil engineer	0,0	0,0	4,8	0,0	9,5	85,7
Environmental consultant	4,8	19,0	9,5	19,0	14,3	33,3
Land surveyor	9,5	47,6	14,3	19,0	4,8	4,8

The research also considered which channels of communication were most likely to be effective in reaching the private property development community in mitigating the perceived economic impact through effective communication. The results are as follows (most likely to least likely): summarised guideline booklet, dedicated website, storm water policy manual, dissemination through SAPOA, and public presentation.

4.3 The impact of storm water attenuation costs on development feasibility

The impact of attenuation inclusion was perceived to be of major significance by 38.1% of the developers in respect of increased densities as compensation for lost utility while a further 19% indicated an above-average impact.

In response to research on the direct impact of attenuation inclusion on project feasibility, the results indicated that, in terms of overall feasibility, the majority of developers reported a moderate impact with a mean score of 2.60 (1=minor impact, 5=major impact), indicating a below-average impact. Selling prices of affected units were found to be only moderately affected, with a mean value 2.44 (1=minor impact, 5=major impact). The resultant low impact may be sensitive to the number of units contained in a development but development profitability was deemed to be only moderately impacted. The results indicate that the inclusion cost of an attenuation pond, when distributed over the total development, does not pose an overly adverse impact on project feasibility or property value.

The level of support for less land-intensive attenuation measures because of land lost to attenuation was fairly high as a mean value of 4.40 was recorded (1=low, 5=high)

4.4 The impact of storm water attenuation inclusion on property values

The research also evaluated the perceived economic impact of attenuation policy requirements *vis-à-vis* the effect on property prices in the immediate vicinity of pond facilities. Respondents indicated a moderate value impact with a mean of 2.83, indicating general developer awareness, but indicating that the influence of proximity is not considered to be a significant impact. Results specific to 'wet' and 'dry' pond types indicated that 'dry' ponds were considered to have a moderately negative impact on property value while 'wet' ponds exhibited an above-average negative impact. The results contrast with those previously identified by Klein (2003), Schueler (2000a: 302) and the USEPA (1995: online). Negative reactions to the 'wet' pond may be attributed to the visual impact of a permanent water pool and the associated issues of safety, aesthetics and pollution, as identified by Apostolaki & Jefferies (2005). Table 4 represents the results.

Table 4: The developer-perceived level of negative impact of attenuation pond proximity and type on property value

Parameter	Response (%)					Mean	
	Unsure	Low.....High					
		1	2	3	4		5
Immediate proximity to attenuation pond	14.3	19.0	4.8	38.1	19.0	4.8	2.83
Proximity to 'dry'-type pond	9.5	14.3	9.5	38.1	14.3	14.3	3.05
Proximity to 'wet'-type pond	14.3	4.8	14.3	19.0	38.1	9.5	3.39

4.5 The perceived impact of storm water attenuation inclusion on maintenance costs and project delays

The inclusion of attenuation ponds in new developments was perceived to have a minor negative impact in terms of both the immediate and long-term maintenance costs for affected developments, with 38% of the developers citing maintenance considerations as being of minor importance during feasibility and design activities. Limited maintenance impact may be attributed to the short-term nature of developer involvement over the lifecycle of the development. Thirty-eight percent of the developers indicated that long-term maintenance costs had a potential negative financial impact on affected development management bodies. At present no effective regulatory mechanism exists to monitor attenuation facility maintenance and the negligible consequences for neglect support the perception of marginal economic impact for developers.

Low levels of developer knowledge currently exist in respect of maintenance requirements with 19% of the developers having no knowledge of maintenance and 47.6% falling at a below-average knowledge level. The current knowledge levels have the potential to impact negatively on development economics, as well as long term sustainability.

Attenuation pond inclusion was strongly perceived by developers to increase the number of delays in both plan approval and completion approval. The economic impact of delays was attributed to higher holding costs, delayed transfer and the concomitant cash flow implications. The issuance of clearance certificates is closely tied to development finances and elicited above average response levels as indicated in Table 5.

Table 5: The perceived impact of approval and clearance delays directly attributed to stormwater attenuation inclusion

Parameter	Response (%)						Mean
	Unsure	Minor..... Major				5	
		1	2	3	4		
Approval delays	4.8	4.8	14.3	23.8	23.8	28.6	3.60
Final clearance	4.8	4.8	14.3	19.0	28.6	28.6	3.65

A response to the specific implementation of a greater level of stormwater control as proposed in the draft CoJ CMP resulted in 42.9% of the developers indicating an above-average level of opposition to the proposed measures, with the mean value of 3.68 highlighting the development community sensitivity towards a perceived negative impact on the development process through additional resources for compliance and an increased potential for delay.

4.6 Storm water attenuation pond inclusion impact on project risk

The mandatory inclusion of attenuation facilities provides an additional level of responsibility for developers and their subsequent successors in title. Apostolaki & Jefferies (2005) identified safety risk concerns as a high priority in community surveys conducted in the United Kingdom. Local developers indicated an above-average level of additional risk as a result of pond inclusion, with particular regard to the safety measures and potential for liability and associated claims. A risk response was evaluated relative to the criteria below, with mean results indicating a consistently low to below-average risk impact response (1=Low, 5=High risk):

Table 6 indicates that the mean rating for all the perceived risks are below average (3.0), indicating that the developers perceive a below-average level of concern from a risk perspective. Risks associated with 'maintenance-related pond failure' are ranked highest while 'catastrophic pond collapse' is ranked last.

Table 6: Risk factors attributable to storm water attenuation pond inclusion

Risk factor	Response (%)						Mean	Ranking
	Unsure	Low.....High						
		1	2	3	4	5		
Maintenance-related pond failure	0.0	23.8	28.6	19.0	28.6	0.0	2.52	1
Adequacy of design	0.0	28.6	38.1	14.3	14.3	4.8	2.29	2=
Danger to residents	0.0	38.1	23.8	14.3	19.0	4.8	2.29	2=
Pond-related litigation	9.5	33.3	28.6	14.3	14.3	0.0	2.11	3
Design-related failure	0.0	38.1	33.3	9.5	19.0	0.0	2.10	4
Flood risk to neighbours	4.8	33.3	33.3	19.0	9.5	0.0	2.05	5
Catastrophic pond collapse	4.8	33.3	47.6	4.8	9.5	0.0	1.90	6

The low risk perception appears to be supported by a level of confidence in storm water attenuation pond design, low levels of liability litigation encountered in South Africa and low levels of safety awareness. Current local legislation does not directly address the risks of attenuation pond inclusion on the safety of residents. In addition, attenuation regulations have only been in effect for a relatively short period and have not been tested by exceptional hydrological events.

5. Summary and conclusions

Developers exhibited moderate knowledge levels of the current CoJ storm water attenuation policy as implemented by the JRA coupled with poor levels of knowledge of the proposed CoJ Catchment Management Plan, CoJ development documentation and national legislation, while noting the lack of CoJ storm water policy documentation and guidelines as a constraining factor.

Overall project feasibility was not perceived to be highly influenced by the storm water attenuation policy but did indicate a high level of support regarding a perceived increased development density as compensation for the inclusion of storm water attenuation ponds as a means to accommodate the lost opportunity cost of pond inclusion. The feasibility, profitability and impact on per unit selling

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prices were found to be of a below-average level of concern for developers indicating that pond inclusion was not ultimately viewed as a significant hindrance to projects in financial terms.

The perceived impact of the proximity of properties to storm water attenuation ponds was deemed to be negative for both 'dry' and 'wet' ponds. However, 'dry' ponds posed a lower impact while 'wet' ponds did not exhibit the positive 'pond premium' identified in US research. Developers further indicated a below-average level of effort expended in incorporating attenuation through landscaping and aesthetic enhancement.

Maintenance considerations during feasibility analysis and pond design stages received little consideration; indications were that maintenance costs for storm water facilities were not deemed a significant burden to the managing bodies of new developments. In addition, the current level of maintenance knowledge within the development community indicated below-average levels, potentially resulting in limited maintenance to many new facilities.

The impact of attenuation inclusion on project delays indicated that an above-average to major level of delay was associated with the approval and final completion processes in place. The results showed that attenuation inclusion played a prominent role as a potential project delay in the private development environment. In addition, the research results indicated that developers were opposed to the introduction of more stringent storm water controls as proposed by the CoJ.

The inclusion of storm water attenuation ponds was perceived to pose an above-average level of risk in terms of liability for the associated safety risks but was not otherwise considered to markedly impact a typical project risk profile and therefore presented limited economic impact.

6. Recommendations

6.1 General

The current storm water landscape policy holds a great deal of uncertainty for the private property developer as an integral part of the urban project delivery system, ultimately contributing to the economic growth of the CoJ. Developers require a clearly defined and efficient policy that encompasses the objectives of sustainable and environmentally conscious urban storm water management within attainable economic boundaries.

General recommendations include educational programmes focused on developers and community residents, demystifying pond-related issues, and mitigating negative impressions while creating credibility in the eyes of both the public and the developer.

Ongoing storm water research is recommended in order to provide quantifiable evidence as to the effectiveness of the storm water policy measures and economic benefits. The CoJ is home to a number of well-respected educational institutions with established research programmes that may be leveraged to benefit their immediate environment in respect of local storm water management studies. Research should also be conducted in other South African cities to analyse whether results are similar.

6.2 Policy knowledge levels

The poor level of storm water management policy knowledge identified requires extensive action on the part of the local authority. It is recommended that, in addition to the fundamental recommendations contained in the CoJ's CMP, the CoJ should develop a comprehensive technical guideline document outlining the acceptable technical parameters, design requirements and performance metrics required, suitable for use by professional engineers, with a condensed version applicable to developers and other relevant professionals.

This is supported by Botha (2005) who identified the lack of a storm water design manual and integrated storm water planning as major constraints in the successful implementation of storm water management for the CoJ area.

Developers identified the three preferred means of communication of storm water policy information as being a summarised guideline booklet, a dedicated website and a storm water policy manual. This can readily be accommodated within the well-developed and expanding e-services infrastructure of the CoJ.

6.3 Project feasibility and property value

The CoJ should consider a broader range of BMPs that can be applied such as subterranean facilities or alternatives such as permeable paving that limit the impact of lost surface area in combination with the development of an incentive/rebate scheme to offset the impact of increasing storm water management requirements.

6.4 Property value impact

A long-term education and promotion effort should be maintained in support of developing a positive relationship between attenuation facilities and property values, by leveraging the proposed CoJ CMP water quality requirements and the positive impacts of 'wet' ponds, thereby unlocking value through landscaping and aesthetically sensitive design. Greater integration of the CoJ open space and green areas management may further support increased values and provide suitable areas for storm water management on public land, including the use of regional attenuation structures.

6.5 Project delay

The recommendations in response to alleviating the impact of the perceived delays attributed to storm water attenuation policy relate to increasing the CoJ and JRA capacity, ensuring consistency of standards, standardised technical parameters, and improved communication structures. Delays in the issuance of clearance certificates and approvals may be further reduced through an increased level of knowledge and awareness in the development community, engineering field, and associated professions, in tandem with clear technical documentation and supporting guidelines.

6.6 Maintenance

Detailed design documentation should include typical maintenance costing to enable developers and designers to quantify typical costs for various attenuation options while the development of an attenuation pond manual issued to all management bodies of pond affected developments is recommended. The details should include guidelines on the intent, functioning, and maintenance responsibilities required with regard to attenuation ponds. Examples of such guides include the publication *Maintaining your BMP – A Guidebook for Private Owners and Operators in Northern Virginia* (Northern Virginia Planning District Commission, 2000). Long-term maintenance incurred by an affected development body may be suitable for a rebate system quantified in relation to minimum maintenance requirements.

6.7 Project risk

Although the majority of attenuation facilities are privately owned, it is recommended that the CoJ provide safety guidelines as part of the proposed technical manual and developers' guide, encompassing safety, functional aesthetics, physical risks and health risks. The safety

of dams, addressed by Brooker (2006) in the CMP, should include a pond inventory, inspection schedule and GIS integration as part of an ongoing long-term monitoring programme to provide supporting data aimed at refining attenuation requirements based on historical performance.

7. Conclusion

Climate change with resultant intense storms, together with less vegetation (forests and tall grass veld) as a result of urbanisation, has led to increased emphasis on finding ways to control storm water. Where there are rivers in the area, efforts could also be made to channel the water into these rivers. An urban river can be an asset to residents of the area; it should be a place where they can relax, with relatively good quality, controlled stream flow, lush vegetation where birdwatching, and even fishing should be possible (De Villiers, 2004: 108).

The long-term economic sustainability of storm water management is dependent on a supportive policy environment as storm water will continue to remain a challenge in the face of urbanisation and accelerated densification.

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Why do South African women choose careers in construction?

Peer reviewed

Abstract

This article analyses the factors influencing the choices of careers in construction by South African women.

Literature was reviewed on challenges facing women in construction which contribute to their choices of careers in a traditionally male-dominated industry such as construction. Questionnaires were conducted with multiple samples that included construction organisations, construction students and professional women working in construction.

The study found that women had a role to play in the construction industry and that they could build successful careers within the sector. However, this was not easy given the various barriers to entry such as gender-based discrimination against them, the harsh work environment of the construction, the lack of sufficient knowledge about the industry itself, and the lack of successful women in construction as role models. There was evidence of discrimination and sexual harassment. All these factors impacted negatively on the choices of careers in construction by South African women.

The study stimulates debate about how the low representation of women in construction can be addressed and how construction careers for women can be promoted and encouraged.

This article makes a contribution to understanding the factors that have marginalised women in a male-dominated industry and provides some indication of approaches to attract more women into the sector. Consequently, the resource pool will be enlarged given the prevalent acute skills shortage in the industry.

Keywords: Discrimination, education, gender, built environment, career choices, culture, cultural background

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Abstrak

Hierdie artikel analiseer die faktore wat die beroepskeuse van Suid-Afrikaanse vroue in die konstruksiebedryf beïnvloed.

'n Literatuurstudie is gedoen oor die uitdagings wat vroue in konstruksie in die gesig staar wat bydra tot hulle loopbaankeuses in 'n tradisioneel manlikgedomineerde industrie soos konstruksie.

Die studie het bevind dat vroue 'n rol te speel het in die konstruksie-industrie en dat hulle suksesvolle loopbane binne die sektor kan bou. Dit was nietemin nie maklik om die industrie te betree gegewe die verskeie struikelblokke soos geslagsgebaseerde diskriminasie teen hulle, die harde werksomgewing van die konstruksie, die gebrek aan genoegsame kennis oor die industrie en die gebrek aan suksesvolle vrouerolmodelle in konstruksie nie.

Die studie stimuleer debat oor hoe die lae verteenwoordiging van vroue in konstruksie aangespreek kan word en hoe konstruksieloopbane vir vroue bevorder en aangemoedig kan word.

Hierdie artikel maak 'n bydrae tot die begrip van die faktore wat vroue in 'n manlikgedomineerde industrie aan die rand plaas en verskaf 'n aanduiding van pogings om meer vroue tot die industrie aan te trek. Gevolglik sal die hulpbronnepot vergroot gegewe die oorwegend akute vaardigheidstekort in die industrie.

Sleutelwoorde: Diskriminasie, opleiding, geslag, bouomgewing, loopbane, kultuur, kultuuragtergrond

1. Introduction

Women encounter pervasive gender issues in their chosen careers which require specific strategies to deal with them (Phaahla, 2000). In particular, they need to contend with gender role stereotyping which believes that a set of traits and abilities is more likely to be found among one sex than the other (Schein, 1978: 259). Women have been defined as inferior to men and they are therefore assigned the position of minors in both public and private spheres of life (National Gender Policy Framework, 2003). In addition, they arguably accept secondary roles without hesitation (Mathur-Helm, 2005: 63). Although women constitute the major segment of the South African population they account for only 35.2% of the eligible working age (Statistics South Africa, 2009). Gender inequality in the workplace is underpinned by job segregation and perceived roles associated with gender groups (Kornegay, 2000). In the construction industry with the number of women presently low, the implication is that individuals, the industry, and ultimately the community all suffer the consequences of only fully utilising the potential of one gender. Women are therefore a wasted resource (Mathur-Helm, 2005: 57). However, prevailing attitudes suggest that change will not be easy because the dominantly male makeup of the construction industry is a deterrent to women who fear isolation, discrimination and

harassment should they pursue careers in that sector. The nature of the workplace culture in construction is critical in explaining the underachievement of women in construction careers. This culture militates against their equal progression through the somewhat exclusionary and discriminatory environment that characterises the sector. Women without an in-depth knowledge of the cultural influences on construction careers soon become disillusioned with the discrimination and the lack of opportunities for themselves. They are regarded by males as added competition for the limited promotional opportunities that exist, and experience entrenched sexism (Bennett, Davidson & Gale, 1996: 273). Consequently, male attitudes are adversarial and confrontational. In addition, many young men still believe that women are both physically and psychologically unsuited to construction work, despite paying lip service to the notion that "women can do anything" (Thompson, 1996: online).

Typically young people start contemplating their career choices at approximately the age of 16 or in their last years of high school. Gender-based career stereotyping makes it particularly difficult for young girls to establish their own career choices or to diverge from the career choices dictated by their parents. A sense of isolation is another reason for high defections, with women having little chance of meeting other women working in construction. Education at school level is only part of the battle to recruit more women into the construction industry. Male builders need to accept women in the building workplace (Thompson, 1996: online).

There is a relationship between higher education and the employment choices of women (Phahla, 2000). Women tend to congregate in areas considered traditional outlets for female employment. Female staff and students are typically drawn to faculties such as the humanities, education and the social sciences. Generally women do not make up large numbers in technology and applied science areas of study. Consequently, the jobs available to women are limited for social and economic reasons. The position of women is further exacerbated by the fact that gender in South Africa is also racially and culturally segmented, creating inequalities that are race-bound. White and Black women have extremely different levels of experiences regarding job and development opportunities (Mathur-Helm, 2005: 67).

While more enlightened senior management staff may have recognised the undesirable and debilitating effects of an entrenched male culture, there was little evidence to suggest that there had

been any significant erosion of it within the ranks of middle managers, employers or employees (Greed, 2006: 74). Women are still regarded as secondary to men in South African business culture (Mathur-Helm, 2005: 63). There is a view that women do not show leadership potential and behave differently from traditional male leaders (Mathur-Helm, 2004; Guppy & Rick, 1994). According to Johnson (1999), they are emotional and cannot shoulder responsibilities. What women do is rarely defined as leadership, given that masculinity is an implicit construct of leadership (Kloot, 2004: 472).

The South African definition of gender equality is guided by a vision of human rights which incorporates acceptance of the equal and inalienable rights of all men and women (Kornegay, 2000). Indeed, the rights of women need to be viewed as human rights. 'Equality' is specified and enshrined in the *Bill of Rights of the South African Constitution* (South Africa, 1996). Section 9(3) of the *Constitution* provides that no one may unfairly discriminate directly or indirectly against anyone on any grounds such as, for example, race, gender and culture. This prohibition on discrimination forms an integral part of processes to achieve social justice in South Africa. Gender equality, therefore, requires that the underlying causes of discrimination be systematically identified and removed in order to give women and men equal opportunities in every sphere of life:

In short, the economic integration of women, which comes only when market barriers are lowered and women are given an equal chance to attain decent work, remains a necessity for economic development and a worthy goal in its own right (ILO, 2008: 4).

In South African society women historically faced the burden of unpaid household labour in addition to income-generating work. A rigid and uncompromising organisation of working hours and environment prevented them from performing well, considering that they needed to take time off for childcare and other family responsibilities (Ellison, 2001; Wilson, 1998). Often these demands reduced their chances of full-time paid employment. In addition, in terms of the South African *Employment Equity Act of 1998*, labour market discrimination arises when employers make decisions about employees for reasons that are not related to genuine work requirements (South Africa, 1998). Discrimination is most obvious when an employer focuses on irrelevant personal characteristics instead of work performance or merit. As a result women in many organisations have to work extra well and hard to gain any prospect of promotion. Unfortunately women have not been benefiting

from government policies and legislation to advance their careers (Mathur-Helm, 2005: 58). There is, therefore, no correlation between policy and practice.

The generally accepted and popular image of construction is that of a male-dominated industry requiring brute strength and tolerance for outdoor conditions, inclement weather and bad language (Fielden, Davidson, Gale, & Davey, 2001). Women, therefore, have three choices, namely to be successful by behaving like men, to fail to adapt to the culture and leave, or by not acting like men to remain in unimportant positions (Bennett *et al.*, 1996: 275; Sachs, Chrisler & Devlin, 1992). According to Agapiou's study (2002), the image and perception of an industry were significant factors in determining career choice. In addition, the construction industry is perceived as being the epitome of crisis, conflict and masculinity, manifesting in the unsociable, confrontational behaviour that discourages women and ethnic minorities from considering construction as a meaningful career. The industry had an industry-wide problem with 'image', which made both men and women reluctant or uninterested in the industry (Gale, 1994). In their study Haupt & Smallwood (2005: 4) found that South African students had very limited knowledge and understanding of the construction industry. According to Fielden *et al.* (2001), the general lack of knowledge and information about the industry, the career opportunities, and what qualifications are offered further compound the problem of the low representation by women in the sector. Parents, teachers and school children generally believed that jobs in the construction industry were limited to bricklaying, joinery, painting and decorating.

Against the background that issues of gender equality have been extensively studied in advanced economies but less so in countries with less advanced economies, this paper highlights the findings of a study conducted in South Africa to examine the factors that influence the career choices of women, with the emphasis on the construction industry. The study examines the interconnection between gender, culture, religion, masculinity and the unattractive image of the construction industry as well as the career choices of women in South Africa. In particular, it provides insight into the popularity of careers in construction among women relative to other industrial sectors. It explores the prevalence of discrimination against women in construction and its overall impact on their final career choice preferences.

2. Methodology

A purposive sampling approach was adopted to gather data on the research topic. Construction companies, construction students, and professional women working in construction were surveyed using self-administered questionnaires. Data was encoded and analysed using SPSS (Statistical Package for Social Scientists).

The views of a convenience sample of 1 435 industry practitioners, 141 first- and final-year construction students and 17 professional women from the Gauteng and Western Cape provinces, where arguably most construction activity in South Africa generally occurs, were canvassed. The industry survey included 11 questions on aspects of gender practices and policies within their organisations. The student and professional women survey instruments included 83 and 33 statements, respectively, to which respondents were required to respond typically using a 5-point Likert scale of agreement.

3. Industry survey

The industry sample consisted of 1 435 participants in construction workshops held in all 9 provinces in South Africa over a 12-month period. The profile of the sample is shown in Table 1.

Table 1: Industry sample profile

<i>Industry participation</i>	<i>%</i>	<i>Province</i>	<i>%</i>
Architect	8.0	Eastern Cape	16.2
Contractor	19.6	Free State	5.5
Engineer (consultant)	21.3	Gauteng	15.7
Manufacturer	1.5	Kwazulu-Natal	23.8
Private sector client	5.8	Limpopo	3.5
Public sector client	19.4	Mpumalanga	5.9
Project manager (consultant)	7.6	Northern Cape	4.0
Quantity surveyor (consultant)	7.0	North-West	3.0
Co-contractor	3.6	Western Cape	19.2
Supplier	1.0	Many provinces	3.4
Other	5.4	Total	100.0
Total	100.0		
<i>Average annual turnover</i>	<i>%</i>	<i>Average annual employment</i>	<i>%</i>
<R1million	16.4	<_10	30.6
_>R1million <_R5million	25.4	>11<_50	25.9
>R5million <_R20million	18.8	>50<_100	8.6
>R20million	39.4	>100<_250	8.2
Total	100.0	>250	26.7
		Total	100.0

It is evident that the sample comprised mostly consulting engineers (21.3%), contractors (19.6%) and public sector clients (19.4%) who operated mostly in the Kwazulu-Natal (23.8%), Western (19.2%) and Eastern Cape (16.2%) provinces of South Africa. Most participants had average annual turnovers greater than R5 million.

Table 2: Average annual employment of females

<i>Number</i>	<i>%</i>
<10	90.5
>10<50	5.2
>50<100	.9
>100	3.4
Total	100.0

In addition, nearly all the participants (95.7%) employed on average less than 50 workers per annum with 90.5% of the sample employing less than 10 females on average per annum in their organizations.

Table 3: Employment categories of females

<i>Employment category</i>	<i>%</i>
Secretarial	69.1
Management (administration)	42.5
Unskilled (labourers)	31.2
Skilled (artisans)	19.9
Supervisory	17.3
Semi-skilled (operators)	16.2

Table 3 confirms that women are mostly employed to perform secretarial (69.1%) and administrative (42.5%) roles. Where they were employed on construction sites they were mostly employed at the level of labourers (31.2%).

Table 4: Gender-based issues

<i>Issue</i>	<i>Yes %</i>	<i>No %</i>	<i>Don't know %</i>
Same rights, benefits and opportunities as males	92.2	3.1	4.7
Separate toilet and ablution facilities provided	83.2	14.9	1.9
Equal advancement and promotion opportunities	87.6	4.9	7.5
Paid same rates of pay (wages and salaries) as males	69.2	7.3	23.4
Visible management endorsement of non-discriminatory practices, gender-based education programmes and information	65.2	18.5	16.3

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Simple, clear and unambiguous communication of gender equity policy	55.2	22.7	22.1
Available funding targeted at improving status and qualifications of female employees	51.1	25.0	23.9
Written gender equity policy in place	44.5	34.9	20.6
Provision of gender-based educational material	27.8	50.0	22.2
Practices that might be regarded as discriminatory because worker was female	8.8	64.3	26.9

Relative to being asked about the prevalence of certain gender-based issues and practices in their respective organizations, nearly all the respondents reported that females were afforded the same rights, benefits and opportunities as males (92.2%). Similarly, most of them reported that separate facilities such as toilets and ablutions were provided for females (83.2%) who were afforded equal advancement and promotion opportunities (87.6%). However, substantially less reported that funding was available targeted at improving the status and qualifications of female employees (51.1%), written gender equity policies were in place (44.5%), and gender-based educational material was provided to employees (27.8%). Notably, nearly 25% of the respondents did not know what the situation was in their organisations relative to gender-related issues and practices.

Relative to observed gender-based discriminatory practices, respondents cited examples of these as follows:

'Decision not to award a tender to a woman because of skepticism'.

'Engineers undermine me and threaten to work me out'.

'No ablution facilities provided on site'.

'Female engineers had to be accompanied to rural sites due to danger'.

Comments suggestive of prevailing attitudes towards females in construction included:

'Too many unqualified females are appointed to top positions'.

'[Gender] equity is not a priority for management'.

'Heavy construction work negatively affects women's reproductive organs'.

'Nature of industry has not encouraged women to apply'.

'Construction sites are not suited to women'.

'Family responsibilities interfere with their [women's] progress'.

'Fellow workers are shocked at my [woman] excellent performance'.

4. Student survey

While the validity of students' views has been questioned (Ross & Elechi, 2002), their views need to be considered, given that they are one of the three cooperative partners in the cooperative construction education model (Haupt, 2003). The student sample was drawn from two major universities in the Western Cape and Gauteng provinces, namely the University of Johannesburg (55.3%) and the Cape Peninsula University of Technology (44.7%). The sample was constituted as follows:

- Junior (first- and second-year) students - 43.6% (males = 31.2%; females = 51.2%), and
- Senior (third- and fourth-year) students - 56.4% (males = 68.8%; females = 48.8%).

From Table 5 it is evident that most (60.8%) of the students majored in quantity surveying majors, 37.5% in construction management, and the remaining 1.7% in civil engineering. In terms of gender representivity, males dominated the sample.

Table 5: Student sample profile

<i>Institution</i>	<i>%</i>	<i>Programme</i>	<i>%</i>
CPUT	44.7	Construction Management	37.5
UJ	55.3	Quantity Surveying	60.8
Total	100	Civil Engineering	1.7
		Total	100
<i>Year /level of study</i>		<i>Gender</i>	
Junior	43.6	Male	61.0
Senior	56.4	Female	39.0
Total	100	Total	100

4.1 The impact of discrimination

Students were presented with five statements relative to gender-based discriminatory practices in construction. Their responses are presented in Table 6.

Table 6: Discrimination against women in the construction workplace

Rank	Statement	Sample		Males		Females	
		Mean	SD	Mean	SD	Mean	SD
1	Women on construction sites are not respected to the same extent as men	3.5	1.2	3.2	1.2	4.0	0.9
2	Women are likely to be sexually harassed on site	3.4	1.2	3.4	1.3	3.4	1.1
3	The fact that there are more male professionals in construction intimidates women	3.1	1.1	3.3	1.1	2.8	1.0
4	Women are more suited to administrative than production functions on site	2.9	1.3	3.4	1.2	2.1	1.1
5	Female students are intimidated by the male students in classes	2.2	1.2	2.2	1.2	2.2	1.1

The sample means suggest feelings of neutrality concerning issues of discriminatory practices except for disagreement on intimidation of female students by their male counterparts in class. Both male and female students agreed similarly that women were likely to be sexually harassed on site. They also disagreed that female students were intimidated by male students in their classes. However, female students agreed more strongly that women on construction sites were not respected to the same extent as men and were more negative about being intimidated by there being more male professionals in the industry. While males tended to agree, women tended to disagree that women were more suited to administrative than production functions on site.

There were linear relationships between the gender of students and their responses to issues of discrimination. The Spearman's correlation coefficient of 0.353 at the 0.01 level (2-tailed) suggests that females were more likely to agree that women on construction sites were not respected to the same extent as men. Similarly, a correlation coefficient of -0.457 at the 0.01 level (2-tailed) suggests that they were more likely to disagree that women were more suited to administrative than production functions on construction sites. In addition, the weak correlation coefficient of -0.188 at the 0.05 level (2-tailed) suggests that they were more likely to disagree that they were intimidated by there being more male consultants in the industry.

The Mann-Whitney tests suggested that responses were significantly gender-biased relative to women not being respected on construction sites to the same extent as men and women being more suited to administrative than site production function on construction sites. This

finding was confirmed by the Kolmogorov-Smirnov test statistics. The Chi-square tests confirmed that the association was not caused by chance and that there was some association between gender and responses to issues of discrimination.

Table 7: Impact of discrimination of women on career choices

	Male (%)	Female (%)
Discrimination impacts careers in construction negatively, resulting in women rather choosing other careers	49.2	50.8
Discrimination creates a sense of being inferior	56.5	43.5
Discrimination results in less women in construction industry	0.0	100.0
Because of discrimination women tend to avoid construction and adhere to the conventional careers such as nursing	39.3	60.7
Men think they can do all things whereas even women can do men's work	0.0	100.0
Most women become unsure of the available choices in the industry and end up dropping out of construction	39.3	60.7

Table 7 shows the split by gender of responses to each of the issues concerning discriminatory practices in the sector. More than half of the respondents (females) reported that discrimination impacted construction career choices negatively, resulting in women choosing careers in other sectors. In addition, a similar proportion of the sample (males) suggested that discrimination created among females a sense of being inferior to their male counterparts. Only females reported that discrimination resulted in less women being employed in construction and that men thought they were the only ones who could do all things. Similar proportions of the sample (females) reported that because of discrimination women tended to avoid the sector and were unsure of the career possibilities in construction.

4.2 The impact of the low representation of women

Table 8: Impact of women on skills shortages

Rank	Statement	Sample		Males		Females	
		Mean	SD	Mean	SD	Mean	SD
1	An increasing number of women in construction will contribute to the improvement of skills shortage in the construction industry	3.5	1.1	3.3	1.1	3.8	0.9
2	The low employment of women in construction contributes to the skills shortage in the construction industry	3.2	1.2	3.0	1.2	3.6	1.1

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The sample means suggest agreement on the impact of women on skills shortages. However, female students agreed more strongly that increased numbers of women would reduce the skills shortage and that the low employment levels of women in the sector in fact contributed to the existence of the skills shortage. However, there was a statistically significant correlation albeit weak between gender and student responses to the impact of the low employment of women in construction to the skills shortage in the industry. The Spearman's correlation coefficient of 0.275 at the 0.01 level (2-tailed) suggests that females were more likely to agree that this was the case. Similarly, a correlation coefficient of 0.230 at the 0.05 level (2-tailed) suggests that they were more likely to agree that increased numbers of women in the industry would contribute to a reduction in the skills shortage.

4.3 Relationship between culture, historical background and career choice

Table 9: Relationship between cultural beliefs, career choice and career success

Rank	Question		Yes (%)	No (%)	Unsure (%)
1	Do you believe that cultural beliefs will influence the success of your career in the construction industry?	S	20.6	64.0	14.7
		M	20.3	60.8	19.9
		F	19.6	71.7	8.7
2	Do you believe that the cultural differences between males and females influence their career choice?	S	44.9	42.6	12.5
		M	50.0	35.1	14.9
		F	30.4	58.7	10.9
3	If yes, do you believe that this influence contributes to the low representation of women in construction	S	52.3	31.8	15.9
		M	54.1	23.0	23.0
		F	50.0	40.6	9.4
4	If yes, do you believe that this contributes to the prevalence of discrimination against women who have entered the construction industry	S	45.2	43.3	10.6
		M	42.4	42.4	15.3
		F	48.4	45.2	6.5

As is evident from Table 9 there are no apparent significant differences between the views of males and females on the influence of culture and historical background on their potential career success. However, a greater proportion of females disagreed that cultural beliefs would influence their success (71.7%) and that the cultural differences between the sexes would influence their choice of career (58.7%). While women generally tended to have more negative or positive

views, there were no significant statistical correlations between gender or year of study and responses regarding cultural and background influences.

4.4 Influences behind career choices

Table 10: Influences behind construction career choices

<i>Student statements</i>	<i>Sample (%)</i>	<i>Males (%)</i>	<i>Females (%)</i>
Opportunities	27.2	27.2	11.5
Looking at something I constructed makes me feel good – passion	11.0	8.5	0.0
Fascinated by the beauty of buildings	10.0	13.6	8.6
My background and family members	15.8	15.3	11.5
The fact that there were few women	7.5	0.0	20.0
To challenge the perception that construction is for males	7.5	0.0	22.9
Successful women in construction	2.8	1.7	5.7

Table 10 shows the relative proportions in the sample of males and females who responded to the statements on the influences behind choosing careers in construction. It is evident that males were more likely to be influenced by opportunities in the industry (27.2%), background and family members (15.3%), and fascination with buildings (13.6%). On the other hand, females were more likely to be influenced by the challenge presented by the male-dominant nature of the industry (22.9%) and the paucity of women employed in the sector (20.0%).

Table 11: Influences behind not selecting careers in construction

<i>Statement</i>	<i>Sample (%)</i>	<i>Male (%)</i>	<i>Female (%)</i>
Nothing	27.8	30.8	26.7
Poor working conditions	14.3	15.3	10.0
Poor safety and risk	10.0	11.5	6.7
Money	7.8	7.7	3.3
Discrimination against women	7.7	0.0	13.3
Lack of understanding of career opportunities in construction	6.7	7.7	6.7
Negative image of the construction industry	5.5	5.7	26.7
Lack of employment in construction	4.4	3.8	3.3
Sexual harassment by men	4.4	0.0	6.7

Similarly, Table 11 shows the proportion of the sample by gender who responded to the statements on the influences for not choosing careers in construction. The findings suggest that nothing would

deter both males (30.8%) and females (26.7%) from pursuing careers in construction if that was their choice. However, males were more likely to be deterred by poor working conditions (15.3%) and the poor H&S performance and risk management records (11.5%) of the industry. Females were more likely to be deterred by the negative image of the industry (26.7%), discrimination against women (13.3%), and poor working conditions (10.0%).

Using a three-point scale where 1 = low, 2 = medium and 3 = high, students were asked to rate the influence of careers in other sectors over construction.

Table 12: Influence of career choices in other sectors over construction

Rank	Influence	Sample		Male		Female	
		Mean	SD	Mean	SD	Mean	SD
1	The dangerous nature of the construction work	2.3	0.7	2.3	0.7	2.4	0.7
2	Challenging work environment	2.3	0.7	2.4	0.7	2.3	0.8
3	The inability to work and have influence in a male-dominated industry	2.3	0.7	2.3	0.7	2.3	0.7
4	Male dominance of the industry	2.3	0.7	2.3	0.8	2.2	0.7
5	The seemingly discriminatory environment of the construction industry	2.2	0.7	2.2	0.7	2.3	0.7
6	Knowledge of the construction industry	2.2	0.7	2.2	0.7	2.2	0.7
7	The masculine and unattractive image of the construction industry	2.0	0.7	2.0	0.8	2.0	0.7
8	Career expectations and financial prospects	2.0	0.8	2.1	0.8	2.0	0.7

The results in Table 12 suggest that the challenging work environment, the dangerous nature of construction, the inability to work and influence a male-dominated industry, male dominance of the industry, discriminatory working environment and lack of knowledge of the industry were rated as being medium to high influences on women choosing careers in other sectors instead of construction.

5. Analysis of student survey findings by year of study

The responses of students were further analysed to determine the impact, if any, of the year of study on their responses. However, there were no statistically significant correlations between year of study and student responses save for a weak linear negative relationship between year of study and female students being intimidated by

male students in classes. In this case the Spearman's correlation coefficient of -0.241 at the 0.05 level (2-tailed) suggests that as students progressed through their studies over time females would feel less threatened by the male students in their classes.

6. Professional women survey

The professional women sample consisted of 17 construction industry professional women working in various construction industry organisations at junior, middle and senior management levels.

6.1 The impact of discrimination

The sample was presented with nine statements related to the impact of discrimination on their careers. Their responses are shown in Table 13.

Table 13: Discrimination against women in the construction workplace

Rank	Statement	N	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	Mean	St Dev
1	Women experience discrimination on entering the construction industry	17	0.0	0.0	5.9	47.1	47.0	4.4	0.6
2	Women who work on construction sites are most likely to experience a higher prevalence of discrimination relative to those who work for consulting firms	17	0.0	5.9	17.6	52.9	23.6	3.9	1.2
3	Women experience discrimination in construction and do not experience upward mobility in comparison to their male counterparts	17	0.0	23.5	11.8	47.1	17.6	3.6	1.1
4	Males discriminate against pregnant women in construction	17	0.0	35.3	11.8	35.3	17.6	3.4	1.2
5	My contribution as a professional woman is not regarded as equally important as that of my male counterparts	17	11.8	20.4	11.8	23.5	23.5	3.2	1.4
6	Women who fall pregnant while working in the construction industry experience a higher prevalence to discrimination than those in other sectors	17	0.0	11.8	23.5	35.3	17.4	3.1	1.3
7	Women working in construction do not have the same opportunities to develop as their male colleagues	17	0.0	29.2	23.5	23.5	11.8	2.9	1.2

8	I have experienced discrimination in my workplace	17	5.9	17.6	23.5	35.3	17.7	2.9	1.2
9	The nature of the construction industry poses a threat to the career development of women in construction	17	0.0	41.2	17.6	11.8	29.4	2.1	0.9

From Table 13, it is clear that nearly all the women (94.1%) believed that women experienced discrimination while working in the construction industry. About three-quarters (76.5%) believed that this discrimination was more prevalent on construction sites than in consultancies. In addition, 64.7% agreed that women in construction did not enjoy the same opportunities for upward mobility as their male counterparts. More than half (52.7%) believed that pregnant women experienced discrimination which was more prevalent in construction than in other sectors. More than half (53.0%) of the respondents had experienced discrimination at work. Almost half (47%) reported that their contribution as professional women was not regarded as equally important as that of their male counterparts. In addition, 41.2% believed that the nature of the construction industry posed a threat to the career development of women in the sector.

6.2 The impact of low representation of women

The responses to two questions related to the impact of the low representation of women on the skills shortage experienced by the construction sector are shown in Table 14.

Table 14: Impact of women on skills shortages

Rank	Question	N	Yes (%)	No (%)	Unsure (%)	Mean	SD
1	Do you believe that the Employment Equity Act is addressing the skills shortage in construction?	17	50.0	14.3	35.7	1.9	0.9
2	Do you believe that the low number of women choosing careers in construction contributes to the skills shortage?	17	80.0	20.0	0.0	1.2	0.4

Half (50.0%) of the women believed that the Employment Equity Act was addressing the low representation of women in construction and subsequently the skills shortage in the industry. However, most (80.0%) of them held that despite this legislation low numbers of women in the construction industry exacerbated the skills shortage.

6.3 Influence of culture, nature of industry and career choice

Participants in the study were presented with three statements on the influence of culture and the nature of the industry on the career choices of women. Their responses are shown in Table 15.

Table 15: Cultural beliefs, nature of the industry and career success

Rank	Statement	N	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	Mean	St Dev
1	I would encourage other young women to pursue a career in construction, because I believe that there is a place and a need for females in the industry	17	0.0	0.0	0.0	29.4	70.6	4.7	0.5
2	Women's cultural beliefs and background influence their success in the construction industry	17	5.9	23.5	29.4	11.9	29.3	3.3	1.3
3	My experience within the construction industry confirmed my expectations and beliefs of the industry as being male-dominated and discriminatory towards women	17	0.0	35.4	23.5	35.5	5.9	3.1	0.9

Professional women strongly agreed (mean = 4.7) that they would encourage women to consider careers in construction, as there was a need for more women in this field. However, they were somewhat neutral (mean = 3.3) regarding the influence of their cultural beliefs and background on their prospects of successful careers in the sector. They were somewhat surprisingly neutral (mean = 3.1) about whether their experience in the industry had confirmed their views about the industry being both male-dominant and discriminatory towards women. It is possible that as they gained experience and acceptance in the industry over time they became less sensitive to the male dominance and discrimination.

6.4 Influences behind career choices

It is evident that job opportunities in the South African construction sector driven by government initiatives, their desire to demonstrate their ability to compete equally with men in a male dominated

industry, availability of bursaries, influence of family and opportunities for financial independence were regarded as influences in choosing careers in construction.

Comments by women included, *inter alia*,

'I wanted to prove that women are strong and are capable of handling the harsh realities of construction activities'

'The fact that women are taken as powerless and unable to do what men can do. I want to be independent as an African woman who can do things without having to depend on male counterparts'

'I was attracted by non-formal clothing, the fact that work on site was not office-based, and jobs are constantly changing'

7. Student views versus professional women views

The findings suggest that experience of the industry by professional women tempered their views relative to the industry itself when compared with the responses of students. The findings suggest that there might be a relationship between the perceptions held by the female students about their success in construction and their experience of the sector. The responses of the professional women working in the construction industry suggest that this prospect is likely. Similarly, the experience of women in the industry suggested that as they gained more experience and acceptance in the industry they were able to hold their own and develop more realistic views of the nature of the sector.

8. Discussion

Despite government efforts to increase the participation ratio of women in construction, bodies such as the South African Women in Construction (SAWiC) and Construction Industry Development Board (CIDB) suggest that while there have been increases these have been marginal and at the lowest end of the CIDB contractor grades. Table 16 shows the respective CIDB contractor grades.

Table 16: CIDB contractor grading and breakdown of registered contractors

<i>Contractor grading designation</i>	<i>Maximum value of contract</i>	<i>Total</i>	<i>Women owned</i>	<i>% of Total</i>
1	R200,000	67,119	32,593	49
2	R500,000	4,735	2,206	47
3	R1,500,000	1,271	600	47
4	R3,000,000	1,718	692	40
5	R5,000,000	1,096	407	37
6	R10,000,000	877	274	31
7	R30,000,000	435	94	22
8	R100,000,000	121	10	8
9	No limit	119	1	1
Total		77,491	36,877	48

Source: CIDB, 2003: online

The CIDB register of contractors has 77,491 construction enterprises of which 48% are owned by women, namely 36,877. However, 88.4% of these enterprises fall within the lowest category of registration, namely grade one. An additional 7.6% are in grades two and three. Only 4% are registered in grades four and higher. Only ten contractors are registered in grade 8. It is likely that the low numbers of qualified women entering the industry contributes to the lack of women-owned contractors in the higher grades of the CIDB register.

The survey of industry stakeholders confirmed that most construction firms employed small numbers of women per annum in their organisations. These women were mostly employed to perform secretarial and administrative roles. Where they were employed on construction sites they were typically employed at the level of labourers, suggesting that women were regarded to be more suited to administrative than production functions on site. Female students, in particular, opined that women on construction sites were not respected to the same extent as men, and were intimidated by there being more male professionals in the industry. There is evidently a need for women to review their own professional roles and accept themselves as competent professional women in their own right.

Nearly all the respondents reported that females were afforded the same rights, benefits and opportunities as males in their organisations, had separate facilities such as toilets and ablutions and were afforded equal advancement and promotion opportunities. However, substantially less reported that there was available funding targeted at improving the status and qualifications of female

employees, written gender equity policies in place, and gender-based educational material provided. These findings suggest a lack of visible and tangible commitment to empower women in their organisations.

Perceived or real discriminatory practices impacted negatively on career choices by women in construction. Arguably, if jobs or work climate were developed to provide a more desirable work environment devoid of overt and covert sexism and racism and inflexible working structures, an increase in the numbers of women attracted to work in construction would likely result. The current situation results in large reserves of skill and talent remaining untapped. The study found that increasing the numbers of women in the sector would reduce the skills shortage and that the low employment levels of women in the sector in fact contributed to the existence of the skills shortage. However, Dainty, Bagilhold, Ansari, & Jackson (2004) suggest that women have a poor initial understanding of the culture of the industry and the inherent difficulties of working in a male-dominated and -oriented environment. The findings of the study supported the view that there was a general lack of knowledge by women of the industry itself and the career opportunities offered by it, suggesting that there might be a relationship between knowledge of the construction industry and the choice of careers in construction.

The study found no significant differences between the views of males and females on the influence of culture and historical background on their career success. Contrary to common belief, cultural beliefs and backgrounds were not major influences on women's career choices. However, females agreed more strongly that neither cultural beliefs would influence their success nor the cultural differences between the sexes would influence their choice of career. Given the challenging work environment, dangerous nature of construction, inability to work and influence a male-dominated industry, male dominance of the industry, discriminatory working environment and lack of knowledge of the industry women were more likely to choose careers in other sectors instead of construction.

Women tended to believe that legislation such as the Employment Equity Act created the platform for addressing the low representation of women in construction. However, most of them held that despite this legislation there continued to be low numbers of women in the construction industry that exacerbated the skills shortage. Evidently, more than merely legislation is needed.

The study findings suggest that it is possible that, as they gained experience and acceptance in the industry over time, women became less sensitive to male dominance and discrimination. The study also found that women in construction did not enjoy the same opportunities for upward mobility as their male counterparts. Pregnant women experienced discrimination which was more prevalent in construction than in other sectors and many women had themselves experienced discrimination at work. The contribution of women as professionals was not regarded as equally important as that of their male counterparts. Clearly, the current nature of the construction industry posed a threat for the career development of women in the sector.

9. Conclusion

The findings of this study confirm the gender bias that still exists within the South African construction sector. The male-dominant nature of the industry accompanied by gender-based discriminatory practices experienced by women employed in the industry are challenges that need to be overcome if increasing numbers of women are to choose careers in construction. Legislation by itself is insufficient to boost the present low numbers of women and significantly reduce the skills shortage that their increased employment will produce. The overall poor image of the industry presents as a further inhibitive factor to women choosing to work in construction. The industry needs to make a more visible and tangible commitment to empowering women at all levels in their organisations by providing equal opportunities for women. Gender relations need to change. Access to construction education needs to be widened and the specific barriers, image and culture addressed. However, it is also necessary for women to review their own roles and accept themselves as competent women in the industry in their own right.

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Client attitude to health and safety – A report on contractor’s perceptions

Peer reviewed

Abstract

The purpose of this article is to present findings of a preliminary survey on contractors' perceptions of clients' attitude relative to health and safety (H&S) implementation in the construction industry of Botswana and Southern Africa.

A questionnaire survey was conducted on construction projects to establish clients' attitude towards H&S. Interviews were also held with contractors' representatives on selected construction sites in and around Gaborone, Botswana.

Findings from the survey include: clients do not perceive H&S to be very important on construction projects; the majority of clients do not address H&S adequately in contract documentation, and H&S is rarely a major item on the agenda of progress meetings. Findings also included that clients are not fully committed to H&S implementation. The client sets the tone for H&S culture. Client attitude is therefore very important for H&S performance improvement as all stakeholders are compelled to act in line with the client's values.

Various researchers have recognised the importance of the client to H&S performance improvement. The extent to which clients are involved in H&S implementation has, however, not been researched extensively, especially in Southern Africa. This article therefore provides an insight into the clients' attitude towards H&S and explains the reason for the current state of H&S in Botswana's construction industry.

Keywords: Attitude, Botswana, client, construction, health and safety

Abstrak

Die doel van hierdie artikel is om bevindings weer te gee van 'n voorafopname oor kontrakteurs se persepsie oor kliënte, houding teenoor gesondheid en veiligheids- implementering in Botswana se konstruksie-industrie en op 'n manier ook die houding daarvan in Suidelike Afrika.

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'n Vraelysopname is saamgestel oor konstruksieprojekte om te bepaal wat kliënte se houding is teenoor gesondheid en veiligheid. Onderhoude is gevoer met kontrakteurs se verteenwoordigers van geselekteerde terreine in en om Gaborone, Botswana.

Bevindings van die opname sluit in: kliënte ervaar gesondheid en veiligheid nie as baie belangrik by konstruksieprojekte nie; meeste kliënte spreek nie gesondheid en veiligheid in kontraktdokumentasie aan nie, en gesondheid en veiligheid is selde 'n besprekingspunt op vorderingsvergaderings se agendas.

Verskeie navorsers erken die belangrikheid van die kliënt vir gesondheid en veiligheidsverbetering. Die mate waartoe kliënte betrokke is in gesondheid en veiligheids-implementering is nog nie intensief in Suidelike Afrika nagevors nie. Daarom verskaf hierdie artikel insig tot die kliënte se houding teenoor gesondheid en veiligheid en verduidelik in 'n mate die rede vir die huidige stand van gesondheid en veiligheid in Botswana se konstruksie-industrie.

Slutelwoorde: Houding, Botswana, kliënt, konstruksie, gesondheid en veiligheid

1. Introduction

The construction industry is an important sector to most economies and Botswana is no exception. In the United Kingdom (UK), for example, the construction industry contributes approximately 8% to the Gross Domestic Product (Bomel, 2001: 2.1). In Botswana the construction industry contributes approximately 7% to GDP (World Bank, 2008: Online). The construction industry has also been growing at a high rate with a development expenditure estimated to be well over hundreds of billions of Dollars at least for the next ten years. For the financial year 2008/2009, the construction sector recorded growth of 12% (Benza, 2008: Online). It is worth noting that in this part of Africa infrastructure is becoming more complex compared to the past years and this will inadvertently cause many challenges for H&S.

The construction industry is said to be dominated by a large number of small and medium-size contractors. This scenario is perceived to have arisen from an increasing reliance on subcontractors by larger firms (Bomel, 2001: 2.4). Research shows that small firms have proportionately more accidents and injuries than large firms (Bomel, 2001: 0.7, Smallman, 2001: 404). An increase in smaller contracting organisations and in complexity of infrastructure inadvertently pose a challenge to managing health and safety in the construction industry. It is believed that risks to H&S increase with a low level of awareness and lack of training (Bomel, 2001: 8.42).

Research conducted in Botswana revealed that the level of H&S awareness in the construction industry is low; H&S legislation is not complied with; the management of contractors is not committed

to H&S implementation; there is a lack of H&S management systems, procedures, and protocol, and clients and designers do not adequately participate in the implementation of H&S (Musonda & Smallwood, 2005: 61). A similar study conducted by Van Ooteghem (2006: 49) revealed that occupational accidents and fatalities continue to be recorded in Botswana. Between 2000 and 2003, a total of 251 occupational fatalities were registered with the workmen's compensation authority from all sectors (Van Ooteghem, 2006: 49). 96 accidents in the construction sector alone were registered with the workmen's compensation during the same period. It is totally unacceptable to allow this status quo to continue considering the contribution construction makes to the economy, the amount of labour force that is at risk, the anticipated complexity of projects to be implemented, the human suffering and the people who continue to face H&S risks. This serves as the motivation for this study.

The need to find solutions to improve the above issue and to work at building a better H&S culture in the construction industry is now just as compelling as previously.

This article proposes that, although safety is everyone's business, improving H&S performance could be realised with the right attitude by the client to H&S. Clients set the tone for H&S.

2. Background

2.1 Client role

Striving for a better H&S performance will remain elusive if the client is not actively involved in H&S implementation, especially in Southern Africa. Huang & Hinze (2006a: 165) rightly argue that the involvement of clients (owners) is an essential requirement for the zero injuries objective. The importance of the client to H&S management is well documented. Construction H&S can be successfully influenced by clients (Smallwood, 1998: 182; Lingard, Blismas, Cooke & Cooper, 2009: 132; Bomel, 2001: 9.7)

Suraji, Duff & Peckitt (2001: 339) contend in their article on accident causation that construction accidents are caused by inappropriate responses to certain constraints and the environment. They observed, for example, that the client responses are the actions or omissions in response to constraints that emerge during the development of the project scope. According to them, these include reducing

the project budget, adding new project criteria, changing project objectives, and accelerating the design or construction efforts of the project. All these factors impact negatively on H&S.

Clients have a positive role to play in lowering injury rates (Smallwood, 1998: 188; Huang & Hinze, 2006b: 180)

2.2 Client attitude

Clients' attitude can be deduced from the extent to which they are involved in the management of H&S. Until now, as Smallwood (1998: 185) observed, the major agencies of client influence have been prescriptive, regulatory or coercive measures as opposed to upstream proactive measures such as design, detail and specification and more importantly prioritisation.

Clients can be seen to be more involved by, for example, setting H&S objectives, selecting suitable contractors in terms of H&S, and participating in H&S management (Huang & Hinze, 2006a: 165). Smallwood (1998: 182) outlines further responsibilities for clients and contends that they should:

- Provide financial support;
- Include H&S as a prequalification criteria;
- Schedule H&S requirements prior to bidding process;
- Structure contract documentation to allow for H&S, and
- Conduct audits in H&S.

One of the areas in which clients can show leadership and attitude to H&S is by conducting periodical audits. Auditing, if properly done, has many benefits for the implementation of H&S. According to Thompson IV (1999: 833), successful auditing provides a methodical and comprehensive approach to the H&S programme analysis. Auditing also identifies new areas of concern as the programme and project evolve. It is clearly an essential activity for the client to undertake and tells of their attitude to H&S in construction.

In order to show commitment, clients should input adequate resources into construction H&S instead of relying on contractors (Huang & Hinze, 2006b: 180). Successful implementation of H&S also depends on the extent to which construction-project clients participate and assign resources to the process.

H&S performance improvement depends on the extent to which construction-project clients provide leadership on H&S matters. Loosemore, Lingard, Walker & Mackenzie (1999: 884) identified the

importance of this and contend that the lead must come from clients themselves. They maintain that without this, the construction industry has a long way to go in changing attitudes towards H&S. Levitt & Samuelson (1993: 215) also argued that monitoring which is one of the activities in providing leadership, makes a difference, and that excellent H&S performance can be obtained with the active participation of clients, even from average contractors. If the clients are taking the lead, they must know exactly what is required to develop a detailed comprehensive brief for the design team and to issue H&S specifications. In addition, as suggested by Suraji, Sulaiman, Mahyuddin & Mohamed (2006: 55), clients have the moral if not the legal duty to take reasonable care to ensure the safety of all workers on the construction site. The client should also carefully consider H&S control in ordering works, exercising supervision, and providing instructions. As Huang & Hinze (2006b: 181) correctly put it, clients set the safety culture tone for a project.

2.3 Client interventions

Successful implementation of H&S also depends on the extent to which construction-project clients participate in the process (Loosemore *et al.*, 1999: 884). Leadership on H&S must come from clients. Without this the construction industry has a long way to go in changing attitudes towards health and safety (Loosemore *et al.*, 1999: 884). Monitoring is one intervention whereby the client can make a difference (Levitt & Samuelson, 1993: 215). The client must also take responsibility for preventing accidents He/she should carefully consider H&S control in ordering works, exercising supervision, and providing instructions (Watanabe & Hanayasu, 1999: 60).

Several ways have been identified whereby clients could participate in the process. Thompson (1999: 835) identifies auditing as one such activity that the client could undertake in order to participate fully in the process of H&S implementation. The list below as suggested by Thompson (1999: 835) outlines some of the areas in which the client could be involved by auditing construction projects:

- Management commitment
 - Includes management's demonstration of examples of safe and healthful behaviour and company resources allocated to the H&S programme.
- Employee involvement
 - An example is investigation of procedures for reporting injuries.
 - Interviews with employees could reveal this.

- Work site hazard assessment
 - Through observations of sites.
- Hazard prevention and control
 - Evidence of PPE and control measures in place.
- H&S training
 - Audits consider how, when, why and where it is done and whether employees understand why they do and practise H&S.

3. Research methodology

This quantitative study was aimed at determining contractors' perceptions of the clients' level of commitment to H&S in construction projects. The reason for using this method is that it is easier to formulate an opinion without bias on specific information that is under consideration because the quantitative study and paradigm is based on positivism (Sale, Lohfeld & Brazil, 2002: 44). Although this method does not accommodate respondents' opinions as they are restricted in the way they answer the questions, the method was deemed to be appropriate for the type of study at hand: to measure contractors' perceptions of clients on H&S. The survey instrument was therefore designed to be able to capture clients' actions and contractors' perceptions of the clients' level of commitment to H&S. It was decided that questionnaires to contractors' project managers on construction sites coupled with physical observations constituted the best method to conduct the research because of the type of data that was to be obtained.

As one of the research tools used in quantitative research (Sale *et al.*, 2002: 45), questionnaires were preferred to face-to-face interviews because respondents find it easier to answer questionnaires in privacy and in their spare time. On the negative side, the response rate to questionnaires is said to be lower. Questionnaires are also a good way of obtaining information because it is relatively cheap and less time-consuming.

The questionnaire was designed to address, among other areas, the clients' level of participation or commitment to H&S on construction projects. Both open-ended and closed types of questions were used. Care was taken to avoid bias by providing for alternative responses by related and preceding closed questions. Respondents were asked to 'state or specify'. Closed questions were placed before open-ended questions. Rating scales based on the five-point Likert scale were used for respondents to mark the level of importance, frequency, or severity.

On the clients' level of commitment, the evaluation was conducted by means of the following questions:

- Evidence of clients' active participation and influence, as evident in the client project meetings, by establishing whether H&S was a major item on the agenda. The reasoning behind the question is that committed clients on H&S would ensure that H&S was at least a major item on the agenda in every project meeting they attended.
- Respondents' view on how clients and designers regarded H&S in relation to other factors on a construction project.
- The purpose of the third question was to identify the respondents' opinion on how H&S could best be improved; client and designer participation was also included to assess whether respondents deemed these important.
- The extent to which clients and designers address H&S in contract documents. The argument is that ultimately the client has a final say on the type of contract and budget.

Apart from using questionnaires to collect information on client commitment and attitude, physical observations on projects in the sample were made. In order to determine site behaviour displays, in other words, the actions of people and by extension what the clients condone, a checklist was developed to capture and learn about people's actions as well as visible signs of H&S implementation. According to Leady & Omrod (2001: 197), checklists and rating scales are used to facilitate both the evaluation and quantification of behaviours. A checklist was preferred to rating scales in that specific behaviours, characteristics and signs were identified in literature and from legislature and were sought on site. It is easier to check whether each item on the checklist is observed, exhibited, present or true; or else not observed. The checklist was completed on all construction sites visited by the researcher.

The checklist's section relating to clients' commitment and attitude aimed at evaluating the implementation of legislature. The reasoning behind the foregoing is that if clients were at all concerned about anything on H&S; it would be at least that all legal requirements on their projects are met. Visible signs sought included the behaviour of workers on site and the artefacts at the construction sites, such as safety warning signs, housekeeping, etc.

This methodology was considered appropriate as the only way to check for consistency and to provide a talking point on the relationship between responses from questionnaires and what was actually observed on construction projects.

3.1 Analysis of data

The primary data obtained from questionnaires and physical observations by using checklists was analysed using MS Excel spreadsheet package and interpreted relative to secondary data obtained from the literature review. From observations and responses, inferences were drawn concerning the larger and general practice relative to client commitment and thus their attitude towards H&S.

The calculation of an importance index was also done to establish the perception on the order of importance of H&S relative to other aspects on a construction project. The importance index was calculated by computing the total of all weighted responses and then relating it to the total responses on a particular aspect. The weights were assigned to each response ranging from one to five for the responses of 'not important' to 'very important'. The weighting was allocated as presented in Table 1. The weighting was developed based on the Likert scale of 1-5. Computation of the importance index was done with the following formula:

$$\text{Importance index} = \frac{5\alpha_1 + 4\alpha_2 + 3\alpha_3 + 2\alpha_4 + 1\alpha_5}{\Sigma\alpha}$$

Table 1: Opinion weighting on the level of importance

<i>Opinion</i>	<i>Responses</i>	<i>Weighting</i>
Very important	α_1	5
Important	α_2	4
Fairly important	α_3	3
Slightly important	α_4	2
Not important	α_5	1

3.2 The population

The selection of the sample was based on the following:

- Number of registered building contractors who were undertaking projects in Gaborone, Botswana at the time of the study.
- Limitations of time and financial resources. Therefore the study could not be extended to other regions in the country.

A survey was conducted before the study and it was determined that there were about 47 active building construction sites in and around Gaborone. It is recommended that, for small populations of less than 100, there is little point in sampling (Leady & Ormrod, 2001: 221). Based on the above, it was decided that the entire population should be included in the study. Anecdotal evidence from other studies shows that questionnaire response rate is approximately 50 to 70%. Based on the above, it was determined that at least 21 respondents would be realised.

The study excluded construction sites for private homebuilders and civil engineering contractors. The justification for this delimitation was the time limit, resources, and the difficulty in obtaining information, especially from private homebuilders. Private homebuilders usually have trades foremen as site managers and the directors also act as project managers. Collecting information from private homebuilders was thus considered problematic and would have required more time.

For the sample to be representative, it was determined that at least all categories of contractors should be represented in the study. The Public Procurement and Asset Disposal Board (PPADB) categorisation is based upon five categories: for projects worth up to USD100,000.00, between USD100,000.00 and USD200,000.00, between USD200,000.00 and USD800,000.00, between USD800,000.00 and USD2,000,000.00 and the last category is for projects worth more than USD2,000,000.00 also referred to as the unlimited category.

Although there were 47 active construction sites at the time of the study, questionnaires were only sent to contractors on 40 construction sites. The reason for this is that some contractors had more than one construction site and there was a need to include at least all the categories of contractors as each category would have a different client profile. Four categories contributed eight contractors each. The only exception was the fifth and the lowest category which only had five building construction sites at the time. In order to make up the numbers, three more construction sites from other categories were randomly selected to the category to make eight contractors. Although some building contractors were working on more than one construction site, only one site was selected for each building contractor. Table 2 provides a summary of the sample stratum.

Questionnaires were addressed to project managers, site engineers, and site agents depending on whether they were the overall manager in charge of the construction site. These were deemed to be the right people as they are based on site and are able to relate what actually transpires on projects. This group was viewed

as having sufficient knowledge and being impartial relative to top management and the actual practice on sites. It was also considered that this group would give an unbiased view of the client on their actions relative to their involvement in H&S implementation. Site observations were conducted on all 40 construction sites. Checklists were used to record or tick off the observed elements on sites.

3.3 Response rates

In total, 40 questionnaires were distributed to building contractors, of which 25 were completed and collected by the researcher. This equates to a response rate of 62.5%. Response rates for all categories are shown in Table 3.

Table 2: Sample stratum

Category	Value in USD	Construction sites	Questionnaires distributed	Observations
OC	< 100,000.00	5	5	5
A	>100,000.00< 200,000.00	11	8	8
B	>200,000.00< 800,000.00	10	8	8
C	>800,000.00<2,000,000.00	8	8	8
D & E	>2,000,000.00	13	11	11
Total		47	40	40

Table 3: Questionnaire response rates

Category	Value in USD	Response (No.)	Response rate (%)
OC	< 100,000.00	1	20.0
A	>100,000.00< 200,000.00	3	37.5
B	>200,000.00< 800,000.00	8	100.0
C	>800,000.00<2,000,000.00	6	75.0
D & E	>2,000,000.00	7	63.6
Total		25	62.5

4. Findings

Respondents were asked in question one how frequently H&S audits and inspections were conducted by clients and other key stakeholders. With respect to clients, 56% of the respondents indicated that clients had 'never' conducted H&S audits and inspections, and 28% 'rarely'. The above compared to 40% of the respondents who indicated that contractors' top management 'never' conducted H&S audits and inspections, 36% 'rarely', and 20% 'often' (Table 4)

showed slightly more commitment by contractors than clients. Results also show that 24% of the respondents indicated that contractors' top management conducted inspections compared to the 8% for the clients. Only 8% of the respondents indicated that clients 'often' conducted audits and inspections. None of the respondents indicated that clients 'always' conducted audits and inspections. Clients' leadership on H&S can also be noted in the supervising consultants' conduct on H&S because supervising consultants are directly answerable to clients. From the results in Table 4, it can be inferred that clients' leadership on H&S and thus their attitude is questionable as over 50% of the respondents indicated that supervising consultants never conducted H&S audits and inspections. It follows therefore that consultants who are appointed by clients and receive instructions from them do not conduct inspections or audits because the clients do not tell them or remind them to do so probably because H&S is not a priority to them. The above may probably confirm the respondents' perception that clients consider cost, time and quality to be more important than H&S (Table 6).

Table 4: Frequency of audits and inspections by all stakeholders

Entity	Response (%)				
	Never	Rarely	Sometimes	Often	Always
Contractor top management	40.0	36.0	0.0	20.0	4.0
Client	56.0	28.0	8.0	8.0	0.0
Supervising consultants	52.0	20.0	16.0	12.0	0.0
Factories inspector	56.0	32.0	8.0	4.0	0.0
Civil organisations	84.0	4.0	8.0	4.0	0.0

Apart from inspections, site project meetings are important events where all issues regarding H&S can be raised and discussed. To indicate the extent of participation by clients and designers or supervising consultants, the position they accord to H&S on the agenda of project site meetings was used for measurement. This is all the more true because they mostly visit the sites at the time of these meetings. Question two, therefore, sought to determine whether H&S was a major item on the agenda item of client progress meetings. Approximately 28% of the respondents indicated that H&S was an important item on the agenda and 72% that it was not (Table 5).

Table 5: Status of H&S in progress meetings

Response	(%)
Yes	28.0
No	72.0
Unsure	0.0
Total	100.0

It was deemed that contractors would best describe clients' attitudes towards H&S. This would, in turn, explain the level of commitment by clients. Therefore, contractors were asked to rate the importance of various aspects to clients on projects. The contractors perceived that clients regarded remaining within budget as the most important, followed by contract period. Quality and avoiding litigation were ranked third and fourth, whereas H&S was identified as the least important (Table 6).

Table 6: Perceived importance of H&S according to clients

Aspect:	Response (%) 1 = not important, 5 = very Important					Importance index	Rank
	1	2	3	4	5		
Budget	0	0	4	16	80	4.76	1
Contract period	0	0	12	20	68	4.56	2
Quality	0	8	8	16	68	4.44	3
Avoid litigation	4	12	4	24	56	4.16	4
H&S	24	48	16	8	4	2.20	5

In an endeavour to further establish the extent to which clients participate in H&S, respondents were asked whether, in their opinion, contract documents always addressed H&S implementation. The reasoning behind this question was that one way in which clients would definitely participate in H&S implementation is by allowing and addressing it in the contract documents. Approximately 71% of the respondents indicated that H&S was addressed and 29% stated that it was not addressed. A follow-up question to check the validity of these responses was posed. The responses ranged between 'not being addressed' and 'being fairly addressed'. Only 4.2% and 8.3% of the respondents, respectively, indicated that H&S was 'addressed' and 'fully addressed' in the contract documents (Table 7).

Table 7: Extent to which H&S is addressed in contract documents

Scale	Extent	Response (%)
1	Not addressed	25.0
2	Slightly addressed	29.2
3	Fairly addressed	25.0
4	Addressed	4.2
5	Fully addressed	8.3
	No response	8.3
	Total	100.0

One of the other areas in which clients could show commitment and leadership and thus their attitude towards H&S is in insisting and ensuring that contractors have safety programmes in place. Respondents were therefore asked whether they had an H&S policy, procedures, programmes, meetings, representatives, and documented work procedures on their projects (Table 8). More than 50% of the respondents indicated that they never had any of the above. Between 20% and 30% of the respondents indicated that they had whereas less than 10% of the respondents were not sure.

Table 8: Existence of H&S programme elements

Element	Response (%)			
	Yes	No	Unsure	No response
H&S policy	20.0	64.0	4.0	12.0
H&S procedures	28.0	60.0	0.0	12.0
H&S programmes	4.0	64.0	8.0	24.0
H&S meeting	20.0	64.0	0.0	16.0
H&S representatives	12.0	68.0	4.0	16.0
Documented work procedures	32.0	56.0	0.0	12.0

Specifically, 64% of the respondents responded in the negative relative to having the required elements of a management system.

In order to further determine whether the requirements of the legislation were being complied with, respondents were asked to state whether they had a copy of the Factories Act and whether an abstract of the Act was displayed in a prominent place on site as per the Act's requirement. 52% of the respondents indicated that they had a copy of the Act, but only 23.1% of these indicated that they had displayed the abstract in a prominent place on site. This equates to 76.9% of the respondents not following the requirements of the Act. 32% of the respondents indicated that they did not have a copy and 16% indicated that they were not sure.

However, physical observations concerning the above revealed that only one contractor, representing about 2.5% of the 40 sites, had displayed the Act. This indicates untruthfulness on the part of the respondents even though it was clear that the Act was not displayed on sites. It was also thought that if clients had the right attitude towards H&S, they would have picked up this basic requirement. Notwithstanding the above untruthfulness, even the 23% response is an indication of the general practice in construction and reflects the clients' attitude towards H&S. Results of the physical investigations reveal that all health, safety, and welfare provisions of the Act are not adhered to.

On almost 70% of the sites, slightly less than half of the workers on site were working in hazardous areas without hard hats. On 96% of the sites workers did not wear eye protection in areas or on tasks that required eye protection, and 91.3% of the sites had no protection against falling objects and/or persons.

5. Discussion

Given the aforementioned, it can be concluded that the contribution by non-contractor stakeholders, specifically clients, is not significant. Such stakeholder input and commitment is cardinal and essential to H&S performance improvement and describes the clients' attitude towards H&S. The respondents' ratings of the perceived importance of H&S to clients reveal the extent to which the client is committed and their attitude to H&S. Relative to cost, time, quality, and avoiding litigation, clients consider H&S to be the least important aspect on a construction project. The attitude appears to be wrong in this instance and it can be argued that this influences H&S performance in construction.

Based upon clients' attitudes and actions, respondents perceived that clients did not consider H&S to be important. Responses relative to whether H&S was a major item on the agenda of client progress meetings validates the perception rating - nearly 71% of the respondents mentioned that H&S was not a major item on the agenda. Client progress meetings are an important event during a project as all stakeholders are required to attend such meetings on site. They are also a forum where progress is evaluated and problems on site are discussed. If clients had the right attitude and were committed to H&S, H&S could have been a major item on the agenda. Standard contract documentation does not reflect clients' commitment to H&S. Although 70% of the respondents stated that H&S was addressed in contracts, only 8% indicated that

it was extensively addressed. On average, 26% of the respondents stated that it was either not addressed, slightly, or fairly addressed. A positive attitude towards H&S by the client would have influenced a different perception by respondents especially regarding the rating of H&S among other traditional project parameters.

6. Conclusion

It can be concluded that participation and commitment by clients to H&S is low, thus describing their attitude towards H&S as negative because of the following:

- Clients and even designers never or rarely conduct H&S audits and inspections.
- H&S is not regarded as a major item on the agenda of clients' progress meetings; approximately 72% of the respondents indicated this, and only 28% indicated that H&S was regarded as a major item on the agenda. Clients influence project progress meetings. The right attitude would therefore have elicited higher percentages of respondents indicating that H&S was a major item on the agenda.
- According to contractors, clients and their agents, designers, considered H&S to be the least important aspect on a construction project. It follows that, if clients perceive the importance of H&S to be low, their attitude is not positive towards H&S. In fact, avoiding litigation and quality were rated higher than H&S.

Clients set the H&S tone for construction projects. Their attitude therefore exerts a great influence on the performance of H&S, especially among smaller national contractors. Improving or addressing clients' attitude would greatly contribute to the improvement of H&S in the sector. However, the question arises as to this can be achieved?

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Tinus Maritz & Andries Schutte

The calculation of acceleration costs on construction projects

Peer reviewed

Abstract

A lack of understanding often exists between contractors, client organisations and consultants as to what may, and what may not, be included in acceleration claims on construction projects. The aim of this article is to create a better understanding of the complexity of acceleration claims. It should also lead to new insights into claim procedures and the substantiation of acceleration costs. The impacts and delays which may result in acceleration claims on a project were analysed as they form the basis for establishing liability in terms of a particular contract. Matters of principle that are applicable to acceleration claims, regardless of the form of contract recommended for use in the South African construction industry, were also examined.

The findings indicate that there are significant differences on a number of aspects regarding the calculation of acceleration costs on construction projects between contractors, consultants and employers/developers. The majority of the respondents, however, were of the opinion that of the various methods used for calculating acceleration costs, the time impact analysis is most frequently applied, but that the modified total cost approach is the method most suitable on projects where there is a significant increase in the scope of work, something that occurs regularly on construction projects.

Keywords: Construction, delays, acceleration, claims, float, critical path

Abstrak

Daar is dikwels onsekerheid by aannemers, kliënte-organisasies en konsultante oor wat mag, en wat mag nie, in versnellingseise op konstruksieprojekte ingesluit word. Die doel van hierdie artikel is om 'n beter begrip rakende die kompleksiteit van versnellingseise te bewerkstellig. Die artikel behoort ook te lei tot nuwe insigte oor die prosedures vir eise en die substansiëring van versnellingskoste. Die oorsake en verdragings wat aanleiding gee tot versnelling op 'n projek is ontleed aangesien dit die grondslag vir die bepaling van aanspreeklikheid ingevolge 'n spesifieke kontrak vorm. Belangrike prinsipiële aspekte wat op versnellingseise betrekking het, ongeag die kontrakvorm wat in die Suid-Afrikaanse konstruksiebedryf vir gebruik aanbeveel word, is verder ondersoek.

Die bevindinge dui daarop dat daar tussen aannemers, konsultante en kliënte/ontwikkelaars aansienlike verskille op verskeie aspekte bestaan met betrekking

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tot die berekening van versnellingskoste op konstruksieprojekte. Meeste respondente was egter van mening dat die "time impact analysis"-benadering die meeste toegepas word, maar dat die "modified total cost"-benadering die mees geskikte metode is op projekte waar daar 'n beduidende toename in die omvang van werk is, iets wat dikwels op konstruksieprojekte voorkom.

Sleutelwoorde: Konstruksie, verdragings, versnelling, eise, vlot, kritiese pad

1. Background

1.1 Delay classification and claims for acceleration costs

Sanders & Eagles (2001: 3) define a delay as an event that results in an extension of the time necessary to complete all or part of a project. Halvorson (1995: C&C.1.1) indicates that the contractor's right to recover increased performance costs as a result of acceleration depends on the type of delay that reduces the performance period.

He classifies delays as follows:

- Nonexcusable delay;
- Excusable delay;
- Compensable delay, suspension and disruption;
- Imposed milestone, and
- Concurrent delay.

Constructive acceleration occurs in the absence of owner-directed acceleration. The employer's refusal to grant an acceleration order or extension of time (EoT) for excusable delay will result in an acceleration effort by the contractor in order to complete the project on the contractual completion date.

The construction industry in the United States of America (USA) has become accustomed to the concept of a constructive acceleration order. Davison (2003) points out that the refusal to grant EoT for excusable delay in the USA is normally converted into an implied instruction to accelerate. In South Africa, however, the situation is somewhat different as indicated hereinafter.

The approach under English law, as pointed out by O'Reilly (2007), is that if there is no express authority in the contract to accelerate, then no entitlement arises to claim extra costs for acceleration. O'Reilly (2007) further states that the only exclusion is where the certifier is expressly empowered under the contract to order acceleration on the employer's behalf. Therefore, the refusal to grant an EoT

cannot amount to a “deemed” instruction to accelerate. A claim for constructive acceleration under English law must be based on the ordinary principles for breach of contract and damages.

The conditions of contract recommended for use in South Africa (the NEC, FIDIC, JBCC and GCC) all make use of different definitions and/or attach different interpretations to the term ‘acceleration’, while some do not address the issue at all. The meaning of acceleration as used by the NEC is to bring the completion date forward, which differs from the usage in the FIDIC where acceleration means speeding up the work to ensure that the completion date is achieved. The JBCC does not refer specifically to acceleration, whereas the GCC provides for acceleration in its clause 40.3, but without defining it anywhere.

For the purpose of this article acceleration is defined as the execution of outstanding contract work within a shorter time than originally planned to mitigate the extension of time that the contractor would have otherwise been entitled to.

1.2 Methods to calculate acceleration costs

Loots (1995: 777) argues that there is no hard and fast formula for calculating acceleration costs. He emphasises that each situation should be individually assessed to determine what costs were sustained in the attempt to buy back time. Davison (2003) points out that specific methods or a combination of methods which can be used to calculate acceleration costs exist. These are:

- The global or total cost approach;
- The modified total cost approach;
- The time impact methodology;
- The measured mile approach, and
- Formula approaches.

Claims in construction contracts very often result from the lack of a good control system. If there is no control system that can effectively register every change that occurs during the project execution, disputes are likely to emerge. The contents of a claim can be checked against Sotelo & Del Mercado's (1993: G.5.6) content checklist.

The checklist is compiled as follows:

- A summary of items and amounts to be claimed;
- Documents that support the claim;

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- A detailed analysis of how the amounts were calculated, and
- Legal and contractual support.

Each standard form of contract has its own detailed requirements regarding record-keeping, document control, notices, *etc.* The prime source of information for any claim between the parties is the contract and the specific requirements contained therein. The process of keeping project records should start during the tender process. Tender documents are often used in disputes to help substantiate the costs that a contractor expects to incur on the project. Other project records such as project cost reports, daily logs and progress reports, daily payroll records, site instructions and related support documentation, minutes of meetings, project correspondence, documentation of design changes, photographs, *etc.* will be vital in substantiating an acceleration claim.

1.3 Float ownership

Float utilised efficiently by the employer and contractor can reduce the negative impact that acceleration or EoT may have on a project considerably. In the critical path method of scheduling, the time difference between the earliest finish and the latest finish of an activity is called total float. Employers in the construction industry are inclined to believe that all float exclusively belongs to the party who is defined as the employer to the particular contract. Contractors, on the other hand, are generally of the opinion that all float belongs to them as they have prepared the detailed programme and have allowed extra time and/or float for activities where high risks are involved (De Leon, 1986: 12). Float is then regarded as a saleable resource belonging to the contractor. Another school of thought is that float should belong to the project and not a specific party to the contract. Float will then be used on a first come, first serve basis. However, this solution may be regarded as being biased towards the employer as he absorbs float over which he has no influence over and which he has not earned.

2. Motivation for the study

The study attempts to define the views, opinions and understanding of employers, consultants and contractors in the construction industry regarding procedures and methods used to calculate and to substantiate acceleration costs on projects.

The reasons underlying the study are as follows:

- exploring whether most acceleration claims are the consequence of significant project scope increase;
- creating a better understanding of the complex nature of acceleration claims, and
- pointing out differences of opinion among consultants, contractors and employers regarding acceleration claims.

3. Problem statement

3.1 Main problem

Which procedure or methodology will normally be used by contractors, client organisations and consultants to calculate the acceleration costs on a project?

3.2 Sub-problems

- Is there a specific impact or delay that is normally the cause of accelerated working on a project?
- Are there key areas relating to acceleration claims where contractors, client organisations and consultants have significant differences in opinion among each other?

3.3 Hypotheses

The main hypothesis is that contractors, client organisations and consultants will generally choose the 'time impact analysis' as a method to calculate acceleration costs on projects.

This is broken down further into corresponding sub-hypotheses as follows:

- Most acceleration claims are the consequence of significant project scope increase as a result of numerous contract instructions.
- The parties normally involved in acceleration claims on projects have different opinions regarding:
 - ownership of float;
 - contractor's ability to claim additional costs for preliminaries or acceleration;
 - reduction of time to complete a project where work is omitted, and
 - implied instruction to accelerate where consultants refuse to issue instructions for acceleration or extension of time where excusable delays occurred.

4. Research approach

The study can fundamentally be characterised as descriptive quantitative research. Data collection was done by means of questionnaires which were completed by a selected group of 60 individuals. The questionnaires tested respondents' views and knowledge regarding issues relating to acceleration claims on construction projects in South Africa.

Leedy & Ormrod (2005: 183) define survey research as follows. The researcher:

- poses a series of questions to willing participants;
- summarises the participants' responses with percentages, frequency counts or more sophisticated statistical indexes, and
- draws inferences about a particular population from the responses of the sample.

4.1 Target population and sampling

The target population consisted of clients, consultants and contractors operating in the building, construction and mining industries in South Africa. The three categories represent the following parties:

- **Employers:** This category consists of the clients who undertake the projects and are responsible for the funding of such projects (i.e. the party engaging in a contract with a contractor).
- **Consultants:** This category includes the project specialists such as project managers, engineers and quantity surveyors who are registered with a governing body in terms of South African legislation and provide specific services to a client as prescribed by the particular contract.
- **Contractors:** This category consists of building and engineering contractors from the mechanical, electrical, civil and mining fields.

The research was restricted to individuals who were based at their respective organisations' head offices in Johannesburg, Gauteng. Purposive sampling was used to select a representative group. A group of 60 individuals was selected (20 employers, 20 consultants and 20 contractors) as they represent the diverse opinions on acceleration matters and provide a cross section of all clients, consultants and contractors within the South African project environment.

Respondents were requested to answer questions related to projects where the following factors were applicable:

- Contracts with bills of quantities (BoQ) and detailed programmes.
- Contracts based on either NEC, FIDIC or JBCC terms and conditions.
- Work remeasured to determine the final value.
- Work where a main contractor, main consultant and employer were involved.

4.2 Data collection procedure

The main objective of the research was to acquire information from three groups of people (contractors, consultants and employers/ developers) concerning their opinions on and previous experiences with regard to project acceleration.

A questionnaire containing eight main areas (Section A – H) of questioning was used to collect the data. The Department of Statistics at the University of Pretoria evaluated the questionnaire to establish whether meaningful conclusions could be derived from it.

Section A illustrates which impacts or delays have the biggest influence on construction projects. These impacts or delays generally cause acceleration and/or extension of time on projects. The impact or delay which occurs most frequently will determine the method to calculate acceleration costs. Section H indicates the method the respondents opted for when certain impacts or delays occurred. The six scenarios illustrated in Section H relate to the impacts and delays described in Section A. Section B reflects the success of contractors' acceleration claims. This is an indication of how well claims are prepared and substantiated. The results of Sections C to G are indicative of the respondents' knowledge relating to acceleration matters in general.

Appointments were made with the selected group of participants and the content and purpose of the questionnaire were explained to them. The researcher hand-delivered all questionnaires to the relevant participants. The participants were requested to complete the questionnaires before 23 September 2007. A pilot study was conducted where questionnaires were handed out to four respondents in order to establish whether they contained any unintelligible or weak areas. This resulted in minor changes to two sections of the questionnaire.

5. Results and recommendations

5.1 Section A: Delays or impacts causing delays on construction projects

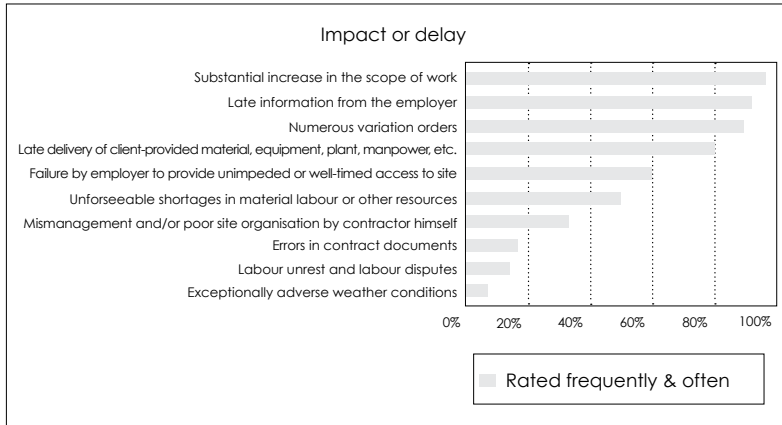


Figure 1: Delays and impacts on construction projects

The results from Figure 1 show that a ‘substantial increase in the scope of the work’ is the delay or impact that most frequently causes delays on construction projects.

5.2 Section B: How often contractors receive certain levels of compensation for claims

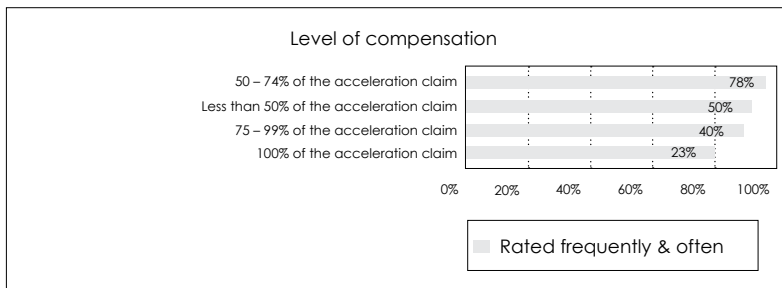


Figure 2: Compensation received by contractors for acceleration claims submitted

The results from Figure 2 indicate that the contractors targeted in the survey were of the opinion that the level of compensation most often received by them for an acceleration claim is 50 – 74% of the original amount of the acceleration claim.

5.3 Section C: Views regarding the origin of acceleration claims

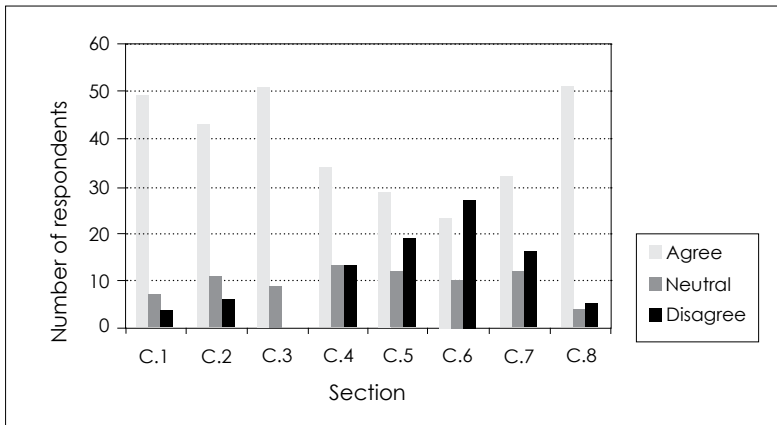


Figure 3: Views regarding the origin of acceleration claims

The following conclusions are drawn from the results portrayed in Figure 3:

- The respondents agreed that employers should allow more time and funds for the study (design) phases of projects (C.1).
- Most acceleration claims are the result of an increase in the scope of work (C.2).
- A poorly defined project scope is usually the reason for the high number of variation orders and claims on projects (C.3).
- An increase in quantities on admeasured contracts where such extra, addition or variation was ordered in writing often give reason to acceleration claims (C.4).
- There was a significant difference of opinion among contractors, consultants and employers/developers with regard to the statement that contractors regularly fail to identify and to alert the client to project risks such as an ill-defined scope in the early stages (e.g. at the tender clarification meetings) of a project (C.5).
- There was a significant difference of opinion among contractors, consultants and employers/developers with regard to the statement that contractors can generally accommodate contract variations and scope increases up to the value of 15% of the contract amount without claiming additional costs for preliminaries or acceleration (C.6).
- There was a significant difference of opinion among contractors, consultants and employers/developers with

regard to the statement that costs for preliminaries can be added to variation orders at any stage even if a contractual clause states that additional preliminaries can only be claimed once variations and scope changes exceed 15% of the contract amount in total (C.7).

- Scope changes can be identified in the early stages of a project by the contractor's quantity surveyor when he/she starts to remeasure work according to the issued construction drawings and specifications (C.8).

Based on the results of Section C the following recommendations can be made:

- The employer must bear the risk where the scope of work is poorly defined.
- The attention of the parties to the contract must be drawn to the fact that no variation order is required where there is an increase in quantities based on a quantity surveyor's remeasurements.
- Contractors must not be forced into a situation by employers where they have to accept contract conditions that prescribe an obligation to accommodate contract variations to a value of 15% of the contract amount without being able to claim for additional preliminaries.
- Scope changes must be identified through the employer's scope management processes.

5.4 Section D: Views regarding the impact of delays and float on the programme

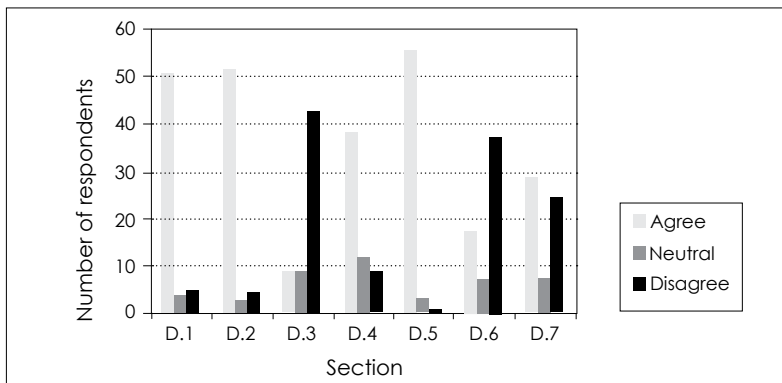


Figure 4: Views regarding the impact of delays and float on the programme

The following conclusions are drawn from the results portrayed in Figure 4:

- Delays or impacts which cause extension of time and/or acceleration are a frequent occurrence (D.1).
- Float in the programme (baseline) as submitted by the contractor within the period as required in terms of the particular contract belongs to the contractor and can be used at his/her discretion (D.2).
- Float does not belong to the project but to a specific party to the contract. Float cannot be used on a first come, first serve basis (D.3).
- The respondents indicated support for the following contract clause to be inserted: "Extension of time shall be based solely upon the effect of delays to the work as a whole...Time extensions shall not be granted for delays to parts of the work, whether or not changed by any variation order, that are not on the critical path of the official schedule. Further, time extensions shall not be granted until all float time available for parts of the work involved is used" (D.4).
- The respondents agreed that if the employer intends to gain the most advantage from the programme, the schedule should be prepared jointly by the contractor and consultant and be accepted as the baseline programme (D.5).
- The contractor cannot use the float for inexcusable delays such as slow work or lack of supervision (D.6).
- There was a significant difference of opinion among contractors, consultants and employers/developers with regard to the statement that the project manager or principal agent in terms of the particular contract can reduce the time for completion of the contract where work is omitted (D.7).

Based on the results of Section D the following recommendations can be made:

- The ownership of float must be clearly defined in the procurement documentation.
- Parties to the contract must be informed of the fact that the time for completion of the contract cannot be reduced where work is omitted. Finsen (2006: 160) supports this recommendation by stating the following in respect of time where work is omitted:

Authorities such as McKenzie, Quail and Malherbe and Lipshitz, relying on the judgement in Kelly and Hingle, conclude that the principal agent does not have the power to reduce time where work is omitted.

- The employer will gain the most advantage from the programme (optimisation) if the schedule is prepared jointly by the contractor and the consultant.

5.5 Section E: Views regarding constructive and directed acceleration

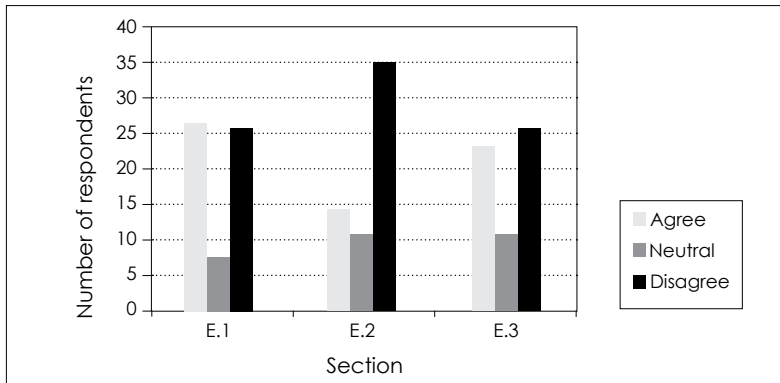


Figure 5: Views regarding constructive and directed acceleration

The following conclusions are drawn from the results portrayed in Figure 5:

- The respondents held opposing views with regard to the statement that the refusal of the certifier in terms of the particular contract to grant extension of time to a contractor for an excusable delay can be viewed as an implied instruction to accelerate (E.1).
- A warning by the project manager or principal agent in terms of the particular contract, which states that a contractor is behind the agreed schedule (due to owner-caused delay), cannot be viewed as an implied instruction to accelerate (E.2).
- The respondents were divided in their opinion regarding the statement that the certifier (consultant) seldom instructs the contractor to accelerate even when it is evident that an owner-caused delay made acceleration or EoT inevitable (E.3).

Based on the results of Section E the following recommendation can be made:

- The attention of the parties to the contract must be drawn to the fact that the refusal of the certifier in terms of the particular contract to grant EoT to a contractor for an excusable delay cannot be viewed as an implied instruction to accelerate. O'Reilly (2007) supports this recommendation by stating that the refusal to grant an EoT cannot amount to a “deemed” instruction to accelerate.

5.6 Section F: Quality of contractor's acceleration claims

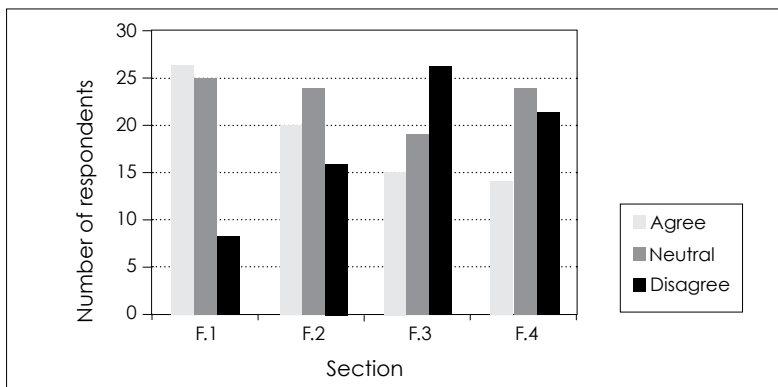


Figure 6: Views regarding the preparation of acceleration claims

The following conclusions are drawn from the results portrayed in Figure 6:

- The respondents agreed that contractors' acceleration claims frequently fail to clearly point out all the instances of contract breach (F.1).
- The respondents were divided in their opinion regarding the statement that contractors frequently cannot submit proper substantiated acceleration claims due to the bad quality or absence of project records such as project cost reports, daily logs and progress reports, daily payroll records, variation orders, minutes of meetings, project correspondence, etc (F.2).
- The respondents were divided in their opinion regarding the statement that contractors are reluctant to include a wide variety of project records in their acceleration claims (F.3).

- The respondents were divided in their opinion regarding the statement that contractors frequently neglect document control on construction sites (F.4).

Based on the results of Section F the following recommendations can be made:

- The attention of the parties to the contract must be drawn to the fact that contractors' acceleration claims should clearly indicate all the instances of contract breach in order to be successful.
- The attention of the parties to the contract must be drawn to the fact that contractors should adhere to certain quality standards regarding contract administration and document control.

5.7 Section G: The most suitable person to prepare an acceleration claim



Figure 7: Views regarding the best equipped or skilled person employed by the contractor to prepare an acceleration claim

The following conclusion may be drawn from the results portrayed in Figure 7, which reflect the views of the respondents as to who among the contractor's personnel would be the best equipped or skilled person to prepare acceleration claims:

- The contractor's quantity surveyor was regarded to be the best equipped or to have the necessary skills to prepare an acceleration claim, but the respondents indicated that the construction manager would also be able to perform this task.

5.8 Section H: The best method for calculating acceleration costs

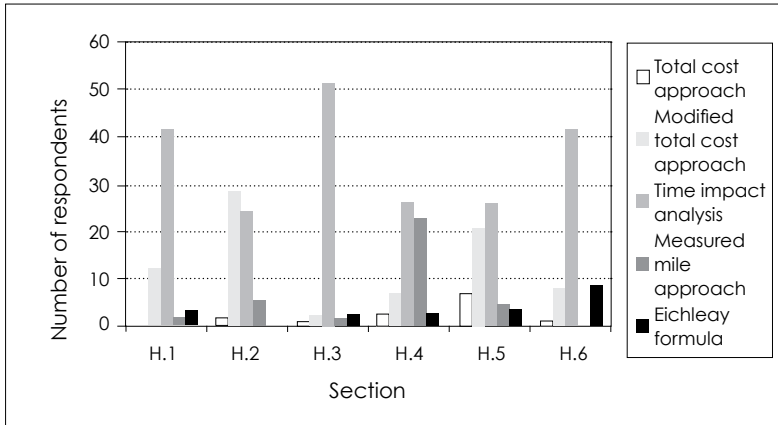


Figure 8: Methods to calculate acceleration costs

The following conclusions are drawn from the results portrayed in Figure 8:

- With the exclusion of H.2, contractors preferred the time impact analysis to calculate the acceleration costs on delay events (H.1, H.3 – H.6).
- The modified total cost approach is the preferred method for calculating acceleration costs where there is a substantial increase in the scope of work (H.2).

6. Conclusions

The following conclusions can be drawn based on the results of this study, and more specifically those obtained from Section H, as well as matters related to the claim methods, which were discussed in the literature study:

- The preferred method for calculating acceleration costs by contractors for most delay events is, in the opinion of most of the respondents, the time impact analysis; this opinion supports the main hypothesis. Other methods can also be used under certain conditions as indicated under scenario H.2. Results from the study indicate that a significant increase in the scope of work is a regular occurrence on construction projects. The modified total cost approach is in this instance regarded as the method most suitable to calculate the acceleration

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costs. In this approach the detailed project as-planned and as-built activity schedules are analysed to identify the time frame of specific delays, disruptions, changes, acceleration, etc., which can be summarised by the following equation:

Acceleration costs = Total actual expenditure – Contract amount – Contract amendments – Non-compensable cost elements

- The results further indicated that in many areas relating to acceleration claims differences of opinion exist among contractors, client organisations and consultants; this supports the sub-hypothesis. This can be eliminated by implementing the necessary project management principles and by improving all stakeholders' knowledge of the commercial and legal issues involved in construction projects through continuous professional development.

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Paul Bowen, Richard Hill, Relebohile Mabote, Keith Cattell & Peter Edwards

The potential role of value management in environmental impact assessment: a Maseru case study

Abstract

Environmental impact assessment (EIA) studies are undertaken to assess the anticipated environmental impacts of proposed projects. Such studies typically address biophysical and socio-economic issues. Using a case study approach, the effectiveness of the EIA process adopted for a landfill project in Maseru, Lesotho, is reviewed. It was found that the Maseru environmental impact statement (EIS) was not fit for the purpose as it did not facilitate effective decision-making. This failure was to a large extent due to inadequate briefing by the client and ineffective study implementation and review procedures. It is proposed that value management (VM), a value-adding technique mainly applied in the manufacturing and construction industries, could improve the effectiveness of EIA.

Keywords: Value management, environmental impact assessment, sustainability, infrastructure, planning and design

Abstrak

Studies oor omgewingsimpakwaardering is gedoen om die geantisipeerde omgewingsimpak van voorgestelde projekte te skat. Sulke studies spreek biofisiese en sosio-ekonomiese sake aan. 'n Gevallestudie oor die effektiwiteit van die omgewingsimpakwaardering van 'n stortingsterreinprojek in Maseru, Lesotho is gedoen. Daar is gevind dat die Maseru omgewingsimpakverslag nie gepas was vir die doel omdat dit nie effektiewe besluitneming gefasiliteer het nie. Hierdie mislukking was grootliks toe te skryf aan onvoldoende instruksies deur

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die kliënt en oneffektiewe studie implementering en oorsigprosedures. Daar word voorgestel dat waardebestuur, 'n waardetoevoegingstegniek grootliks toegepas in die vervaardigings- en konstruksie-industrieë, die effektiwiteit van omgewingsimpakwaardering kan verbeter.

Slutelwoorde: Waardebestuur, omgewingsimpakwaardering, volhoubaarheid, infrastruktuur, beplanning en ontwerp

1. Introduction

The *National Environmental Policy Act (NEPA)* was implemented by the Federal Government of the United States of America (USA) in 1970. NEPA was the first legislation that required environmental impact assessment (EIA) to be carried out before implementation of certain projects (Lawrence, 1997: 79; George & Lee, 2000: 3).

The fundamental aim of NEPA was to force all agencies of the federal government to integrate environmental concerns into their planning and decision-making (Ortolano, 1997: 315).

Many countries have since adopted similar EIA policies. Requirements for EIA are even imposed in countries that do not have legal EIA mandates because development assistance organisations such as the World Bank insist that EIA be undertaken for projects that they finance (Ortolano, 1997). Despite this widening application of EIA, critics claim that EIA does not always meet the needs of informed decision-making (Pardo, 1997: 137; Saarikoski, 2000; Sigal & Webb, 1989 cited in Hill, 2004). Such EIAs are therefore ineffective and of limited value to the developer or the commissioning decision-maker.

Kelly, Male & Graham (2004) describe value management (VM) as a process in which the benefits of a project are elucidated and evaluated against a set of values held by the client. The application of this technique in the manufacturing and construction industries is well documented (see, for example: Kelly & Male, 1988; 1999: 333; Male, Kelly, Fernie, Grönqvist, & Bowles, 1998a; Thomson & Austin, 2001; Lin & Shen, 2007). However, there is no published evidence of attempts to link the application of VM to EIA.

The premise of this study is that the application of VM principles in EIA will facilitate the integration of environmental considerations into the decision-making process for development projects. The potential of VM to facilitate more effective EIA is explored by means of a case study of an EIA for a landfill project commissioned by the Maseru City Council in Lesotho.

2. EIA objectives

The primary goal of EIA is the provision of environmental advice to decision-makers. EIA has multiple objectives (Clark, 1984: 12; Caldwell, 1988), including stimulating debate among interested and affected stakeholders about the nature and form of a development proposal and its environmental and social consequences, and assisting a proponent's planning and design team to develop alternatives and/or mitigation measures that meet the proposal's needs with reduced environmental impacts (Brown & Hill, 1995). Lawrence (1997: 84) has called for a re-ordering of EIA objectives, with environmental sustainability as the overarching goal. He proposes that objectives such as formulating more environmentally sound undertakings are more important than decision-making and institutional objectives such as the provision of environmental advice to decision-makers.

EIA seeks to attain its various objectives, as set out by Hill (2004), in four main stages: scoping (planning); assessment (design); evaluation (approval), and management (implementation). Terms in parentheses refer to a simplified view of the life-cycle for a project. Scoping is conducted at an early stage of an EIA as a participatory process to identify the key environmental issues and reasonable alternatives to a proposed project that are subsequently assessed by appointed specialists. The exploratory environmental studies for these issues are subsequently presented in an EIA report which then informs a public evaluation of impacts and alternatives and the approval/rejection decision for the development proposal by a competent authority.

3. Usefulness of VM in EIA

According to Kelly (2007: 435), VM is:

a project-focussed process that makes explicit and appraises the functional benefits of a product, process or service consistent with a value system determined by the client.

Kelly (2007), drawing on the work of Borjeson (1976) and Morris & Hough (1987), provides guidance regarding the meaning, from a VM perspective, of the terms 'project' and 'client'. A 'project' is:

an investment by an organisation on [sic] a temporary activity to achieve a core business objective within a programmed time that returns added value to the business activity of the organization, while a 'client' is described as: the unitary or

multifaceted specifier of (construction) activity and employer of resources, sponsoring a project in parallel to the core business activity (Kelly, 2007: 435).

As he observes, it is the client whose requirements are to be satisfied and whose core business will be enhanced through the undertaking of the project.

EIA seeks to extend this limited delineation of project value to at least ensure that existing environmental and social attributes (that have value to society) will not be compromised by a project. It preferably seeks to ensure that a project will enhance these attributes by delivering wider benefits to society, such as restoring degraded environments, during project implementation.

Male *et al.* (1998a: 16) identify six situations which provide value opportunities when there is: an unstructured problem or business opportunity; a need for strategic commitment by the organisation; a convergence of information from different parties; uncertainty about or within the project; an introduction of new personnel to the project, or a need for technical and/or capital commitment. The last four - and possibly all six - of these situations typically apply to particular EIAs, to a lesser or greater extent. VM can take place at any stage of the project life cycle where opportunities for value improvement can be realised (Kelly & Male, 1988; SAVE International, 1998: online). Male *et al.* (1998a: 16) assert that VM uses structured, team-orientated exercises that evaluate existing or generated solutions to a problem by reference to the value requirements of the client. The VM process usually incorporates a series of workshops, interviews and reviews, whereby the project requirements are communicated and evaluated against the means of achieving them (Constructing Excellence, 2004: online).

Several VM techniques can be applied during the project life cycle. The choice of technique depends on the project stage at which VM is to be undertaken. Kelly & Male (1988; 1993: 21-22) describe four formal VM approaches: the Charette (to review the brief); the 40-hour VM workshop; the VM audit, and the contractor's change proposal. The VM framework developed by Male *et al.* (1998a: 14-15) provides five additional VM approaches that can be used at specific stages during the project life cycle. These approaches are comprehensively described by Male *et al.* (1998a: 14-15; 1998b) and include: the pre-brief workshop; a briefing workshop; an outline (sketch) design workshop; a final (sketch) design workshop; an operations workshop, and an implementation workshop. The relationship between the project life cycle, the EIA process and

possible VM workshops is depicted in Figure 1, but it should be noted that the timing of EIA processes and VM workshop interventions is not intended to match exactly.

Of particular relevance to EIA are the pre-brief (strategic brief) workshop, the briefing (project brief) workshop, the scoping brief review (Charette) workshop, and the implementation workshop.

The strategic brief sets out the broad scope and purpose of the project and its key parameters, together with an output specification. A primary function of the pre-brief workshop is to provide a clear indication of project mission and its strategic fit with the client's business organisation. This VM approach has similar objectives to the EIA scoping process, which engages with a range of external stakeholders to identify their environmental concerns.

The project briefing workshop converts the strategic brief into operational terms. More specifically, it specifies the performance of the elements of the project; in essence, the deliverables. The project briefing workshop could be used at the end of the scoping process in EIA to develop the terms of reference for the selected specialist studies which, in turn, generate predictive information about potential environmental impacts.

The Charette workshop is a VM audit of the brief, often undertaken before the project design is complete. In the context of EIA, this intervention could occur when the scoping report and draft EIA are completed. At this stage of EIA, the value that different stakeholders attach to each impact is ascertained via participatory processes, typically either by written submission of comments to the EIA team or by face-to-face dialogue. The evaluation stage provides information on values to the decision-maker to complement the more factual information on predicted impacts provided by the environmental specialists. Information on facts and values can then be combined to weigh impacts, leading to the choice of a preferred project option.

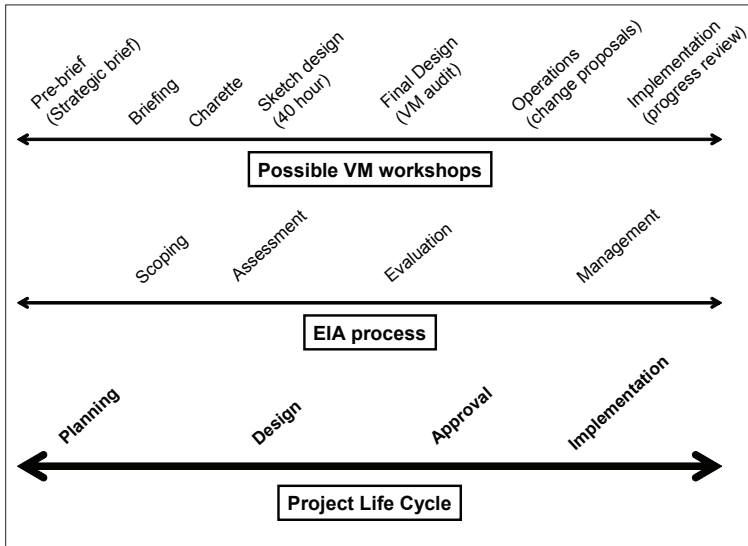


Figure 1: Relationship between the project life cycle, EIA process, and VM workshops
 Source: Edwards, 2009: own drawing

Finally, the aim of the VM project implementation workshop is to ensure that the recommendations of previous workshops are implemented. This would typically include progress reports, solutions to problems encountered, reviewing, and fine-tuning. The VM implementation workshop can occur after any previous workshop; from the pre-brief stage through to site operations. In EIA, the implementation stage is called EIA follow-up, where the actual impacts of construction and operation of a facility or infrastructure are monitored to provide feedback to project managers for remedial action if necessary. After implementation of an EIA, a post-hoc audit can be undertaken to evaluate the effectiveness of the EIA process so as to generate lessons for improving future studies.

During each VM workshop a generic VM process comprising a structured job plan is used to explore ways to maximise the value of the project (SAVE International, 1998: online). The job plan comprises six phases which are all comprehensively documented by Male *et al.* (1998a, 1998b): information gathering, functional analysis, creative speculation, evaluation of alternative ideas, development, and presentation. Functional analysis and creative speculation are phases critical to the success and effectiveness of VM.

Value improvement is not solely aimed at reducing costs; its primary purpose is to assist in delivering a project, product or service that best meets the requirements of the client, even if that eventually means added cost (de Leeuw, 2001). In applying the concept of value improvement in EIA, the requirements need to be broadened beyond that of the client to improve, or at least maintain and not degrade, the value of the environment into which a project is to be introduced.

Environmental values can be categorised as either economic or non-economic (Erikstad, Lindblom, Jerpåsen, Hanssen, Bekkby, Stabbetorp & Bakkestuen, 2008: 132). The economic category consists of utilitarian values, in which the environment is valued for the direct benefits it provides to humans in the form of living and non-living resources. Another set of functional (utilitarian) values are the less visible ecological processes and life-support systems that sustain human life, including agricultural systems, fisheries, forests, water catchment areas, and clean air (IUCN, 1980). Non-economic values attached to the environment are based on ethical or moral grounds, the so-called immaterial values (Erikstad *et al.*, 2008: 132). These include aesthetic values that people attach to aspects of the environment, which is an anthropocentric approach. This category of non-economic values also includes what is called an existence value, which is held to be an intrinsic value in nature that is independent of the use it has for humans – a claimed non-anthropocentric value of the philosophy of Deep Ecology (Næss, 1973 cited in Erikstad *et al.*, 2008: 132) that is, nevertheless, a value held by people.

EIA adds consideration of environmental values to project planning and design, commencing with scoping, where environmentalists and experts are asked to identify those aspects of the environment that they value and wish to protect. The EIA process then uses specialist studies to inform two aspects of environmental planning and design. On the one hand, EIA identifies the intrinsic suitability of an environment for a particular development, by analysing physiographic constraints such as soils, slopes, flood plains, and climatic factors (McHarg, 1971). Avoiding areas subject to these constraints in the planning of development can reduce the capital cost of engineering structures. On the other hand, EIA also evaluates the impact of a development on those aspects of the environment that have social value, which McHarg (1971) defines widely to include wildlife, cultural heritage, and recreational value. EIA and VM processes are thus complementary, in aligning value systems from the outset and bringing together representatives from competing value systems (Male *et al.*, 2007: 112-113). The potential usefulness of VM in EIA is explored below using a case study.

4. Maseru waste landfill project

Maseru is the capital of the Kingdom of Lesotho, a mountainous country of approximately 30 350 sq. km surrounded entirely by South Africa. The country, poverty stricken and with one of the highest rates of HIV infection in the world, has a population of two million people of which Maseru accounts for some 174 000.

The Maseru City Council was tasked with developing a sanitary landfill site to cater for the variety of municipal waste produced in Maseru. Since 1983 all municipal waste produced in Maseru and its environs has been dumped in an abandoned quarry selected by the City as an official dump site (Khalema & Sets'abi, 1999). The quarry site is unsatisfactory, being located on sloping ground upstream from the main reservoir that supplies the city with potable water (Chapeyama, 2004). It is situated within 25m of domestic dwellings in the HaTs'osane residential area (Lesotho Council of NGOs, 2006: online), and produces noxious gases as a result of decomposition and spontaneous combustion (Ministry of Health and Social Welfare, 2005). The site thus poses serious health hazards to the local population (Lesotho Council for NGOs, 2006). In addition, the rapid growth of the local textile industry, fuelled by trade opportunities initiated by the USA (Chapeyama, 2004: 6), has resulted in a new source of solid and liquid waste which needs appropriate management. Illegal dumping of sludge from some factories is already occurring on the outskirts of Maseru (Chapeyama, 2004: 10). The environmental problems, in particular the issue of waste disposal, associated with such economic expansion are further exacerbated by rural-urban migration (Motsamai *et al.*, 2003: online). It is against this background that a potential landfill site was identified by the Maseru City Council, and a consultant commissioned to undertake an EIA of the site. The EIA was commissioned in line with the *Environment Act No. 10 of 2001* (Government of Lesotho, 2001) which provides a mandate within which EIAs are to be undertaken in Lesotho (Government of Lesotho, 2001). Even though the commencement date of the Act has not yet been published (see Lesotho: Second State of Environment Report for 2002 [Government of Lesotho, 2004]), the National Environmental Authority is using the Act to encourage developers to undertake EIAs voluntarily for projects with potential to cause adverse impacts on the environment.

The contract to undertake the EIA was awarded to a locally-based environmental consultancy. The objectives of the EIA were to assess the biophysical and socio-economic impacts of the project and to use this information to establish the suitability of the project for the

area proposed for its development (Maseru City Council, 2005). The Environmental Impact Statement (EIS) was published in October 2005.

The National Environment Secretariat rejected the first EIA on the grounds that it was inadequate to inform decision-making. More specifically, it was deemed insufficient in scope and in detail (Ts'asanyane, 2007: personal communication). Faced with this problem, and given the national significance of the project, the Maseru City Council was obligated to commission a second consultant to repeat the EIA exercise. This resulted in the Council being faced with disruptive delays and abortive costs.

The questions arising from this case are: (i) how effectively did the Council communicate its EIA requirements to the first consultant?; (ii) what steps were taken by the Council to ensure that the consultant's interpretation of the EIA brief aligned with its own?, and (iii) what measures did the Council implement to ensure that the EIA procedures employed by the consultant would result in their brief being satisfied?

Given this specificity of context (Yin, 1994: 13), the case study methodology was adopted, with a single case pilot study being selected as a prelude to further study (Yin, 1994: 40-41). Data was collected via: (a) a review of the documentary evidence, namely, the terms of reference prepared by the Maseru City Council for the consultant (scope of the EIA) and the first EIS developed by the consultant; (b) a semi-structured telephone interview with a representative of the Council to establish how the EIA was conducted, and (c) unstructured face-to-face interviews with officers of the local environmental authority regarding the inadequacy of the EIA and to clarify issues relating to environmental legislation and EIA procedures in Lesotho. Follow-up telephone interviews were conducted for clarification purposes.

Content analysis (see Krippendorff, 1980) was applied to the project documents and responses to the interview questions. This technique allows systematic analysis of qualitative data so that generalised conclusions can be drawn (Haggarty, 1996). By tracing the EIA process from the perspective of each of the stakeholders, a series of 'stories' was developed (Eisenhardt, 1991). Through this storytelling similarities and differences emerge, facilitating a deeper understanding of the process under review (Tzortzopoulos & Sexton, 2007). Cross-checking the results from one technique with those from another (triangulation) leads to greater reliability in the analysis (Jankowicz, 2000).

5. Discussion of the results

5.1 Initiation of the EIA

The Maseru City Council, working in close collaboration with the project stakeholders, had prepared a scoping document outlining the terms of reference for the EIA consultant. In addition, an inception meeting was held upon commencement of the EIA. This meeting was attended by Council representatives, the consultant, subcontractors and specialists, and other key stakeholders. The purpose was to reach a common understanding of the EIA objectives, its scope, and the services the consultant would be offering. The inception meeting was used as a platform upon which the Council's requirements and expectations for the EIA were communicated to the consultant. In essence, the consultant was tasked with undertaking a baseline survey comprising ecological, hydrology, geotechnical, and water quality surveys; investigating the socio-economic status of communities in relation to the proposed waste site; liaising with major stakeholders; promoting comprehensive public participation by engagement with villagers likely to be affected by the project; comprehensively assessing the likely impacts of the project, including prevention measures, mitigation or compensation, and analysing alternatives. The following evaluation shows that common understanding was not achieved in the first EIS.

5.2 Evaluation of the EIS

Table 1 summarises the extent to which the consultant analysed issues identified in the scoping stage as being requirements of the EIA. While the consultancy firm was selected for its technical ability to assess the issues to be covered in the EIA, in many instances the level of detail contained in the first EIS was inadequate for informed decision-making by the Council and environmental authority. These shortcomings can be ascribed to a poorly defined EIA brief (from the client) and execution plan (from the consultant) that failed to indicate specific procedures and methods that would be used to execute the EIA, despite the inception meeting held to develop a shared vision of the nature and extent of the EIA. It is against this backdrop that the process of VM is tested for its potential for maximising the effectiveness of EIAs. This is explored by highlighting the shortcomings of the EIA undertaken by the consultant and indicating where the use of VM could have obviated or mitigated these shortcomings.

Insofar as the baseline survey is concerned, a number of VM interventions would conceivably have rendered this phase more meaningful in terms of providing the Council with sufficient information upon which to base decisions. The application of a VM Charette workshop at the briefing stage could have clarified the need for investigation of the ecosystem structure and patterns, together with their propensity for disruption as a result of project activities. If such clarification had not occurred at that stage, a subsequent VM implementation workshop should have been able to identify this shortcoming and facilitate remedial action. Similarly, the absence of a geotechnical map to facilitate assessment of the suitability of the area for the intended purpose, and the deficiency of information relating to water quality, might also have been addressed by VM interventions.

The provision of infrastructure required for the effective functioning of the landfill, such as access roads and a transfer station, was not addressed by the EIS, despite having been highlighted in the scoping brief. Again, the use of a VM implementation workshop could have avoided this omission.

A tenet of VM is the participatory nature of its processes. The apparent lack of participation by local village councillors is a serious deficiency of the EIS, leading the Maseru City Council to conclude that public participation in the EIA process had been inadequate. The use of VM workshops during the various phases of the project would have facilitated stakeholder participation; and would have been reported upon during the relevant implementation workshops.

Insofar as impact assessment is concerned, there was no indication in the first EIS of how the infrastructure required for mitigating the negative impacts of the project would be dealt with. Using VM techniques, these requirements would have been noted in the briefing workshop (application of the Charette) and subsequently verified at an implementation workshop.

A serious shortcoming of the EIS is that of not providing a technical design with specifications. Coupled to this was the failure to consider alternatives, thereby diminishing the possibility of objectively considering the proposed design and any alternatives. The EIA consultant had been tasked with producing and assessing a technical design for the landfill project, and with proposing and assessing alternative designs (Genesis Environmental Solutions, 2005). In addition, the consultant was supposed to assess alternative sites for the project that had been through the original site selection process, but only the preferred site was considered in the EIS. Since VM considers the technical attributes of selected components and

Table 1: An evaluation of the EIA for the Maseru waste landfill project

EIA component	Analysis requested by the client	Analysis done by the consultant as revealed by the EIS	Shortcomings of the analysis	Implication for the EIA outcome
Baseline survey	Undertake ecological survey	Plant and animal species found on site were identified	Ecosystem structure and functioning is more than lists of species; what is needed is discussion of ecosystem patterns and processes and how these may be disrupted by project actions	Not adequate to inform decision-making
	Undertake hydrology and groundwater survey	Boreholes were drilled to determine the depth of the water table, the presence of aquifers in the area, and the direction of groundwater flow	None	Adequate to inform decision-making
Socio-economic investigations	Undertake geotechnical survey	Geological map used to describe the geology	Geotechnical investigations not done to determine the suitability of the area for the project	Not adequate to inform decision-making
	Analyse the quality of ground- and surface water sources within the area proposed for development	Laboratory analysis of the water samples from the ground- and surface water sources to assess the quality of the water	The water quality data presented without any interpretation, no mention of the projected changes in water quality when the landfill becomes operational	Not adequate to inform decision-making
	Carry out the socio-economic survey in collection zones of Maseru City Municipality	Problems with the current solid waste removal service and the willingness to pay of the waste producers determined	None	Adequate to inform decision-making
	Carry out socio-economic survey in the communities around the proposed site to determine their social and economic status	The socio-economic status of the area determined with respect to sources of livelihoods of the communities and availability of services and facilities	None	Adequate to inform decision-making

Stakeholder participation	Liaise with all the major stakeholders	Scoping report prepared by the consultant and submitted to stakeholder institutions; inception meeting to establish shared vision between key stakeholders; meetings with stakeholder institutions; debriefing meeting; stakeholder workshop	Some of the issues raised during scoping not addressed in the EIS. For example, there is no indication of how the facilities required for the functioning of the landfill will be made available, such as access roads and a transfer station	Not adequate to inform decision-making
Public participation	Undertake a comprehensive public participation process	Public gatherings held in the villages to be affected by the development	Findings from the interviews indicated that the local councillors in the villages mentioned in the EIS were not aware of the public participation meetings said to have taken place in the villages. The local councillors should have been involved in all matters of development proposed in the villages. This revelation led to the local environment authority questioning the accuracy of the EIS on this matter and concluding that the public participation was not adequate	Not adequate to inform decision-making
Impact assessment	Identify all impacts that are likely to result from the project activities and determine measures for their prevention, mitigation or compensation	Impacts identified and mitigation measures indicated	No indication of how the infrastructure required for mitigating impacts will be made available, which the consultant should have discussed with the relevant government authority	Not adequate to inform decision-making
Analysis of alternatives	Provide an analysis of alternative sites and technical designs of the project	Project designs were not done, neither preliminary nor alternatives to the proposal. Only one site considered	The consultant stated in the EIS that the project does not have a technical design with specifications (Maseru City Council, 2005). Without project designs (preliminary and alternatives) it would be difficult to accurately determine specific impacts of the project	Not adequate to inform decision-making

then proposes and analyses alternatives in terms of functionality and cost, these shortcomings would have been addressed by VM intervention. This would typically be carried out via a 40-hour (or shorter) VM workshop. Again, a VM implementation workshop could be used to ensure that approved design decisions were implemented.

Finally, during the subsequent operations on site, the opportunities for contractor's change proposal could be used to initiate project changes conducive to the attainment of the Council's (and other stakeholders') objectives. The VM implementation workshop could again serve as a vehicle to ensure that imperatives decided at previous meetings were actually implemented and reported upon.

6. Conclusions

This article explores the potential role of VM in EIA, using a case study to illustrate how VM can be applied to improve the value of EIA to a project client. The case study suggests that, while the Maseru City Council relied on EIA consultants to produce an EIS to communicate potential environmental impacts of the proposed landfill project, the Council did not effectively brief and manage its consultants. The first EIS did not provide information that was adequate to inform Council's decision-making, particularly with respect to proposing and assessing alternative sites and technical designs for the projects.

The application of VM techniques could be directed, first, towards defining and reviewing methods to be used to execute the various aspects to be addressed in the EIA. In this context, VM can improve management of, and co-ordination between, the range of organisations and individuals involved in the EIA process. Secondly, VM can contribute to the formulation of projects that not only meet a client's need, but can also be adapted to address environmental values held by interested and affected parties, in reconciling competing value systems. This reconciliation can be achieved through VM's change-orientated, participatory approach to facilitate the generation of alternatives that represent better value satisfaction to a range of stakeholders. In summary, VM in EIA would focus on what Male *et al.* (2007: 112) describe as 'value system evolution and resolution'. This focus applies in two contexts: in managing the relationships between the multiple stakeholders involved in an EIA's organisational system more effectively, and in producing a project formulation that optimises environmental values in addition to the more traditional emphasis on cost and functional performance specifications.

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