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Acta Structilia is 'n Suid-Afrikaanse geakkrediteerde tydskrif, wat publikasiegeleenthede bied vir onafhanklik-gerefereerde artikels deur plaaslike en buitelandse navorsers op die terreine van die fisiese en ontwikkelingswetenskappe. Elke gekeurde artikel word as sodanig aangedui. Die redaksie oorweeg Afrikaanse of Engelse artikels oor onderwerpe binne studievelde soos: argitektuur, stads- en streekbeplanning, bourekenkunde, konstruksie- en projekbestuur, bou-ekonomie, ingenieurswese, die eiendomsbedryf en die ontwikkelingsveld rondom gemeenskapsbouprojekte. *Acta Structilia* verskyn twee keer per jaar onder die vaandel van die Universiteit van die Vrystaat. Die tydskrif word gelewer aan die betrokke navorsingsinstansies, Suider-Afrikaanse universiteite met bogemelde navorsingsdepartemente, Suid-Afrikaanse navorsingsbiblioteke, geselekteerde buitelandse instansies en intekenaars. Menings en kritiek in die tydskrif is dié van die outeur(s). Publikasie daarvan is nie 'n aanvaarding dat die Redaksie of die Universiteit van die Vrystaat verantwoordelikheid daarvoor aanvaar nie.

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The South African Council for the Quantity Surveying Profession endorses

Acta Structilia

The South African Council for the Quantity Surveying Profession (SACQSP) has simplified the submission and assessment of Continuining Professional Development (CPD) requirements of registered persons. CPD submission now requires disclosure of the number of hours invested meaningfully in activities in two main categories. Category 1 activities are those arranged or presented by or to 'external' organisatins such as participation in conferences, congresses, workshops or seminars, presentation of lectures, external examination for academic programmes, publication of articles in journals or magazines, other similar activities. Category 2 activities are less formal 'internal' activities such as in-house training or seminars, small group discussions, self-study of journals, magazines, articles on web pages, etc.

To assist registered persons with access to journal articles related to quantity surveying and, more generally, built environment issues, the SACQSP at its meeting in March 2007 adopted a recommendation to endorse the journal, *Acta Structilia*, which publishes quality, peer-reviewed articles and is accredited by the Department of Education.

Council encourages registered persons to peruse *Acta Structilia* and similar peer-reviewed journals as one of the alternative options to accumulate CPD credits in Category 2 activities. For a limited period, Council will encourage the circulation of *Acta Structilia* to registered persons.

Professor RN Nkado
President

Royal Institution of Chartered Surveyors (RICS) supports *Acta Structilia*

Royal Institution of Chartered Surveyors (RICS) supports the aims and objectives of *Acta Structilia* and welcomes the efforts being made to improve our knowledge and understanding of the built environment, particularly in an African context.

Paul Bowen, Keith Cattell & Peter Edwards

Workplace stress experienced by quantity surveyors

Peer reviewed and revised

Abstract

This article reports on the relationship between workplace stress of quantity surveyors and job demand, control and support factors. Using an online quantitative survey, the perceptions of workplace stress of professional quantity surveyors in South Africa is sought. Particular focus is given to differences in gender, age and ethnicity. Job demand issues explored include working to tight deadlines, working long hours, the work/family balance, and a perceived need to work harder to 'prove oneself'. Job control factors include control over the type of work assigned, the pace of work, the work environment, and the match between authority and responsibility. Job support factors include assistance and support received from line managers and colleagues. Organisational stressors, in the form of job prospects and the general work environment, are also examined.

Findings show that the majority of the respondents experience high levels of stress at work, with females reporting higher levels than males. Younger, more than older colleagues, experience workplace stress, although this may be explained by conditioning over time. The extent to which these professionals are able to control their job situations does not appear to have a major influence on stress. Tight deadlines, long working hours, and a work/family imbalance may play a bigger role. Respondents would appreciate having more time to do a better job. Employees generally do not expect managers and colleagues to consistently make their work easier, but they do believe that colleagues can be relied upon in times of difficulty.

Professional and employer organisations should pay closer attention to the issues concerning workplace stress and implement appropriate policies and measures to counter it. Further research will be undertaken to explore in more detail the relationships between stress and the type of work undertaken.

Keywords: Occupational stress, job demands, job control, stressors, quantity surveyors, South Africa

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Abstrak

Hierdie artikel doen verslag oor die verband tussen bourekenaars se beroepspanning en werkuitdagings, beheer en ondersteuningsfaktore. 'n Aanlyn kwantitatiewe opname word gedoen en die siening van werksplekspanning onder professionele bourekenaars in Suid-Afrika word nagevors. Daar is in besonder gefokus op verskille in geslag, ouderdom, en etnisiteit. Teikendatums, lang werksure en die wanbalans tussen werk en familie asook die behoefte om harder te werk om 'jouself te bewys' is van die beroepseise wat ingesluit is. Beheer oor die tipe werk wat gedoen word, die werkspas, die werksomgewing en die toets tussen gesag en verantwoordelikheid is werksbeheerfaktore wat ingesluit is. Werkondersteuningsfaktore sluit in hulp en ondersteuning van bestuurders en kollegas. Organisasiestressors in die vorm van werksvooruitsigte en die werksomgewing word ook getoets.

Resultate toon dat die meeste deelnemers hoë vlakke van spanning by die werk ondervind en dat die vroulike geslag se spanningsvlakke hoër is as dié van die manlike geslag. Jong mense beleef meer spanning as hul ouer kollegas, wat meer beheer het as gevolg van jare se ondervinding. Die mate waartoe hierdie professionele werkers hul werksituasies kan beheer, beïnvloed waarskynlik nie hul werkspanning nie. Teikendatums, lang werksure en die wanbalans tussen werk en familie speel moontlik 'n groter rol. Deelnemers dui aan dat hulle dit sal waardeer indien daar meer tyd toegelaat kan word sodat hulle werk van 'n beter gehalte kan doen en, alhoewel hulle nie van hul bestuurders en kollegas verwag om hul werk deurentyd makliker te maak nie, glo hulle tog dat hulle op hul kollegas kan staatmaak in moeilike omstandighede.

Professionele en werkgewersorganisasies behoort meer aandag te gee aan probleme wat te doen het met werkplekspanning en behoort 'n toepaslike beleid in werking te stel en toe te pas om werkspanning te verminder. Verdere navorsing sal gedoen word om die verband tussen spanning en die tipe werk wat gedoen word, vas te stel.

Sleutelwoorde: Beroepspanning, werkseise, werksbeheer, stressore, bourekenaars, Suid-Afrika

1. Introduction

Many authors have pointed to the stressful nature of working in the construction industry (Lingard & Francis, 2004: 991; Pocock, Skinner & Williams, 2007: 31; Love, Edwards & Irani, 2010: 650). Construction professionals are responsible for the safe delivery of projects, on time, within budget and capable of satisfying client requirements. Project work is characterised by considerable dynamism and uncertainty, elevating its stressful nature (Williams, 1999: 272; Asquin, Garel & Picq, 2010: 166; Mohr & Wolfram, 2010: 168). Work hours in construction are long (Van Wanrooy & Wilson, 2006: 352) and the ability to meet project objectives is often compromised by unexpected events (Miceli & Castelfranchi, 2005: 291; Leung, Chan & Yuen, 2010: 1094). Interpersonal and inter-role conflict (Leung, Skitmore & Chan, 2007: 1064; Loosemore & Galea, 2008: 127), well established stressors, as

well as 'burnout' (Lingard, 2003: 69; Lingard & Francis, 2004: 162) characterise the industry.

Stress is a major challenge to the health of working people (HSE, 2006: 31). Houtman (2005: 2) reports that work-related stress was the second most common work-related health problem found in a survey across 15 European Union countries. The European Working Conditions survey indicates that work intensity and quantitative demands have increased, particularly up to the mid-1990s and in the period between 1996 and 2001, and that job autonomy has decreased (Gallie, 2005: 352). The increasing significance of work stress was recognised in the European Commission's Strategy on Health and Safety at Work 2002-2006, which identified psychosocial issues as an emerging occupational health and safety priority risk area (Commission of European Communities, 2002: 3).

Previous studies of workplace stress in construction have focused on site managers (Djebarni, 1996: 281), construction labourers (Goldenhar, Williams & Swanson, 2003: 218), construction managers (Lingard & Francis, 2004: 991), estimators (Leung *et al.*, 2007: 1063), architects (Sang, Dainty & Ison, 2007: 1305), and construction project managers (Leung, Chan & Olomolaiye, 2008: 644).

This present research forms part of a larger study examining the workplace stress experienced by construction professionals in South Africa. This study focuses on the relationship between workplace stress and job demand, control and support factors, the effects of workplace stress, the coping mechanisms adopted by professionals in an attempt to militate against the effects of stress, and the role of harassment and discrimination as work-related stressors. Data were collected from architects, engineers, quantity surveyors, as well as project and construction managers *via* an on-line survey (*N*=676). Earlier articles have reported on the comparative levels of perceived job stress and job demand, control and support (JDC/S) factors (Bowen, Edwards & Lingard, 2013a: 393); the comparative relationship between job stress and harassment and discrimination at work (Bowen, Edwards & Lingard, 2013b: 620); stress, stress effects and coping mechanisms (Bowen, Edwards, Lingard & Cattell, 2013c), and predictive modelling of stress as a function of JDC/S factors (Bowen, Edwards, Lingard & Cattell, 2013d).

Using the data emanating from the quantity surveyor respondents, this article reports on the relationship between quantity surveyors' workplace stress and job demand, control and support factors. It focuses, in particular, on differences in gender, age and ethnicity. Job demand issues explored include working to tight deadlines,

working long hours, the work/family balance, and a perceived need to work harder to 'prove oneself'. Job control factors include control over the type of work assigned, the pace of work, the work environment, and the match between authority and responsibility. Job support factors include assistance and support received from line managers and colleagues. Organisational stressors, in the form of job prospects and the general work environment, are also examined.

The contribution of this work lies in its examination of the work stress experienced by quantity surveyors in a developing country characterised by economic hardship and social problems.

2. Workplace stress

According to Karasek (1979: 285), the relationship between work and health can be explained by the combination of demands and control inherent in a job. The Job Demand-Control (JDC) model of workplace stress posits that work that is simultaneously high in demands and low in control produces the most stressful responses and is most damaging to health (Belkic, Landsbergis, Schnall & Baker, 2004: 86; De Lange, Taris, Kompier, Houtmans & Bongers, 2004: 160).

Later adaptations of Karasek's JDC model have incorporated workplace support as a resource that, together with control, can mitigate the extent to which job demands induce harmful effects in workers (Schaufeli & Bakker, 2004: 908). Thus, Johnson, Hall & Theorell (1989: 272) suggest that social support from one's colleagues or supervisor serves to reduce the damaging impact of stressful work situations on workers' health. Social support is defined as "instrumental aid, emotional concern, informational, and appraisal functions of others in the work domain that are intended to enhance the wellbeing of the recipient" (Michel, Mitchelson, Pichler & Cullen, 2010: 92).

According to the Job Demands-Control-Support (JDC-S) theory of workplace stress, jobs that are high in demands, low in control and low in workplace social support are experienced as the most stressful and produce the most damaging health impacts. When employees perceive an imbalance between work demands and their personal or environmental resources, a range of stress responses can occur, including physiological, emotional and behavioural responses that have a damaging impact on workers' health, work performance and relationships (Houtman, 2005: 2).

Organisations differ in physical structures as well as in the attitudes and behaviours they elicit in people (Sharma, 2013: 212). According to French, Kast & Rosenzweig (1985), organisational climate is an enduring quality of the internal environment of an organisation as perceived and experienced by its members, which influences their behaviour, and can be described in terms of the values of a particular set of characteristics (or attributes) of the organisation. These characteristics form the organisational culture, and their perceived presence and strength combine to form the organisational climate. McShane & Travaglione (2003) suggest that organisational culture shapes the way in which an organisation interacts with its environment, and the actions chosen to be implemented. Assumptions, beliefs and values can be difficult to observe as they are learnt and often unconsciously followed by employees. Cultural values include those which are being sought by the organisation (espoused values) and those which are currently in use (enacted values). The latter tend to guide individual decisions and actions. Organisation cultures may be overtly or covertly exhibited in an organisation. They can also appear as counter subcultures within larger organisations, and thus conflict with an espoused corporate culture.

Thompson, Stradling, Murphy & O'Neill (1996: 647) found that stress and strain conditions were significantly less favourable in organisations with a negative organisational climate (characterised by employee perceptions of high compliance expectations, lower individual recognition and supervision, and lower employee autonomy), compared to organisations that were not so characterised.

Sharma (2013: 212) identifies fear of job redundancy, lack of job security, non-commensurate wages with levels of responsibility, under-participation in decision-making, office politics and conflicts, and interpersonal relations as important determinants of occupational stress.

Newton & Jimmieson (2006) examined the relationship between organisational culture and occupational stress. They report that an employee's 'fit' with the organisational culture is important, and that for some employees, workplace events are viewed as more of a challenge than stressful, and that these employees tend to more closely identify themselves with the organisation.

3. Workplace stress and the construction industry professions

The construction industry is a high-risk industry for work stress (Pocock *et al*., 2007: 31) and several contributory factors have been identified. Sutherland & Davidson (1989: 226) identify inadequacy of information flow, onerous paperwork and excessive workload as the top three stressors among construction site managers. Leung *et al*. (2007: 1067) report high levels of objective stress (i.e., stress associated with external demands such as deadlines, time constraints and workload) in construction estimators, associated mainly with a perceived lack of autonomy and/or low levels of reward. In a study of Hong Kong construction industry employees, onerous bureaucracy, a lack of opportunity to learn new skills and work-family conflict were ranked as the three most difficult stressors to manage (Ng, Skitmore & Leung, 2005: 273).

The experience of work stress is associated with low levels of job performance in construction. Djebarni (1996: 281) reports a curvilinear relationship between stress and leadership performance among construction site managers. However, Leung *et al.* (2008: 648) provide no evidence for a curvilinear relationship between stress and performance. Indeed, they report that the task performance of construction project managers is inversely and linearly linked to stress. Leung *et al.* (2008: 648) suggest that the stress levels of construction project managers in their sample may be higher than the threshold value at which the 'inverted U-curve' effect would apply.

In Australia, Haynes & Love (2004: 137) identified workload, long hours and insufficient time with family as the three most significant stressors experienced by construction project managers. However, there is evidence that work stress is experienced to varying degrees, depending on the nature of employment in the construction industry. Love *et al*. (2010: 655) report that construction professionals, who are working for construction contracting organisations, experience higher levels of stress and lower levels of workplace support than construction professionals working for consulting organisations. Similarly, Lingard & Francis (2004: 998, 996) found that site-based construction professionals worked longer hours and experienced higher levels of burnout than their counterparts working in the head or corporate offices of the same organisations.

Research suggests that female construction professionals experience higher levels of work stress than their male counterparts. In a comparative study of architects, project managers, engineers,

quantity surveyors and construction managers, Bowen *et al*. (2013a: 393) found that proportionately more females reported higher levels of stress than males. In a comparative analysis of male and female architects, Sang *et al*. (2007: 1305) report that female architects experienced significantly higher levels of work-family conflict and reported lower levels of job satisfaction and higher turnover intention than their male counterparts.

Previous research has shown that construction professionals experience high levels of work stress. However, this research has almost always taken place in developed economies, such as Australia (Lingard & Francis, 2009; Love *et al*., 2010), the United Kingdom (UK) (Djebani, 1996) or Hong Kong (Leung *et al*., 2007; 2008). Consequently, the extent to which the findings apply to developing countries such as South Africa is not known. Moreover, few studies have focussed on the quantity surveying profession. This research aims to:

- Explore workplace stress levels among quantity surveyors in the developing nation of South Africa, and
- Examine the relationship between job demand, control and support factors and perceived levels of workplace stress of quantity surveyors in the South African construction industry context.

The research questions posed in the study are: To what extent do South African quantity surveyors perceive themselves to be stressed at work? What is the relationship between workplace stress and job demand, control and support factors?

4. Research method

A questionnaire survey was chosen as a suitable method of collecting data for the initial stage of the research, since it allows wide coverage of the quantity surveying profession in South Africa and follows the approach used by earlier researchers. Surveys are a convenient, relatively inexpensive and effective way of obtaining a broad 'snapshot' view of peoples' perceptions and opinions, but usually need to be followed up with case-based methods when issues require exploration in greater depth.

The survey sought demographic, cultural and professional background information from respondents; determined their currently perceived levels of workplace stress; explored their work situations in terms of job demands and job control, and examined organisational stressors such as job security and perceived support

in the workplace. The catalogue of questions was drawn from the works of Sutherland & Davidson (1989: 221) on communication, workload, conflict and social support; Haynes and Love (2004: 129) on workload and work/family imbalances; Ng *et al*. (2005: 264) on working relationships, communication and personal factors; Leung *et al*. (2007: 1063, 2008: 644) on job demands, control and support; Leung, Chan & Yu (2009: 127) on stress and stressors; Love *et al*. (2010: 650) on stress, support and mental health, and Leung, Chan & Chen (2011: 312) on job stress, burnout and physiological stress. Likert scales (Kline, 2000a: 95) were generally used for rating-type questions.

Whilst no definitions of the various constructs *per se* were provided, the information in the covering letter to the questionnaire, the information in the Introduction to the questionnaire, and (indeed) the actual questions themselves provide ample insight into the issues of stress, and job demand, control and support factors. As noted earlier, the questions relating to this study constitute a subset of a wider group of questions in the questionnaire – dealing with job demand, control and support factors, coping mechanisms, as well as harassment and discrimination at work. The pilot study also served to confirm the efficacy of the questionnaire.

Occupation stress indicator (OSI) scales (involving appropriate subscales of, and sub-subscales within job satisfaction; mental and physical health; personality type; control; job pressure, and coping with stress) are extremely complex and not without considerable criticism (Kline, 2000a: 631). The development of such a scale is beyond the scope of this article. The 10-point stress 'scale' used in this study can more properly be described as a form of 'perception metric', indicating the degree of a condition being perceived to be felt at a point in time. Such metrics are used by social psychologists (Kline, 2000b: 122).

Exploratory factor analysis (EFA) was not performed on the job demand, control and support variables. EFA is a data-reduction technique, essentially reducing a large set of variables into smaller sets or components (Pallant, 2010: 181). It is used in the compilation of tests and scales. Factor analysis (FA) helps create coherent subscales from an initial, large number of individual scale items or questions. We are not developing a psychometric scale.

The purpose of this article was not to examine the 'causal' relationships between a dependent variable (stress) and a series of predictor variables. It was never the intention to derive a predictive model; hence, regression analysis (logistic or hierarchical) was not performed.

The difficulty associated with demonstrating validity in questionnaire surveys is acknowledged (Platt, 2001: 33). The analysis is based mainly on statistical significance testing. Consequently, the results do not establish with any certainty a 'causal' link between any of the demographic, job demand, control and support factors, and perceived workplace stress levels. The results may be suggestive of such links, but more in-depth research would be necessary to establish its validity. This study adopted a self-reporting survey measurement method. Therefore, the findings may have the potential risk of common method variance and the validity of data may be questioned. However, it should be noted that the metrics used in this study were based on issues highlighted in the stress management and construction literature. The sample size, to some extent, militates against validity concerns, as do the significance of the correlations between perceived workplace stress level and the job demand, control and support variables. The Cronbach's alpha for each scale (reported below) ranged from 0.75 to 0.78, indicating internal consistency.

Ethical considerations in the form of the absence of deception; privacy and confidentiality, and accuracy were observed (Christians, 2005: 139). Institutional ethical clearance was also obtained.

Following a pilot online study to test the adequacy of the questionnaire, the full survey was conducted between September and November 2010 and administered as an Internet web-based online instrument, as this allowed easy and inexpensive coverage of quantity surveyors registered with their statutory council. Professional registration of quantity surveyors is a legal requirement in South Africa. Undertaking the survey through the auspices of the statutory council provided a valid way of targeting the sample group.

A total of 1.449 quantity surveyors received the request to participate in the survey, of whom 177 completed the questionnaire online. Discounting email 'bounces', this represents a response rate of 12.2%. This level of response is typical for web-based surveys of this nature (Fricker, 2008: 207).

The response data were analysed using the Statistical Package for the Social Sciences (SPSS) (Ver. 21.0 for Mac) software application. Where cross-tabulation was used to establish degrees of association between categorical variables, Pearson's chi-square test (or Fisher's Exact Test, where applicable) for independence was applied at the 5% (p=0.05) level of significance. Ethnic differences were analysed by grouping the responses to the 'African', 'Indian', and 'Coloured' (mixed race) options in the questionnaire together as 'Black'

because of the comparatively small numbers of respondents in the separate categories.

5. The results

5.1 Sample profile

The majority of the respondent quantity surveyors are male (80%), White (81%), married (including common law marriages) (77%), English-speaking (53%), and older than 40 years (59%). Whilst nearly two-thirds of all respondents are at least 40 years old, 40% are older than 50 years. The majority of the respondents are located in the more populous provinces of Gauteng (44%), Western Cape (22%), KwaZulu-Natal (12%) and the Eastern Cape (11%). Compared to the SACQSP statistics, female quantity surveyors are over-represented in this study (20% compared to 12%). The biases of the sample in terms of gender, ethnicity, and age should be borne in mind when drawing inferences from the data.

Nearly half of the respondents report more than 20 years' experience, and a quarter have at least 10 years' experience. Experience is significantly related to gender (p=0.005) and to race (p<0.001), with White male quantity surveyors having worked longer, while 40% of respondents have been with their present firm for five or less years, and 22% in excess of 20 years. Service length is significantly related to gender (p<0.001) and race (p=0.004), and White males have worked longer for their current firms than females and other ethnic groups.

Overall, the response sample may generally be described as experienced quantity surveying practitioners in private practice, mostly White, male, English-speaking, in a stable relationship, and in a stable work environment.

5.2 Overall levels of workplace stress

Using a 10-point scale (1=minimum stress; 10=maximum stress, with no defined intermediate scale intervals), survey respondents were asked to rate the level of stress that they currently perceive themselves to experience at work. The results are shown in Table 1.

Table 1: QS survey respondents' self-assessment of workplace stress (*n*=160)

Perceived levels of workplace stress	*Frequency(%) (n)*
Level 1 (minimum)	4% (*n*=6)
Level 2	6% (*n*=10)
Level 3	10% (*n*=16)
Level 4	9% (*n*=14)
Level 5	10% (*n*=17)
Level 6	16% (*n*=25)
Level 7	21% (*n*=33)
Level 8	17% (*n*=27)
Level 9	6% (*n*=10)
Level 10 (maximum)	1% (*n*=2)
Mean score (+/- standard error)	5.76 (+/- 0.18)

Notes: Scale values: 1=minimum stress; 10=maximum stress (no intermediate scale interval definitions). Level of stress is significantly related to gender (p=0.042), but not to race or age.

Quantity surveyors appear to be highly stressed at work (45% report a stress level of '7' or above) and only 39% report a stress level of '5' or less. The mean stress level scale value reported is 5.76, i.e., respondents generally perceive themselves as experiencing more stress than not. Stress level is not significantly related to ethnicity (*p*=0.719) or age (*p*=0.636), but is to gender (*p*=0.042), with proportionately more women respondents than men reporting high levels of stress compared to their male counterparts.

It can thus be inferred that stress levels experienced by quantity surveyors in South Africa are relatively high, particularly for females.

5.3 Job demands

Respondents were asked to rate the nature and effect of their workplace demands. Factors explored include working to tight deadlines; having to work long hours (at work and/or at home); inadequate time to balance work/family responsibilities; actual hours worked, and the need to work harder than others to 'prove' oneself. Except for hours worked per week (grouped in seven time bands), these factors were assessed in terms of 5-point Likert scales vectored from most to least. Tables 2 and 3 depict the results.

Perceived workplace stress level is significantly related to working to tight deadlines (p=0.054), working long hours (p=0.021), and inadequate time to balance work/family responsibilities (p<0.001) (see Table 9).

Table 2: QS survey respondents' self-assessment of job demands

Job demand factors	*Frequency (Most of the time/ frequently) (%) (n)*	*Mean rating value (+/- standard error)*
Work to tight deadlines (n=175)	90% (n=158)	1.65 (+/- 0.05)
Work long hours (n=175)	67% (n=118)	2.09 (+/- 0.07)
Inadequate time to balance work/family responsibilities (n=175)	51% (n=89)	2.45 (+/- 0.08)
Need to work harder than others to 'prove' yourself (n=142)	39% (n=56)	2.75 (+/- 0.10)

Notes: Scale values: 1=most of the time; 2=frequently; 3=sometimes; 4=seldom; 5=very seldom. The statistics exclude 'not applicable' responses. None of the job demand factors are significantly related to gender, race, or age.

The majority of the respondent quantity surveyors (90%) report having to work to tight deadlines more often than not (Table 2: mean rating score = 1.65). Similarly, many (67%) find it necessary to work long hours (Table 2: mean rating score = 2.09). This finding aligns with the actual hours worked per week (see Table 3), where 35% of respondents report working more than 50 hours per week. At least 18% of the respondents claim to work more than 55 hours per week.

Table 3: QS survey respondents' reported hours worked per week (n=175)

Hours worked per week	*Frequency (%) (n)*
31-35 hrs (1)	3% (n=5)
36-40 hrs (2)	5% (n=8)
41-45 hrs (3)	23% (n=41)
46-50 hrs (4)	34% (n=59)
51-55 hrs (5)	17% (n=30)
56-60 hrs (6)	14% (n=24)
>60 hrs (7)	4% (n=8)
Mean score (+/- standard error)	4.17 (+/- 0.10)

Note: Hours worked per week is not significantly related to gender, race, or age.

When actual hours worked are considered in terms of gender, race and age, none of the relationships are statistically significant. Against a background of the changing nature of the workforce, changing family structures and dynamics, and the demands of organisations, Lingard & Francis (2009: 2) emphasise the importance of work/life balance in the construction industry. In the current survey, the mean rating score for quantity surveyors (Table 2: <2.5) indicates that their *inability* to successfully balance work/family responsibilities occurs more often than not. Differences of perceptions of work/life imbalance in terms of gender, race and age are not significant: the perception is uniform. A minority (39%) of respondent quantity surveyors perceive a (self-imposed) need to work harder than other colleagues in the same firm in order to 'prove' themselves (Table 2: 39%; mean rating score = 2.75), but differences in terms of gender, race and age are not significant for this factor.

In addition to examining each of the five job demand factors as individual indicators of workplace demands, an overall job demand *scale* was computed by summing all items in the direction of greater job demand (Pallant, 2010: 87). All demand factors, except hours worked per week, were reverse-coded for this purpose. Scale scores thus represent the sum total of the endorsed items, and range from 5 to 27, with 27 representing the highest level of job demand. The job demand scale score was internally consistent, α = 0.76.

5.4 Job control

Survey participants were asked to rate their perceived degree of control over workplace tasks; their pace of work; their work environment, and whether or not an imbalance exists between their responsibility and level of authority. A 5-point Likert scale was used in each case. For the first three factors, the scale intervals corresponded to 1=total control; 2=a lot of control; 3=some control; 4=a little control, and 5=no control. For the fourth factor (responsibility/authority), the scale intervals were 1=strongly agree; 2=agree; 3=neutral; 4=disagree; 5=strongly disagree. Responses to each of the four job control factors were examined first as individual indicators of workplace control. A job control *scale* was then computed by summing all items in the direction of greater job control. All control factors were reverse-coded for this purpose. Scale scores represent the sum total of the endorsed items, and range from 4 to 20, with 20 representing the highest level of job control. The job control scale score was internally consistent, α = 0.75. The results are depicted in Table 4. None of the job control factors are significantly related to perceived level of workplace stress (see Table 9).

Table 4: QS survey respondents' self-assessment of degree of job control

Job control factor	*Frequency(total control/a lot of control) (%) (n)*	*Mean rating value (+/- standard error)*
Type of work assigned (*n*=177)	79% (*n*=140)	1.86 (+/- 0.06)
Pace of work (*n*=177)	65% (*n*=115)	2.12 (+/- 0.08)
Work environment (*n*=175)	61% (*n*=106)	2.30 (+/- 0.07)
Job lacks the requisite authority to match the responsibility (*n*=177)	45% (*n*=79)	2.95 (+/- 0.10)

Notes: Scale values: 1=total control; 2=a lot; 3=some; 4=a little; 5=no control. Gender is significantly related to task assignment (p=0.009), pace of work (p=0.024), and an authority/ responsibility imbalance (p=0.022). None of the job control factors are significantly related to race. Age is significantly related to task assignment (p=0.012), pace of work (p=0.007), and work environment (p=0.029).

The majority of the respondents report having considerable control ('a lot' or 'total control') over their task assignment (79%), pace of work (65%), and work environment (61%). An imbalance between authority and responsibility is reported by just under half of QS respondents (45%). The respective mean rating scores for the four job control variables are 1.86, 2.12, 2.30, and 2.95, respectively (see Table 4).

Gender difference is significantly related to task assignment (p=0.009), pace of work (p=0.024), and an authority/responsibility imbalance (p=0.022). Proportionately more women than men consider this to be the case. None of the job control factors are significantly related to race. Age is significantly related to task assignment (p=0.012), pace of work (p=0.007), and work environment (p=0.029). Note that cross-tabulation is not shown in this instance.

5.5 Job support

Using 6-point Likert scales (1=most of the time; 2=frequently; 3=sometimes; 4=seldom; 5=very seldom; 6=not applicable), survey participants were asked about the extent of support received from line managers and colleagues at work in terms of making an effort to make life easier at work and being relied upon to help when a difficult situation arises. The results are given in Table 5. The option of 'not applicable' was included to cater for instances such as sole practitioner firms. The analysis *excludes* those responses. After examining each factor as individual indicators of job support, a job support *scale* was computed by summing all items in the direction

of greater job support, with total scores ranging between 4 and 20, and 20 representing the highest level of job support. All support factors were reverse-coded for this purpose. This scale was internally consistent, α = 0.78.

Table 5: QS survey respondents' assessment of the frequency of support experienced at work

Types of support received at work (n=total applicable responses)	*Frequency(most of the time/frequently) (%) (n)*	*Mean rating value (+/- standard error)*
Effort by line manager to make work-life easier (*n*=111)	23% (*n*=26)	3.27 (+/- 0.11)
Assistance by line manager in difficult situations (*n*=113)	46% (*n*=52)	2.73 (+/- 0.11)
Efforts by colleagues to make work-life easier (*n*=145)	29% (*n*=42)	3.08 (+/- 0.08)
Assistance by colleagues in difficult situations (*n*=151)	47% (*n*=71)	2.64 (+/- 0.09)

Notes: Scale values: 1=most of the time; 2=frequently; 3=sometimes; 4=seldom; 5=very seldom. The statistics exclude 'not applicable' responses. Gender is significantly related to assistance from colleagues in difficult situations (p=0.044). Race is significantly related to assistance from a line manager in difficult situations (p=0.003). None of the job support factors are significantly related to age.

Support at work is strongly related to perceived level of workplace stress (see Table 9), most notably in the form of efforts by colleagues to make work-life easier (p<0.001) and to provide assistance in difficult situations (p<0.001). Of all respondents to this question, only 23% report that their *line managers* most of the time or frequently make an effort to make their lives easier at work. Differences in terms of gender, race and age are not significant. However, when considering support from line managers in difficult situations at work, nearly half (46%) of all the respondents believe that such support is forthcoming most of the time or frequently. Proportionately more White than Black respondents feel that this support is forthcoming (p=0.003), but gender and age are not found to be significantly related to expectations of manager support.

Identical questions were posed to participants in respect of support emanating from *colleagues*. Whilst work colleagues are generally perceived as making more of an effort (than managers) in making their lives easier at work, the overall situation is perceived by

respondents as being much the same. Only 29% believe that their colleagues make their lives easier most of the time or frequently, whereas 47% think that colleagues assist with difficult situations frequently or most of the time. Of the demographic factors, only gender is significantly related to colleagues' assistance with difficult situations (p=0.044), with proportionately more men reporting this than women. Note that cross-tabulation is not shown in this instance.

5.6 Workplace stress mean scores, and job demand, control and support scale scores: by gender, race and age

The results of this analysis are depicted in Table 6. Despite males reporting significantly lower levels of perceived workplace stress than their female counterparts (p=0.042), when the job demand, control, and support *scale scores* are considered, no significant differences for gender and ethnicity emerged. However, in terms of age, younger (<45 years) respondents report significantly higher levels of perceived workplace stress than do older colleagues (p=0.050). Older colleagues report lower levels of job demands, greater job control, and greater job support, but the differences are not significant. The finding with respect to age essentially 'mirrors' that relating to gender in perceived levels of stress.

Table 6: Workplace stress *mean scores*, and job demand, control and support *scale mean scores* for quantity surveyors: by gender, race and age

	Mean	*SD*	*Mean*	*SD*	*p-value*
Scores by gender	*Male*		*Female*		
Workplace stress score (1=minimum stress; 10=maximum stress)	5.44	2.25	6.83	1.56	0.042*
Job demands scale score (score range 5-27) *(R)*	19.08	3.63	19.45	3.54	0.612
Job control scale score (score range 4-20) *(R)*	14.91	2.29	13.94	2.21	0.440
Job support scale score (score range 4-20) *(R)*	12.33	3.33	11.46	3.39	0.179
Scores by race	*White*		*Black*		
Workplace stress score (1=minimum stress; 10=maximum stress)	5.74	2.25	6.04	1.91	0.719
Job demands scale score (score range 5-27) *(R)*	19.22	3.67	19.46	3.50	0.420
Job control scale score (score range 4-20) *(R)*	14.68	2.35	14.97	2.16	0.672

Job support scale score (score range 4-20) *(R)*	12.33	3.33	11.26	3.43	0.900
Scores by age	*Older (≥45 yrs)*		*Younger (<45 yrs)*		
Workplace stress score (1=minimum stress; 10=maximum stress)	5.38	2.40	6.15	1.96	0.050*
Job demands scale score (score range 5-27) *(R)*	18.87	3.55	19.58	3.68	0.273
Job control scale score (score range 4-20) *(R)*	15.08	2.29	14.42	2.29	0.282
Job support scale score (score range 4-20) *(R)*	12.31	3.36	11.97	3.38	0.840

Notes: *$p \leq 0.05$; *R*=reversed. Scores for *all* QS respondents are: mean stress=5.76 (SD=2.22); job demand score=19.27 (SD=3.63); job control score=14.74 (SD=2.31), and job support score=12.11 (SD=3.36). Level of workplace stress is significantly related to gender (p=0.042) and age (p=0.050). The job demand, control, and support scale *scores* are not significantly related to gender, race, or age.

5.7 Organisational stressors

Aside of job demand, control and support factors *per se*, additional (organisational) stressors relating to job certainty and opportunities as well as to human relations aspects of the work environment were examined.

5.7.1 Job certainty and opportunities

Survey respondents reported their perceptions of job security, the existence of promotion opportunities within the industry, and alternative job opportunities. Five-point Likert scales (1=strongly agree; 2=agree; 3=neutral; 4=disagree; 5=strongly disagree) were used. This scale was internally consistent, α = 0.76. The results are given in Table 7. None of these factors are significantly related to workplace stress level (see Table 9). Mean rating scores (Table 7: >2.5) for all factors indicate that, overall, the issues of job security and promotion and alternative employment opportunities are more negatively than positively perceived. While 51% of the respondents feel positive about their job security, only 33% feel optimistic about promotion opportunities, and only 29% consider themselves capable of getting an equivalent job within a reasonably short period.

Table 7: QS survey respondents' assessment of the existence of job certainty issues

Existence of job stability and prospects	*Frequency(Strongly agree/agree) (%) (n)*	*Mean rating value (+/- standard error)*
Job security (*n*=170)	51% (*n*=86)	2.68 (+/- 0.08)
Job promotion (*n*=169)	33% (*n*=55)	2.90 (+/- 0.08)
Ability to secure a similar level job reasonably quickly (*n*=169)	29% (*n*=49)	3.12 (+/- 0.08)

Notes: Scale values: 1=strongly agree; 2=agree; 3=neutral; 4=disagree; 5=strongly disagree. Gender is related to perceptions of job promotion (p=0.003). None of the job certainty issues are significantly related to race or age.

None of the other job security issues are significantly related to gender, race or age. The factor cross-tabulation is not shown in this instance.

5.7.2 The work environment

Survey participants were asked to comment on their general working environment with respect to a variety of issues, namely their freedom to speak freely and frankly about matters concerning them; whether or not they argue frequently with line managers, colleagues or clients; if they feel that they could do a better job if more time was available; whether or not they are given opportunities to improve or perfect their skills, and whether or not they feel fairly compensated for the work done and hours devoted. The results are depicted in Table 8. Six-point Likert scales (1=strongly agree; 2=agree; 3=neutral; 4=disagree; 5=strongly disagree, and 6=not applicable) were used. The '*not applicable*' responses relating to the skills improvement question were excluded from the analysis for the reason described earlier. This scale was internally consistent, α = 0.57. Perceived workplace stress level is significantly related to the perception of being able to do a better job if more time was available (p<0.001), and to the freedom to speak openly about issues of concern (p=0.054) (see Table 9).

Table 8: QS survey respondents' agreement with work environment factors

Work environment factors	*Frequency (Strongly agree/agree) (%) (n)*	*Mean rating value (+/- standard error)*
Freedom to honestly say what I feel and get things off my chest (*n*=176)	63% (*n*=110)	2.34 (+/- 0.08)
Argue frequently with line managers, colleagues or clients (*n*=177)	16% (*n*=28)	3.55 (+/- 0.08)
Could do a much better job if there was more time (*n*=175)	68% (*n*=119)	2.20 (+/- 0.08)
Opportunities to improve skills (*n*=170)	37% (*n*=63)	2.81 (+/- 0.08)
Fairly compensated for the work I do and the hours I devote (*n*=175)	55% (*n*=96)	2.62 (+/- 0.08)

Notes: Scale values: 1=strongly agree; 2=agree; 3=neutral; 4=disagree; 5=strongly disagree. Gender and age are significantly related to freedom of expression (p=0.004 and p=0.043, respectively), and race is significantly related to being fairly compensated (p=0.020).

The majority (63%) of the respondents consider themselves able to speak openly about matters of concern (Table 8: mean rating score = 2.34). Both gender (p=0.004) and age (p=0.043) are significantly related to this issue. Proportionately more men than women, and older rather than younger quantity surveyors, consider themselves able to speak freely.

When arguments with line managers, clients and colleagues are considered, only 16% of the respondents believe that this occurs frequently (Table 8: mean rating score = 3.55), and differences in terms of gender, race and age are not significant.

Over two thirds (68%) of the respondents claim that they could do a better job if given more time (Table 8: mean rating score = 2.20). Differences in terms of gender, race and age are not significant. Over a third (37%) of the quantity surveyors report that they are given opportunities to improve their skills (Table 8: mean rating score = 2.81). Again, differences in terms of gender, race and age are not significant.

Slightly more than half (55%) of the respondents consider themselves to be fairly remunerated in terms of work done (Table 8: mean rating score = 2.62). However, differences in terms of ethnicity are significant,

in this instance (p=0.020), with proportionately fewer Whites considering themselves unfairly compensated for their efforts, and 25% of Black quantity surveyors considering themselves 'underpaid'.

Table 9: Cross-tabulation of perceived workplace stress level with job demand, control and support factors and general working environment factors

JDC/S factors	*p-value*
Job demand factors	
Work to tight deadlines (n=160)	0.054*
Work long hours (n=160)	0.021*
Inadequate time to balance work/family responsibilities (n=160)	<0.001*
Hours worked per week (n=160)	0.311
Need to work harder than others to 'prove' yourself (n=128)	0.064
Job control factors	
Type of work assigned (n=160)	0.747
Pace of work (n=160	0.527
Work environment (n=158)	0.228
Job lacks the requisite authority to match the responsibility (n=160)	0.209
Job support factors	
Effort by line manager to make work-life easier (n=105)	0.049*
Assistance by line manager in difficult situations (n=107)	0.391
Efforts by colleagues to make work-life easier (n=137)	<0.001*
Assistance by colleagues in difficult situations (n=142)	<0.001*
General work environment factors	
Job security (n=160)	0.133
Job promotion (n=160)	0.747
Ability to secure a similar level job reasonably quickly (n=160)	0.797
Freedom to honestly say what I feel and get things off my chest (n=159)	0.054*
Argue frequently with line managers, colleagues or clients (n=160)	0.287
Could do a much better job if there was more time (n=160)	<0.001*
Opportunities to improve skills (n=155)	0.123
Fairly compensated for the work I do and the hours I devote (n=160)	0.058

Note: *p □ 0.05

6. Discussion

This section considers the nature of professional quantity surveying work in the construction industry and how this might relate to stress. The focus then shifts to stress-related issues such as job demands, job control, support at work, job opportunities, work/life balance, and the work environment, taking into account gender, age and ethnicity differences where these are relevant.

6.1 The nature of professional work in the construction industry

Professional work in the construction industry is characterised by two features that are common to the professions of architecture, engineering, quantity surveying, and project and construction management.

First, more often than not, the work involves multitasking on multiple projects. Few construction industry professionals enjoy the luxury of engaging in one task on one project only. In addition, high levels of task differentiation and interdependence are usually encountered; i.e., multitasking involves a substantial number of different tasks (frequently across different projects). Many of those tasks have interrelated dependencies, thus rendering the professional work itself as complex as the projects upon which it is performed (Williams, 1999: 272; Asquin *et al*. 2010: 166; Mohr & Wolfram, 2010: 168).

Secondly, the work of professionals in the construction industry inevitably involves making professional judgements and decisions under conditions of uncertainty. The uncertainty may be associated with the search for solutions to problems relating to project design and construction and/or to the need to model or plan for situations and actions that may (or may not) occur in a future that is not known with certainty. Uncertainty is recognised as a substantial contributor to human stress (Miceli & Castelfranchi, 2005: 291; Lingard, Francis & Turner, 2010: 1094).

Thirdly, in terms of the critical parameters of every construction project, namely time, cost, quality and safety, it can be argued that professionals will each place different emphasis on each criterion, and will be impacted by different uncertainties that arise in relation to project objectives, which often conflict. For example, professional quantity surveyors are highly concerned with project cost (in terms of forecasting and financial administration) and uncertainty, in this instance, is similar to uncertainty associated with the macro-economic systems of society. Considerable uncertainty may exist in terms of the distribution of elemental costs derived from elemental

analyses, forecasted tender price indices, likely rates of escalation, and procurement and contractual arrangements, while the decision-making associated with these factors is frequently critical to project success.

6.2 Stress levels

The survey findings show that high stress levels exist for quantity surveyors working in the South African construction industry (Table 1: 24% of all respondents report levels >7), confirming the Hong Kong findings of Leung *et al.* (2007: 1072). The relationship between time demands of work and the experience of stress may be complex and be moderated by other variables. The results suggest that is not just the quantity of work but the quality of the work experience that determines perceived stress levels and there may be qualitative differences between different quantity surveyors. Female quantity surveyors report significantly lower levels of positive promotion prospects than male colleagues. This is important because job 'certainty' has been shown to impact negatively on the job satisfaction of permanent workers, increase worker stress, and detrimentally affect work-life balance (Burke & Greenglass, 2001: 592; De Cuyper & De Witte, 2007: 65; Probst, Stewart, Grys & Tiernay, 2007: 479; Schreurs, Emmerik, Notelaers & De Wit, 2010: 56).

The findings of this research are also consistent with previous research that has revealed that women working in the construction industry generally experience higher levels of stress than males in similar employment (e.g. Goldenhar, Swanson, Hurrell, Ruder & Deddens, 1998: 28; Caven, 2005: 527; Sang *et al*., 2007: 1315; Bowen *et al*., 2013a: 393). Previous research has also reported higher levels of job stress and burnout among younger employees, which is consistent with the findings of the current research (Lingard, 2003: 69; Brewer & Shapard, 2004: 108; Soares, Grossi & Sundin, 2007: 61). This warrants further investigation to examine the role played by family status, life stage, the number of years of professional experience, and the effects of 'conditioning' in determining stress levels and success in coping with stress among quantity surveyors.

6.3 Stress factors

The job demand/control nexus with stress, found in earlier research (e.g., Karasek, 1979; Houtman, 2005), is strongly supported. The high stress levels reported by South African quantity surveyors is matched by their significantly diminished control over the type of work undertaken, the pace of that work, and the environment in

which it is carried out - particularly among female and younger quantity surveyors (Table 4). The strain effects are exacerbated by having to work long hours, meet tight deadlines, and by finding it difficult to balance work/family responsibilities successfully (Table 2). Of particular concern is that fewer than 8% of all the respondents report working a 'normal' week of 40 hours or less. The long hours worked also match the general agreement among respondents that they could do a better job if given more time (Table 8), thus providing fertile and aggravating grounds for job frustration: more time would mean even longer hours and thus even greater work/life imbalance and faster burnout rate.

The high burnout rate associated with all these demand/control factors (Lingard & Francis, 2004: 162; Hausser, Mojzisch, Neal & Schulz-Hardt, 2010: 33) provides a clear signal to the quantity surveying profession that increasingly excessive workloads may be counter-productive, damaging to health and social well-being, and lead to diminishing work standards and declining attractiveness of the profession to new entrants.

7. Conclusions

The contribution of this work lies in its examination of the work stress experienced by professional quantity surveyors in a developing country characterised by economic hardship and social problems. The stress levels experienced by quantity surveyors in South Africa are sufficiently high as to cause concern, not only for the health of individual professionals, but also for the continuing effectiveness of their contribution to the construction industry. The body responsible for guiding and promoting the work of the quantity surveying profession should take careful note of this, and consider what measures of support are needed for their members. The negative ramifications of stress have an inevitable ripple effect, spreading from individuals through families and extended families to communities and thus to society as a whole.

We need to know more about the nature of the work undertaken by quantity surveyors, and what might make some tasks more stressful than others. We need to explore why females report higher stress levels than their male counterparts. Besides seeking more intra-professional understanding, we should also explore inter-professional issues. While uncertainty, in relation to decision-making, cannot be entirely eliminated, it may be possible to mitigate it and manage it.

Employers need to better understand the effect that occupational stress has on their employees and implement strategies preferably aimed at prevention. Such interventions should encompass regular reviews of workload allocations, empowering employees, fostering a supportive work environment, conducting stress appraisals, conducting stress-management workshops, and facilitating stress counselling where warranted. A powerful target would be the eradication of unrealistic deadlines in the planning and scheduling of construction work.

Addressing the root causes of stress among construction professionals and developing measures to deal with them will almost certainly have to proceed on a broad front. The quantity surveying profession could provide a lead in this.

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Douw Boshoff

Investigation into the supply of information and measurement of transparency in the listed property sector

Peer reviewed and revised

Abstract

This article investigates the information that is available to shareholders and the public by listed property companies in order to make investment decisions. It also mentions the usefulness of this information for purposes of mass valuation of the portfolio of properties that are owned by these entities, or to extrapolate to other non-portfolio properties. The study makes use of a multiple regression analysis with empirical testing of property loan stock (PLS) companies in South Africa. It was found that only six of the PLS companies publish any useful information with regards to their property portfolio and only one provided sufficient information to be of statistical significance. It was also found that the provided information is lacking specific property and portfolio details and is, therefore, of limited use overall as far as investment decision-making is concerned. The method applied is, however, confirmed to be applicable for mass valuation techniques, but limited by the amount of information available.

Abstrak

Die artikel ondersoek die inligting wat aan aandeelhouers en die publiek beskikbaar gestel word deur genoteerde eiendomsfondse om sodoende beleggingsbesluite te neem. Die bruikbaarheid van hierdie inligting vir doeleindes van massawaardasietegnieke van die portfolio of nie-portfolio eiendomme word ook gemeld as 'n sekondere aanwending. Veelvoudige regressie analise word gebruik met empiriese toetse van die eiendomsleningseffekte maatskappye in Suid-Afrika. Die ondersoek het bevind dat slegs ses van die maatskappye enige bruikbare inligting publiseer ten opsigte van hul eiendomsportefeulje en slegs een genoegsame inligting publiseer om statisties beduidend te wees. Dit was ook bevind dat die inligting tekortkom ten opsigte van eiendoms- en portefeulje spesifieke besonderhede om beleggingsbesluite te neem. Die metode wat toegepas is, bevestig egter die gebruik van massawaardasietegnieke, maar dat dit beperk word deur inligting wat beskikbaar is.

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1. Introduction

When considering the valuation techniques of income-producing property, various types of information should be obtained from the market in order to apply them to the valuation of the property under consideration. This includes the comparison with other properties sold in the market. However, due to the illiquid nature of property, especially those typically owned by institutional investors, such transactions do not take place every day. Therefore, the necessary information is not always readily available, nor of the required quality. Furthermore, the commercial property market is so diverse that the difference in property attributes leaves comparison to a few comparables of questionable level of accuracy. With the increasing requirement for accuracy and speed of valuation due to high volume purposes such as municipal valuations, portfolio valuation for large investment companies, auditing of security of financial institutions, etc., the use of alternative techniques such as Computer Assisted Mass Appraisals (CAMA) and Automated Valuation Models (AVM), where no human intervention is present, have developed. These models are based on various techniques such as neural networks or artificial intelligence, multiple regression or hedonic models and hybrid AVMs with human intervention.

As some of the largest property investors in South Africa, the listed property sector possesses information that might be useful in performing valuations on commercial property. This might exceed the general premises of interpolation and also include extrapolation to valuing other properties not included in the listed sector. The purpose of this article is twofold:

1. To test the use of publicly available information from the listed property sector for application in valuation processes such as multiple regression analysis, and
2. The success with which a valuation process such as multiple regression analysis could be used to perform commercial property valuation.

2. Literature review

Downs & Güner (1999: 518) stated that problems associated with observing the value of the underlying asset in real-estate securities are frequently cited by practitioners and academics. Brennan (1990: 727-728) refers to this as a latent-asset problem, i.e., the information acquisition problem of investors when the value of some assets is not observable. This suggests that the value of the assets

in listed property funds could not generally be observed by the investors due to information deficiency in the sector. This questions the information that is being made available to investors by publicly traded listed companies in order to make informed investment decisions. If this information is of a sufficient level to make informed decisions, it would provide the opportunity also to extrapolate to other properties not held in the listed market, which generally suffers from information deficiency for valuation purposes.

2.1 Information deficiency in property markets and property valuation

Webb (1994: 63-64), reported that less than 5% of properties in the appraisal-based index are sold in a given year, indicating that commercial properties transact, on average, once in every 20 years. This leaves valuers with very little information to work with in determining market value at specific times. Booth & Marcato (2004: 147) stated that the provision of performance information on the direct real-estate market suffers from a lack of timeliness and reliability. Rode (2004) also mentioned that valuers have a serious problem in estimating market values, because market data were outdated by the time they became available to market players.

This confirms the need for alternative methods to arrive at accurate market assessment. Hager & Lord (1985: 23) are, however, of the opinion that valuation is an expression of personal opinion and that the success of a valuation relies extensively on personal knowledge and expertise in interpreting the many existing variables.

Boyd & Irons (2001: 6-8) discussed the challenges facing valuation practice and commented that the tasks of valuers extend beyond the traditional role of providing a single point estimate. According to him, the valuers' primary role is that of a property market analyst and, therefore, the valuers should be capable of competently commenting on both macro- and micro-factors that are influencing the market in which they are specialists. His views on the competency of valuers is supported by the fact that the courts have, on many occasions, criticised valuers for differing markedly from the market figure or other valuations. The case of 'Interchase Corporation Ltd v CAN 010087573 Pty Ltd and others was discussed to illustrate this. According to Boyd & Irons (2001: 17), this case demonstrates the importance of accurate data. He mentioned that it is not unusual to find that information provided to the valuer is incomplete and occasionally misleading, but it is the responsibility of the valuer to exercise reasonable care in the acceptance and use of valuation

data. He also stated that the valuer must demonstrate expertise in attempting to obtain the most accurate information available and that the valuers' responsibility extends to an evaluation of the reliability and accuracy of the data within a risk analysis, and the subsequent quantification of the degree of uncertainty in the valuation figure. Boyd & Irons (2001: 17) also mentioned that the accuracy that is achievable in a valuation figure depends, to a large extent, on both the quality of the comparable data provided and the competence of the valuer.

Information deficiency is not only affecting valuers. Downs & Güner (1999: 517) found that information deficiency has a direct impact on price-formation decisions by investors, which also ultimately affect valuers when comparable transactions are investigated. This was confirmed by Boshoff (2012), indicating that listed property companies that provided more transparent information to shareholders received better support from institutional shareholders and had clear evidence of shareholder activism.

The mentioned studies indicate that information availability is a concern not only to valuers, but also in investment decision-making. This brings together two aspects of information availability:

1. The information made available by listed property companies in order to enable prospective investors to make investment decisions, and
2. The possibility to use this information to provide evidence of individual market values, which could also be extrapolated to other non-portfolio properties.

2.2 Valuation methods and the use of mass appraisal

In order to evaluate the usefulness of information that is made available in the listed property sector, it is necessary to consider the information that would generally be required. For this purpose, reference is made to literature on different valuation methods.

Various valuation models have been proposed to determine the market value of any property. According to Hager & Lord (1985: 23-24), two methods are used for the valuation of investment properties, namely the investment method and the comparative method. The approach of the investment method is essentially one of income capitalisation, and is also described as the discounted cash flow (DCF) approach. The latter is stated to have the advantage of sophistication, but, due to the possible margins of error in all the variables, might result in inferior results if it is not applied carefully.

Market capitalisation is used to determine the value of income-producing property. The principle is to take the first year's sustainable income of a property and to capitalise that at a rate generally accepted in the market. In this instance, the income and the capitalisation rate are compared to the market separately. It is accepted that the value of a specific amount of net income will have a certain value to the investor and the ratio of the income and the amount that an investor is prepared to pay for that expected income is determined by the market and measured by comparing the same ratio of other properties that have been sold. The capitalisation rate can also be determined by taking the discount rate and deducting long-term capital or income growth.

Gilbertson & Preston (2005: 127-128) indicated that competition between lending institutions and valuers, in terms of speed and cost of valuation services and the availability of data, is stimulating greater use of technology. Technology assists with the collection, organisation and formatting of data utilised for valuations. This has led to technology-based systems such as Computer Assisted Mass Appraisals (CAMA) and Automated Valuation Models (AVMs), which are used for mass appraisal. According to IAAO (2013: 5), mass appraisal is the process of valuing a group of properties as at a given date, using common data, standardised methods, and statistical testing. Mass appraisal is used for various valuation purposes such as municipal tax, mortgages and portfolio management. Values are determined by utilising valuation equations, tables, and schedules developed through mathematical analysis of market data. In addition, IAAO (2013: 16) defined an AVM as a computer programme for property valuation that analyses data using an automated process. A distinction is made with regards to CAMA, which is a system of valuing property that incorporates computer-supported statistical analyses such as multiple regression analysis and adaptive estimation procedure to assist the valuer in estimating value (IAAO, 2013: 17). IAAO (2011: 14-15) described an AVM as a mathematically based computer software programme that produces an estimate of market value based on analysis of location, market conditions, and real-estate characteristics from information collected, whereas the Collateral Risk Management Consortium (2003: 3) indicated that an AVM can be defined as the generic term for any electronic analytic algorithm, process or model that is intended to estimate the value of an individual property, without human assistance (other than the initial entry of the data). Specific to this report, the term applies to models designed to value residential properties. The distinguishing feature between CAMA and AVM is the

level of human interaction, whereby the former assists in valuation, but a reasonable level of human activity is involved, and the latter is without any human interference after database compilation. Robson & Downie (2007: 31) indicated a further difference between AVMs and CAMA systems as the intended application where CAMA systems are mostly applied for taxation purposes, whereas AVMs are mainly applied for loan purposes.

The first signs of AVMs originate from the 1960s. The last decade saw the use of these models outside of North America, and the models are currently used for security valuations on a global basis (Miller & Markosyan, 2003: 173). The development of AVMs in the private sector was driven by the use of technology to automate the residential lending process. Miller & Markosyan (2003: 180) stated that a prolonged period of low interest rates and related increase in lending activity, along with the Internet, are the key stimulants for the development of AVMs. According to Robson & Downie (2007: 46), AVMs developed in the USA and in the UK and have been used for mortgage valuations for over 20 years, but that the most established users of AVMs are still the USA and Canada (Robson & Downie 2007: 29), although general use is observed in the UK, Australia, New Zealand and South Africa.

AVMs have been developed and their use has been established for residential valuations mainly due to the homogeneous nature of this type of property. AVMs are becoming increasingly important and have a role to play in the marketplace. Predictions are that AVMs will improve as database sizes increase and new approaches develop to predict values in heterogeneous residential areas. However, AVMs are still developing and are not free from criticism (Boshoff & De Kock, 2013: 20).

According to Gilbertson & Preston (2005: 127), commercial property valuations are more complex than residential valuations, as limited comparable data is generally available and requires more inputs. The full automation of valuation models is debated, as specialised and heterogeneous properties will not fit into a standard statistical data model. The income valuation approach requires data analysis and adjustments before the value is calculated. Limited research is available on AVMs for commercial property applications, mainly due to the ongoing development of the models, the financial feasibility of such a venture and the intellectual property, which is viewed as confidential.

Boshoff & De Kock (2013: 5) stated the following advantages and disadvantages of AVMs over traditional valuation methods:

- Advantages: lower cost and time saving; consistency; data management; combat fraud, and valuer bias.
- Disadvantages: data shortages; public opinion; the need to inspect property; financial regulation and risk acceptance, and transparency.

Boshoff & De Kock (2013: 20) established that there is scope for commercial property AVMs, however, on a limited basis. They stated that commercial property AVMs will never replace traditional valuers and that they can be implemented as a useful tool for verification and auditing of values. Although AVMs are already well established for use in residential valuation, the application is still very limited for commercial property. In terms of this study, the application of the principles of AVMs and mass appraisal as auditing tool is emphasised. Such an auditing tool is, however, still reliant on a minimum amount of information in order to be of any use.

2.3 Information deficiency in listed property companies

Downs & Güner (1999: 518) stated that problems associated with observing the value of the underlying asset in real-estate securities are frequently cited by practitioners and academics. Brennan (1990: 727-728) referred to this as a latent-asset problem, i.e., the information-acquisition problem of investors when the value of some assets is not observable. Gillan & Starks, in two separate studies (1999 & 2000), found that the behaviour of listed property share prices is influenced by the involvement of institutional investors, as well as by the amount of information that is available to them when they are making investment decisions. The availability of information, therefore, influences shareholder activism and has a direct impact on monitoring management's activities, so that this monitoring ability of institutional investors could affect a firm's value (Chan, Leung & Wang, 1998: 357).

It is, therefore, evident that information availability to shareholders is important and that the ability for shareholders to have a transparent view of the company's operations would have a positive influence on the shareholder activism and subsequent value of the company. More specific to property and the valuations profession, the National Committee for Property Education (2004: 173) stated that one of the purposes of a good valuation report is to provide sufficient information for the reader to draw his/her own conclusions. This could probably also be applied to the annual reports of listed property companies in that these reports should provide sufficient information that shareholders or prospective shareholders can

arrive at their own interpretation of the value of the assets held and, subsequently, the value of the company.

2.4 Summary

The literature review indicated that there is evidence of information deficiency in order to perform valuations accurately as well as decision-making for investment purposes. The different valuation models indicated that the information required for valuation purposes of commercial property would be the income-producing abilities of property, which could be different for different types of property, location and use. Boshoff (2013: 47) noted in this regard that the factors that are property specific and that differentiate the performance of individual properties or property types are:

- Physical characteristics of property;
- Retail sales and profits;
- Vacancy rates;
- Location;
- Employment, and
- Production levels.

With the difficulties that are experienced with property valuation, mass appraisal techniques have developed that are less time consuming, and can overcome fraud and valuer bias. However, the applicability of these techniques is questionable for purposes of commercial property valuation. The information deficiency that is stated for valuation purposes also applies to investors who are interested in purchasing properties. Investors need to use information in order to form an opinion of their willingness to pay a specific price. This would also apply to investors purchasing shares in listed property companies, who need to form an opinion of the underlying value of the portfolio of assets. Such an investor would typically want to make use of the mentioned mass valuation techniques in order to form an opinion of the portfolio.

3. Problem statement

From the literature reviewed, the question is raised as to whether the observed information deficiency is also evident in the listed property sector, with regards to property-specific information that is provided to shareholders, and whether the provided information can be used for property valuation purposes in order to determine the individual values of property by using mass valuation techniques.

In order to investigate the research problem as stated above, it is necessary to consider the null hypothesis, which could be stated as follows:

$$PV_t \neq \beta_0 + \sum_{j=1}^{n} \beta_j A_{ij} + \epsilon_i$$

and the alternative hypothesis as:

$$PV_t = \beta_0 + \sum_{j=1}^{n} \beta_j A_{ij} + \epsilon_i$$

where:

PV_t	=	*Property value at time t*
β_0	=	*Y intercept*
A_{ij}	=	*Property attribute j for observation i*
ϵ_i	=	*random error in Y for observation in i.*

If the null hypothesis could be rejected, the alternative hypothesis could be accepted that the property value at time *t* is explained by the sum of individual property attributes as explained by the information that is provided by the listed property companies in their publicly available documentation. It is further accepted that, if the alternative hypothesis could be accepted, the principles could in a similar way be applied to other valuations of property, if similar information is available.

4. Research method

The research design is a theoretical description of the subject matter, leading to a quantitative analysis and statistical regression of historical data and an empirical analysis for hypothesis testing.

This study investigated the listed property sector in South Africa, by considering the property portfolios as published in the public domain. An attempt was made to include the portfolios of all listed PLS companies that are reasonably active, but some companies were excluded due to a lack of information. The study considered data from the listed funds for the specific period from 2001 to 2010. The actual data and treatment are for purposes of consistency explained at the applicable points of testing.

5. Analysis

The actual data of PLS companies with regard to their property portfolios will be used to develop a model that can explain the value of an individual property, by considering the information provided by the PLS companies.

Actual data on the location, use, size and value variables were available for only six of the companies; other companies did not publish the information. Different companies also provided different levels of information, with Growthpoint Properties (Ltd) being the only company that provided in-depth information that includes subcategories for each type of property. The data used is cross-sectional data only, consisting of the published portfolio information as per the last financial report. The data that were analysed are summarised in Table 1 and the descriptive statistics are included in Annexures A and B. For this purpose, 730 observations were obtained and tested. The data was transformed using the logs of the raw data in order to cater for the diminishing marginal utility of the extra variables, and then tested in two ways. The first was allowing for a dummy variable for each different type of property use, as well as for each different location in combination with the log-transformed other data (dummy analysis), and the other by using the average value per square meter of each type as well as the average value per square meter for each location as proxies for these two variables also as log-transformed data (proxy analysis). The second option has the difference that the number of variables reduced substantially, as the three different dummy variables for *Type* (offices, retail and industrial) are replaced by one *Type* variable and the same for the location dummies, which are in excess of 100 total variables for each of the different locations analysed, that could be replaced by one *Location* variable. Annexure A provides the results of the regression using proxies instead of dummies.

Table 1: Summary of data

Analysis	*Variable*	*Data type*		*No. of proxies / dummies used*	*Number of observations*
		Dummy	*Proxy*		
All property	Size	Ratio	Ratio	1	730
All property	Location	Dummy	Categorical	108	730
All property	Type	Dummy	Categorical	3	730
Growthpoint data	Size	Ratio	Ratio	1	410

Analysis	*Variable*	*Data type*		*No. of proxies / dummies used*	*Number of observations*
		Dummy	*Proxy*		
Growthpoint data	Location	Dummy	Categorical	65	410
Growthpoint data	Type	Dummy	Categorical	23	410
Growthpoint data	Depreciation	Ratio	Ratio	1	410

Source: Adapted from annual reports of Acucap, Growthpoint, Hyprop, Pangbourne, Redefine and Resilient

From the analysis using dummy variables to the analysis using proxies, although the adjusted R square reduced slightly from 0.590 to 0.581, the F-value increased from 10.357 to 338.532. In order to compare these two figures, it is considered in relation to the critical F-values at the 0.01 level of significance, which is 1.447 and 26.100, respectively. This indicates that the F-value using dummies exceeded the critical F-value 7.16 times, while the F-value using proxies exceeded the critical F-value 12.97 times.

Testing for multicollinearity also posed a problem with the dummy variable analysis, with the VIF values for the three type variables being 48.41, 40.17 and 32.21. With proxy analysis this also reduced to well within acceptable levels (see Annexure A).

A Goldfeld-Quandt test was performed to test for heteroscedasticity in both regressions. For both the dummy and the proxy analyses, the hypothesis of homoscedasticity was only rejected at the 0.25 level of significance, with the F-values being 1.144 and 1.123, respectively, and the critical F-values 1.089 and 1.086, respectively. This indicated that heteroscedasticity could be proven with a marginally higher probability in the dummy analysis.

The above tests confirmed the proxy analysis to be slightly more credible. Replacing the Betas into the multiple linear regression equation, and solving for each of the data points in the data set that contained the actual properties for the six companies, the observed values regressed against the anti-logs of the calculated values could be plotted, as seen in Figure 1. The blue line represents the 1:1 relationship. It is evident that, although the regression of the log transformed data did not have much evidence of heteroscedasticity, the anti-logs of the regressed data still have strong graphical evidence of heteroscedasticity. It is evident that the

larger the properties' values, the more underestimated it becomes in the regression.

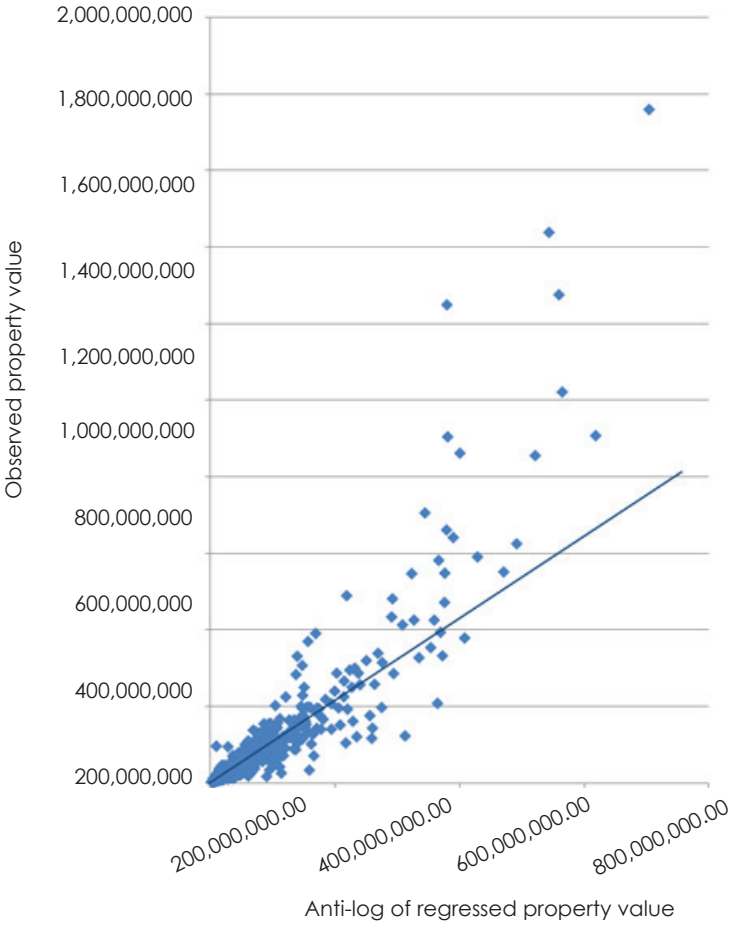

Figure 1: Multiple regression of actual property data

As the largest of the companies with 419 of the 730 properties, as mentioned, Growthpoint publishes its portfolio information in more detail, including subtype use. Each of the three main categories (industrial, offices and retail) is further divided into specific types.

By changing the type variable to include subtypes, the correlation of the calculated values regressed against the actual values strengthened significantly. By having the subtypes available, it was also possible to estimate a depreciation variable, by taking the construction cost, as published by Davis Langdon (2011: 34-35), for each subtype, multiplied by the size of the property, and multiplied by 1,5 to allow for land, professional fees, escalation, etc. The actual value is then divided by the replacement cost to determine the amount of depreciation of each property.

The Growthpoint data is also tested by transforming the data by taking the logs of each variable. The type and location data was also tested, using both dummy variables and proxies.

The R square for the regression of the Growthpoint data strengthened significantly to 0.965 and 0.963 for the dummy analysis and the proxy analysis, respectively. In the case of the dummy analysis, the F-value is 130.146, with the critical F-value at 1.568. This indicates that the F-value exceeds the critical F-value 83.01 times. With the proxy analysis, the F-value is 2,679.902 and the critical F-value 13.5, indicating that the F-value exceeded the critical F-value 198.51 times. This indicates that the addition of the specification information for the Growthpoint data allowed for substantially closer and more significant regression than the general portfolio regression shown in Annexure B. It also confirms the use of proxies rather than dummies in the analysis.

As with the general portfolio regression, multicollinearity posed to be problematic for the dummy analysis, with the VIF values for a number of type dummies indicating severe multicollinearity at values of up to 114.4. It is clear from the regression details in Annexure B that this is not the case for the proxy analysis.

A Goldfeld-Quandt test was also performed on the Growthpoint data in order to test for heteroscedasticity, which indicated that homoscedasticity could be rejected at the 0.25 level for the dummy analysis, with the F-value being 1.240 and the critical F-value at 0.25 being 1.168. For the proxy analysis, homoscedasticity could not be rejected at any level, where the F-value was calculated at 1.018 and the 0.25 level critical F-value 1.120. This indicates not only that it is less probable for heteroscedasticity to be present in the proxy analysis than the dummy analysis, but also that it is less likely for heteroscedasticity to be present in the regression of the Growthpoint data than in the general portfolio data.

As a final test, the Mean Average Percentage Error (MAPE) of the regressions of both the dummy and the proxy analyses was compared. The MAPE analysis is stated by the following equation:

$$MAPE = \sum_{i=1}^{N} \left| \frac{A_i - R_i}{A_i} \right| X \, {}^{1}/_{n} \qquad (1)$$

where:

MAPE = Mean Absolute Percentage Error

A_i = Actual values

R_i = Regressed values

The results of the MAPE analysis as per equation 1 are shown in Table 2.

Table 2: Results of MAPE analysis

	Dummy analysis	*Proxy analysis*
All property	29.84%	34.55%
Growthpoint data	24.46%	15.40%

The tests performed on the property data indicated that there is a significant smaller probability of specification errors in the analysis of the Growthpoint data than in the overall property data. Although the results of the MAPE analysis worsened from the dummy analysis to the proxy analysis for the overall property portfolio, both tests have improved for the Growthpoint data and indicated a significant improvement on the proxy analysis. The worsened results for the overall portfolio, moving from dummy analysis to proxy analysis, might be due to the few variables that are available, confirming the specification error in the overall portfolio and indicating that there is a lack of information provided by these companies to their shareholders. The MAPE results for the Growthpoint analysis support this finding in that both MAPE tests delivered more accurate results. The improvement in the MAPE results for using the proxy analysis on the Growthpoint data also confirms the use of the proxy analysis with the increased level of variables used. The graphical presentation of the observed Growthpoint data to the anti-logs of the regressed data is shown in Figure 2.

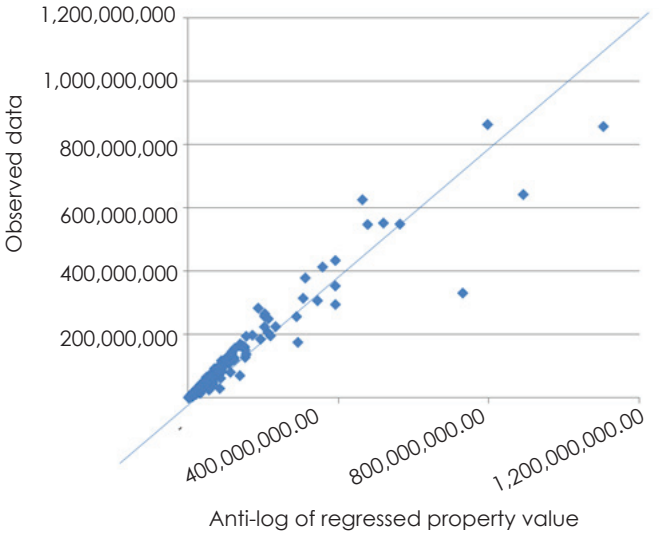

Figure 2: Multiple regression of actual property data – Growthpoint portfolio

The closer regression is evident from Figure 2, but the larger discrepancies in the higher valued properties are still evident, especially in the case of a few outliers. This might be an indication that there are still some specification errors evident, preventing this regression to be a correctly specified hedonic model. Factors not taken into consideration and that might be responsible for this, and should be tested by way of further research, are lease terms, vacancy levels, redevelopment potential, and closer information on actual depreciation and specification levels. In addition, the model did not allow for mixed-use properties, such as industrial and office components to individual properties, which should be further investigated.

6. Conclusion

The null hypothesis was partly rejected, as the rejected null hypothesis is only for information supplied by Growthpoint Properties. This indicates that the alternative hypothesis could be accepted in principle, but that the information supplied by all other PLS companies is not sufficient in order for shareholders to make

an informed decision about the assets held by these companies. The importance of this is that the information generally supplied by listed property companies in their annual reports does not equip investors to reach the same conclusions as the directors of these companies in terms of the values of properties that they own. The lack of information limits the extent to which shareholders can make investment decisions and thus hampers shareholder activism and resultant company performance (also refer Boshoff, 2012).

It also shows that it is possible to use listed property information that is publicly available to extrapolate to other properties for which the values are not known, using the properties' attributes to predict the individual value. This would, however, just hold for the value of the property at the same date as the values of the portfolio when it was published, i.e. at year-end, and does not take into consideration the value at any other date in between, or after year-end, for which no published data are yet available.

Apart from the formal hypothesis, a number of findings are worth mentioning:

- Information deficiency was found to be problematic with regards to property-specific variables. Only Growthpoint provides a reasonable accurate level of information that could be used for pricing or valuation purposes and, even then, it still lacks information on lease terms, depreciation or condition of assets, development potential, etc. These are arguably not provided in order to protect competitive advantage, but are to the disadvantage of shareholders who need to make purchase and pricing decisions on shares.
- Discrepancies in property-specific regression were found to be especially problematic in the top-end retail and office properties. The values, as provided by the funds, substantially exceeded the replacement costs, which were estimated using market analysts' information of replacement cost. This could, therefore, indicate that either the properties are overvalued, or the replacement costs for these types of properties are underestimated, indicating that construction cost indexes for these types of properties should be reconsidered.
- Mass valuation techniques such as statistical modelling could be applied successfully, but the data requirement is of utmost importance. A property's value would only be predicted accurately if full details of its condition, quality of built, etc. are also available, which could typically only be determined by an inspection. This supports previous literature that mass

valuation could be used to avoid valuer bias and can be successfully applied for auditing purposes, but has limited application for a full automated valuation process.

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Annexure A: Multiple regression of actual property data

Descriptive statistics			
	Mean	*Standard deviation*	*N*
Logvalue	7.602617	.5564042	730
Logsize	3.867066	.5122158	730
Loglocation	3.8327	.23684	730
Logtype	3.7874	.24526	730

Model summary[b]					
Model	*R*	*R square*	*Adjusted R square*	*Standard error of the estimate*	*Durbin-Watson*
1	.764[a]	.583	.581	.3599817	1.380

a. Predictors: (Constant), Logtype, Logsize, Loglocation

b. Dependent variable: Logvalue

ANOVA[a]						
Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	131.608	3	43.869	338.532	.000[b]
	Residual	94.080	726	.130		
	Total	225.688	729			

a. Dependent variable: Logvalue

b. Predictors: (Constant), Logtype, Logsize, Loglocation

Coefficients[a]							
Model		Unstandardised coefficients		Standardised coefficients	t	Sig.	VIF
B		Standard error	Beta				
1	(Constant)	1.030	.265		3.887	.000	
	Logsize	.702	.026	.647	26.627	.000	1.027
	Loglocation	.348	.066	.148	5.268	.000	1.376
	Logtype	.666	.064	.294	10.455	.000	1.374

a. Dependent variable: Logvalue

Annexure B: Multiple regression of actual property data – Growthpoint portfolio

Descriptive statistics			
	Mean	Standard deviation	N
Logvalue	7.502001	.4717502	410
Logsize	3.840095	.3941955	410
Logdepreciation	-.337096	.2033475	410
Logtype	3.6687	.29457	410
Loglocation	3.8179	.25607	410

Model summary[b]					
Model	R	R square	Adjusted R square	Standard error of the estimate	Durbin-Watson
1	.982[a]	.964	.963	.0904547	1.932

a. Predictors: (Constant), Loglocation, Logsize, Logdepreciation, Logtype

b. Dependent variable: Logvalue

ANOVA[a]						
Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	87.708	4	21.927	2679.902	.000[b]
	Residual	3.314	405	.008		
	Total	91.022	409			

a. Dependent variable: Logvalue

b. Predictors: (Constant), Loglocation, Logsize, Logdepreciation, Logtype

Coefficientsa							
Model		Unstandardised coefficients		Standardised coefficients	t	Sig.	VIF
B		Standard error	Beta				
1	(Constant)	.545	.085		6.376	.000	
	LogSize	.943	.011	.788	82.074	.000	1.025
	Logdepreciation	-.502	.023	-.216	-22.192	.000	1.057
	Logtype	.785	.019	.490	41.255	.000	1.571
	Loglocation	.075	.022	.041	3.390	.001	1.610

a. Dependent variable: Logvalue

Paul Bowen, Peter Edwards, Helen Lingard & Keith Cattell

Harassment and discrimination experienced by quantity surveyors in South Africa

Peer reviewed and revised

Abstract

This article examines the workplace discrimination and harassment experiences of professional quantity surveyors in South Africa and explores the relationship between harassment, discrimination and perceived workplace stress. An online survey is administered and 177 responses (12.2% of the target population) received. Descriptive and inferential statistics are used to analyse the response data. A minority of respondent quantity surveyors claim to experience workplace harassment and discrimination on gender and ethnic grounds. Respondents also indicate that they feel underpaid and that their ethnicity adversely affects their job security. The article reports on sexual harassment and gender-based harassment and discrimination. Harassment and discrimination are found to correlate with higher perceived levels of workplace stress. Strategies designed to address and counter harassment and discrimination in quantity-surveying practices should be implemented or reinforced as part of broader stress management programmes. Employers have a major role to play in this, but professional associations should also take part. Previous research into work stress focused on the experiences of workers in developed countries. This research provides insight into the problem of workplace harassment and discrimination in the unique context of post-apartheid South Africa. It supports the link between harassment and discrimination and perceived levels of personal stress in this context.

Keywords: Harassment, discrimination, workplace stress, quantity surveyors, South Africa

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Abstrak

Die artikel ondersoek diskriminasie in die werkplek en teisteringervarings van professionele bourekenaars in Suid-Afrika en ondersoek die verband tussen teistering, diskriminasie en oënskynlike werkstres. 'n Aanlyn-opname is gedoen en 177 antwoorde (12.2% van die teikenbevolking) is ontvang. Beskrywende en afgeleide statistiek is gebruik om die data te ontleed. 'n Onbeduidende aantal van die bourekenaarrespondente dui aan dat daar teistering in die werkplek sowel as geslags- en etniese diskriminasie ondervind word. Respondente dui ook aan dat hulle onderbetaal word en dat etnisiteit hul werksekuriteit negatief beïnvloed. Seksuele en geslagsgebaseerde teistering sowel as diskriminasie is aangemeld. Teistering en diskriminasie korreleer met hoë waargenome vlakke van werkstres. Strategieë wat ontwerp is om teistering en diskriminasie aan te spreek, moet geïmplementeer of versterk word in bourekenaarpraktyke as deel van 'n breër stresbestuurprogram. Werkgewers het 'n groot rol om te speel hierin, maar professionele verenigings moet ook betrokke wees. Vorige navorsing oor werkstres het gefokus op die ervarings van werkers in ontwikkelde lande. Hierdie navorsing bied insig oor die probleem van werkplekteistering en diskriminasie in die unieke Suid-Afrikaanse post-apartheid konteks. Dit bevestig die verband tussen teistering en diskriminasie en waargenome vlakke van stres in hierdie konteks.

Sleutelwoorde: Teistering, diskriminasie, werkplekstres, bourekenaars, Suid-Afrika

1. Introduction

Construction is a high-risk industry for work-related stress (Lingard & Francis, 2004: 991; Pocock, Skinner & Williams, 2007: 31; Love, Edwards & Irani, 2010: 650). Project work is characterised by considerable dynamism and uncertainty, elevating its stressful nature. Work hours in construction are long and unexpected events often compromise the ability to meet project objectives (Lingard, Francis & Turner, 2010: 1085). The construction industry has also traditionally been characterised by interpersonal and inter-role conflict, known work stressors (Leung, Skitmore & Chan, 2007: 1064; Loosemore & Galea, 2008: 127). Work-related stress is a major challenge to the health of working people (Health and Safety Executive (HSE), 2006: 31). Houtman (2005: 2) reports that, in the 2000 European Working Conditions Survey (EWCS), work-related stress was the second most common work-related health problem across 15 European Union countries.

Previous research has found that sexual and racial discrimination and harassment are commonplace in the construction industry in several parts of the world. In the USA, Goldenhar, Swanson, Hurrell, Ruder & Deddens (1998: 26) reported that 51% of a sample of female construction workers had experienced sexual harassment or discrimination in the 12 months preceding a survey. Loosemore & Chau (2002: 96) found that 40% of Asian construction workers in an Australian sample felt that they had suffered discrimination at work. Dainty & Lingard (2006: 113) report the comparative prevalence of

subtle, but damaging forms of sex discrimination in the construction industries of the UK and Australia.

The present research forms part of a larger study examining the workplace stress experienced by construction professionals in South Africa. The study focuses on the relationship between workplace stress and job demand, control and support factors, the effects of workplace stress, the coping mechanisms adopted by professionals in an attempt to militate the effects of stress, and the role of harassment and discrimination as work-related stressors. Data were collected from architects, engineers, quantity surveyors, as well as from project and construction managers *via* an online survey (*N*=676). Earlier papers have reported on the comparative levels of perceived job stress and job demand, control and support (JDC/S) factors (Bowen, Edwards & Lingard, 2013a); the comparative relationship between job stress and harassment and discrimination at work (Bowen, Edwards & Lingard, 2013b); stress, stress effects and coping mechanisms (Bowen, Edwards, Lingard & Cattell, 2013a), and predictive modelling of stress as a function of JDC/S factors (Bowen, Edwards, Lingard & Cattell, 2013b).

Using the data emanating from the quantity surveyor respondents, this article reports on the relationship between quantity surveyors' workplace stress and experiences of harassment and discrimination at work. The research aims to compare and contrast the harassment and discrimination experiences of quantity surveyors juxtaposed against their perceived levels of workplace stress, with particular focus on gender and ethnicity. Issues explored include unwanted physical contact, and unwanted references of a sexual nature, by line managers and colleagues. It also examines harassment and discrimination by line managers and colleagues, feeling underpaid for work done, and experiencing job insecurity – each in terms of language, ethnicity, religion, gender, and sexual preference.

South Africa's apartheid legacy provides a unique context to examine workplace stress among construction professionals. The contribution of this work lies in its examination of the work stress experienced by quantity surveyors in a developing country characterised by economic hardship and social problems.

2. Background to the study

Under pre-1994 apartheid legislation, persons were racially classified as 'White', 'Black', 'Coloured', or 'Asian'. The term 'Coloured' was used to describe South Africans of mixed race descent. The 'Asian'

classification included Indians (a large minority grouping in South Africa). For the purposes of enforcing apartheid, persons were generally categorised as either 'White' or 'Non-White' (using this term as a broad, non-pejorative descriptor). Klug (1999: 5) highlights complexities associated with the 'language of race' – focusing on the definition and use of the words 'racial' and 'ethnic'; the vocabulary of colour ('black', 'white', etc.) in the language of race, and the notion that 'White' is an ethnic category.

Post-apartheid South Africa saw the introduction of 'positive discrimination' or 'affirmative action' as a vehicle to assist previously disadvantaged individuals (PDIs) who were broadly identified as 'Non-Whites' and women (RSA, 1996: s.217(2-3)). Black Economic Empowerment (BEE) and affirmative procurement policies are examples of mechanisms used to facilitate change. Within the construction industry, affirmative action has taken the form of preferential procurement in the award of building contracts and the appointment of professional consultants in terms of which the number of PDIs in the practice, in general, and in managerial positions, in particular, is an important consideration. Women, along with 'Black' people have been deemed to be 'historically disadvantaged individuals' (HDIs) for the purposes of affirmative action policies (RSA, 2000: s.2(1)(d); DPW, 2001: cl.2; DTPW, 2002: cl.1.7).

In the period January-March 2013, the construction industry employed just over one million people, or 7.5% of the employed population of 13.6 million. Of these economically active persons, 6.4% are in professional occupations and, of these, 57% are male. Gender discrimination persists in the labour force, with women continuing to be distinctly over-represented in clerical, service, and health-related occupations, while men tend to be over-represented in management, professional, craft, operator and elementary occupations. Of the persons employed in the construction industry, 88% are male (Mutedi, 2013: 16). Compared to professional women in the general economy, the percentages of professional women in construction are reportedly far lower (CBE, 2013: 7), specifically engineers (3%); architects (19%); quantity surveyors (15%), and project and construction managers (3%).

Similarly, in January-March 2013, the ethnic distribution of persons employed in the economy was 'Black' 71%; 'Coloured' 11%; Indian 4%, and 'White' 14% (Stats SA, 2013: 4). According to the CBE (2013: 8), 'Whites' account for 77% of registered professional engineers, 73% of architects, 74% of quantity surveyors, and 82% of project

and construction managers. Clearly, 'Whites' are disproportionately represented as professionals in the South African construction industry.

2.1 Discrimination

Discrimination is defined as "a set of behaviors that create societal, psychological and physical barriers that prevent minority group members from obtaining parity with majority group members" (Landry & Mercurio, 2009: 193). Discrimination includes sexist or racist 'put downs' and unfair treatment by employers, supervisors or co-workers (Goldenhar *et al*., 1998: 21; Caplan, Aujla, Prosser & Jackson, 2009: 22). Discrimination is related to negative mental health outcomes (Williams, Neighbors & Jackson, 2003: 200; Pavalko, Mossakowski & Hamilton, 2003: 29) and is a risk factor for work-related stress (King, 2005: 202; Dollard, Skinner, Tuckey & Bailey, 2007: 3; De Haas, Timmerman & Höing, 2009: 391).

Discrimination may be conceived as a more significant stressor than general 'daily hassles', because it threatens a person's goals and sense of value as a person (Landry & Mercurio, 2009: 193). Consistent with the conceptualisation of discrimination as a stressor, the experience of discrimination is reported to impact negatively on job satisfaction (Ensher, Grant-Vallone & Donaldson, 2001: 56) and mental health (Landrine, Klonoff, Corral, Fernandez & Rosesch, 2006: 80; Hoobler, Rospenda, Lemmon & Rosa, 2010: 438). In addition, Ong, Fuller-Rowell & Burrow (2009: 1267) explored the process whereby racial discrimination leads to diminished mental health, and reported that stressors have a tendency to multiply and create other stressors, in a process known as stress proliferation. Wadsworth, Dhillon, ShawBhui, Stansfeld & Smith (2007: 18) show that there is a strong association between racial discrimination and perceived work stress, and that 'Black' women who reported experiencing racial discrimination at work have higher levels of psychological distress. Ferfoija (2005: 51) points to the damaging effects of discrimination based on sexual preferences; specifically, threats of dismissal, forced resignations, and implicit harassment (structural violence). Cobas & Feagin (2008: 390) identify the racism in language struggles, and how the language of 'Whites' can be used to sustain their political-economic domination. Thus, the experience of chronic discrimination predicts more frequent experiences of daily discrimination and negative events, resulting in higher levels of distress. Some research has not distinguished between the concepts of discrimination and harassment; however, in the present study, the concepts are examined separately.

2.2 Harassment

Like discrimination, harassment can be sexual or ethnic or based on another point of difference between people, such as language, religion or sexual preference. However, whereas discrimination involves unequal treatment and/or the lack of positive opportunities, harassment involves threatening verbal or physical conduct or exclusionary behaviour that is directed at the recipient because of his/her ethnicity/race, language, religion, sex or sexual preference. Harassment of various forms has been identified as a significant stressor. For example, Schneider, Hitlan & Radhakrishnan (2000: 4) report that ethnic harassment is negatively related to well-being (i.e., life satisfaction, post-traumatic stress, and health conditions). Sexual harassment and general workplace harassment have also been linked to maladaptive coping behaviours, including problem drinking (Rospenda, 2002: 142). Sexual harassment is a specific category of harassment that includes such behaviours as making "unwelcome sexual advances, requests for sexual favours, and other verbal or physical conduct of a sexual nature" (Schneider, Swan & Fitzgerald, 1997: 401). Schneider *et al.* (1997: 411) also report that even relatively low levels of sexual harassment have a significant impact on mental health, over and above the effects of general job stress. In addition, Raver & Nishii (2010: 238) indicate that gender and ethnicity-based harassment have a cumulative negative effect on workers' psychological well-being. That is, when more than one form of harassment is experienced, each new type of harassment adds to the target individual's level of stress and strain outcomes. Nielsen & Einarsen (2012: 309) state that exposure to bullying is associated with both job-, health- and well-being-related outcomes, such as mental and physical health problems, symptoms of post-traumatic stress, burnout, increased intentions to leave, and reduced job satisfaction and organisational commitment. Biaggio (1997: 89) points to homophobic prejudice at work against lesbians, impacting on lesbians in the form of negative attitudes and denigrating or destructive acts, and by means of actual discrimination, whether overt or subtle.

2.3 Workplace stress

Transactional models of stress suggest that stress occurs as a result of the relationship between a person and his/her environment when the environment is perceived as taxing, exceeding a person's resources and threatening his/her well-being (Lazarus & Folkman, 1984: 19).

Previous research has also shown that construction professionals experience high levels of work stress. However, this research has nearly always taken place in developed economies such as Australia (Lingard & Sublet, 2002; Love *et al*., 2010), the United Kingdom (UK) (Djebarni, 1996) or Hong Kong (Leung, Chan & Olomolaiye, 2008). Consequently, the extent to which the findings apply to developing countries such as South Africa is not known. Furthermore, little research has considered harassment and discrimination as work-related stressors in the construction sector, despite the research evidence suggesting that discrimination/harassment occur in construction and are linked to the experience of work stress. It is, therefore, important that the relationship between discrimination, harassment and stress be better understood in the construction context.

This research aims to:

- Explore experiences of discrimination, harassment and work stress among quantity surveyors in the developing nation of South Africa, and
- Examine the relationship between discrimination, harassment and perceived levels of workplace stress in the South African construction industry context.

3. Research method

A questionnaire survey was developed. The survey sought demographic, cultural and professional background information from respondents; determined levels of perceived workplace stress, and examined a range of stressors, including participants' experiences of harassment and discrimination in the workplace. The catalogue of survey items includes closed, dichotomous, declarative and rating questions. Questions are drawn from the works of Loosemore & Chau (2002) on racial discrimination in construction; Ferfoija (2005) on discrimination and harassment on the basis of sexual orientation; Sang, Dainty & Ison (2007) on gender as a risk factor for occupational stress; Cobas & Feagin (2008) on language as a vehicle of oppression; Caplan *et al*. (2009) on ethnic and religious discrimination in the construction industry; Raver & Nishii (2010) on ethnic and gender harassment, and Love *et al*. (2010) on workplace stress, support and mental health.

Survey participants were asked whether they had been harassed or discriminated against as a result of their language, race, religion, gender or sexual preference in the twelve months preceding the survey administration. This period was chosen to reflect recent

(and thus more reliable) rather than past memory. The questions were posed in relation to their interactions with colleagues as well as their line manager. Response options are "Yes" (indicating that harassment or discrimination had occurred); "No" (no occurrence), and "not applicable". The "not applicable" option is included to cater for instances such as a 1-person practices or branch offices. The analysis excludes those responses. This scale was internally consistent (α = 0.90). Survey participants were also asked to indicate whether they had experienced unwanted suggestions about, or reference to sexual activity; or unwanted physical contact or unwanted physical contact of a sexual nature in the same twelve-month period. This scale was internally consistent (α = 0.83). They were asked whether they felt that they were underpaid for their efforts or that their job security was affected/threatened due to their language, race, religion, gender or sexual preference. This scale was internally consistent (α = 0.64). The Cronbach's alpha for each scale ranged from 0.64 to 0.90, indicating internal consistency.

While no definitions of the various constructs *per se* were provided, the information in the covering letter to the questionnaire, the information in the Introduction to the questionnaire, and (indeed) the actual questions themselves provide ample insight into the issues of stress, harassment, and discrimination. The pilot study also served to confirm the efficacy of the questionnaire.

Exploratory factor analysis (EFA) was not performed on the variables. EFA is a data-reduction technique, essentially reducing a large set of variables into smaller sets or components (Pallant, 2010: 181). It is used in the compilation of tests and scales. Factor analysis (FA) helps create coherent subscales from an initial, large number of individual scale items or questions. We are not developing a psychometric scale. When the observed variables are dichotomous, as in this instance, FA is not really appropriate. Binary variables yield counts which can be analysed using contingency tables – as was done in this study.

In the South African context, language (e.g. English, Afrikaans, Zulu, Xhosa, etc.) and religion (e.g., Christian, Hindu, Muslim, etc.) can be used pejoratively or as a means of discrimination. Given South Africa's apartheid past, issues of ethnicity, culture, and gender are particularly important in any consideration of workplace harassment and discrimination.

Participants were also asked to assess their own stress levels on a 1 to 10 scale, ranging from 1=minimum ('feeling little or no stress') to 10=maximum ('highly stressed'). No intermediate scale intervals

were defined. Occupation stress indicator (OSI) scales (involving appropriate subscales of [and sub-subscales within]: job satisfaction; mental and physical health; personality type; control; job pressure; and coping with stress) are extremely complex and not without considerable criticism (Kline, 2000a: 631). The development of such a scale is beyond the scope of this article. The 10-point stress 'scale' used in this article can more properly be described as a form of 'perception metric', indicating the degree of a condition being perceived to be felt at a point in time. Such metrics are used by social psychologists (Kline, 2000b: 122). It is not possible to construct a scale involving only one, interval-based, variable. Nor is it possible to undertake factor analysis on such a 'scale'.

The purpose of this article is not to examine the causal relationships between a dependent variable (stress) and a series of predictor variables. It was never the intention to derive a predictive model; hence, regression analysis (logistic or hierarchical) is not performed. The research aims to compare and contrast the harassment and discrimination experiences of professional quantity surveyors juxtaposed against their perceived levels of workplace stress.

The survey was administered online to all registered quantity surveyors (professional registration is a legal requirement in South Africa). Following a pilot online study to test the adequacy of the questionnaire, the full survey was conducted between September and November 2010. Registered quantity surveyors were emailed using an email address list provided by the Registrar of the SA Council for the Quantity Surveying Profession (SACQSP), provided with an explanatory letter, given a URL where the questionnaire could be accessed online, and asked to participate.

Using a web-based distribution method encourages potential respondents to express their views in a simple and 'safe' way, particularly when issues may be sensitive. Undertaking this study through the auspices of a respected statutory council provides a valid way of targeting sample groups. However, care is needed in over-generalising the findings of such surveys, since the sample is, to a large extent, self-selecting.

The difficulty associated with demonstrating validity in questionnaire surveys is acknowledged (Platt, 2001: 33). The analysis is based mainly on statistical significance testing. Consequently, the results do not establish with any certainty a causal link between any of the demographic, harassment, and discrimination factors, and reported stress at work. The results may be suggestive of such links but, more in-depth research would be necessary to establish its validity. This

study adopted a self-reporting survey measurement method. Therefore, the findings may have the potential risk of common method variance and the validity of data may be questioned.

The sample size, to some extent, militates against validity concerns, as do the significance of the correlations between perceived workplace stress level and the harassment and discrimination variables.

Ethical considerations in the form of the absence of deception; privacy and confidentiality, and accuracy were observed (Christians, 2005: 139). Institutional ethical clearance was also obtained.

The data were analysed using the Statistical Package for the Social Sciences (SPSS) (Ver. 21.0 for Mac) software application. Where cross-tabulation was used to establish degrees of association between categorical variables, Pearson's chi-square test (or Fisher's Exact Test where applicable) for independence was applied at the 5% (p=0.05) level of significance. The Mann-Whitney U Test was used to examine whether respondents who had, or had not experienced various forms of harassment or discrimination reported significantly different levels of perceived stress. Ethnic differences were analysed by grouping the 'Non-White' categories ('African', 'Indian', and 'Coloured') together, because of the comparatively smaller numbers of respondents in each of these four categories.

A total of 1.449 quantity surveyors received the request to participate in the survey, and 177 completed the questionnaire online (N=1449; n= 177). Discounting email 'bounces', this represents a response rate of 12.2%. This level of response is typical for web-based surveys of this nature (Fricker, 2008: 207).

4. Results

4.1 Sample profile

The majority of the respondents are male (80%; n=139), 'White' (81%; n=143), married (including common law marriages) (77%; n=137), English-speaking (53%; n=93), and older than 40 years (59%; n=104). While nearly two-thirds of all respondents are at least 40 years old, 40% (n=71) are older than 50 years. The majority of the respondents are located in the populous provinces of Gauteng (44%; n=74), Western Cape (22%; n=37), KwaZulu-Natal (12%; n=21) and the Eastern Cape (11%; n=19). The dominant religion of respondents is reported to be Christianity (86%; n=150). Compared to the most recent SACQSP statistics, females are over-represented in this study (20% compared

to 15%), as are 'Whites' (81% compared to 74%) (CBE, 2013: 7-8). The biases of the sample in terms of gender, ethnicity, and age need to be acknowledged when drawing inferences from the data. Missing data account for slight differences in reported percentages.

Years of experience in the construction industry vary between respondents. Specifically, nearly half (49%; n=84) report more than 20 years' experience. By contrast, only a quarter (n=43) have at least 10 years' experience. Years of experience is significantly related to gender (p=0.005) and to race (p<0.001), with 'White' men having worked longer.

Of all the respondents, 40% (n=70) have been with their present firm for five or less years. Nearly a quarter (22%; n=39) of the respondents have been with the same firm for over 20 years. Service length is significantly related to gender (p<0.001) and race (p=0.004). Again, 'White' males have worked longer for their current firms.

Overall, the construction industry professionals who participated in the survey may generally be described as experienced practitioners in private practice, mostly 'White', male, English-speaking, in a stable relationship, and in a stable work environment. These sample characteristics will be borne in mind in the following sections.

4.2 Overall levels of workplace stress

Using a 10-point scale (1=minimum stress; 10=maximum stress, with no defined intermediate scale intervals), survey respondents were asked to rate the level of stress they perceive to experience at work. The results are shown in Table 1.

Table 1: Survey respondents' self-assessment of workplace stress (n=160)

Perceived levels of workplace stress	*Frequency(%) (n)*
Level 1 (minimum)	4% (n=6)
Level 2	6% (n=10)
Level 3	10% (n=16)
Level 4	9% (n=14)
Level 5	10% (n=17)
Level 6	16% (n=25)
Level 7	21% (n=33)
Level 8	17% (n=27)

Perceived levels of workplace stress	*Frequency(%) (n)*
Level 9	6% (*n*=10)
Level 10 (maximum)	1% (*n*=2)
Mean score (+/- standard error)	5.76 (+/- 0.18)

Note: Scale values: 1=minimum stress; 10=maximum stress (no intermediate scale interval definitions).

For the perceived workplace stress variable, a median-split method (Lingard, Francis & Turner, 2012: 654) was used to effectively position the responses for this variable into one of two (categorical) groups, namely values falling below the median, and values equal to, or exceeding the median. The median value for the level of workplace stress reported by respondents is 7.0 (on a scale of 10) (see Table 1). Participants' responses were, therefore, 'grouped' into those below 7.0, and those equal to 7.0 or above. Quantity surveyors appear to be highly stressed at work (45%; n=72 reporting a stress level of '7' or above). Only 39% (*n*=63) of the respondents report a stress level of '5' or less. The mean stress level scale value reported is 5.76.

Stress level is not significantly related to ethnicity (*p*=0.719), age (*p*=0.636), location (*p*=0.992), marital status (*p*=0.413), home language (*p*=0.793), or religion (*p*=0.287), but it is to gender (*p*=0.042), with proportionately more women respondents than men reporting high levels of stress compared to their male counterparts.

The reasons *per se* for the differences in perceived stress levels between different groupings are not covered in this article. This aspect warrants further investigation to examine the roles played by family status, life stage, and nature of the work *per se*, in determining perceived stress levels. This is the subject of our on-going research.

4.3 Harassment and discrimination at work

Tables 2 and 3 show the incidence of harassment and discrimination experiences of survey respondents, at the hands of line managers and work colleagues, respectively.

Table 2: Workplace harassment reported by survey respondents ('Yes'/'No')

Types and sources of harassment experienced in the previous 12 months	*Frequency (%) (n) reporting 'Yes'*
Unwanted suggestions about, or references to, sexual activity by:	
Line manager (*n*=105)	4% (*n*=4)
Colleagues (*n*=127)	6% (*n*=8)
Unwanted physical contact by:	
Line manager (*n*=107)	4% (*n*=4)
Colleagues (*n*=130)	5% (*n*=6)
Unwanted physical contact of a sexual nature by:	
Line manager (n=108)	3% (*n*=3)
Colleagues (n=130)	2% (*n*=2)
Harassed by your line manager because of your:	
Language (*n*=111)	2% (*n*=2)
Ethnicity (*n*=113)	5% (*n*=6)
Religion (*n*=110)	2% (*n*=2)
Gender (*n*=109)	4% (*n*=4)
Sexual preference (*n*=107)	0% (*n*=0)
Harassed by your colleagues because of your:	
Language (*n*=138)	5% (*n*=7)
Ethnicity (*n*=140)	14% (*n*=19)
Religion (*n*=138)	4% (*n*=5)
Gender (*n*=137)	7% (*n*=10)
Sexual preference (*n*=130)	2% (*n*=3)

Note: These statistics exclude 'not applicable' responses.

For some harassment factors, experiences during the previous 12 months were reported by as many as 14% (*n*=19) of the respondents (e.g., harassment from colleagues on ethnic grounds); 7% (*n*=10) indicated they had been harassed by colleagues because of their gender, and 6% (*n*=8) had received unwanted suggestions about, or references to sexual activity by their colleagues. Unwanted physical contact by colleagues was reported by 5% (*n*=6) of the respondents,

as was harassment by line managers in terms of respondents' ethnicity (5%), and by colleagues on the basis of language (5%).

Table 3: Workplace discrimination reported by survey respondents ('Yes'/'No')

Types and sources of discrimination experienced in the previous 12 months	*Frequency (%) (n) reporting 'Yes'*
Discriminated against by your line manager because of your:	
Language (*n*=111)	4% (*n*=4)
Ethnicity (*n*=111)	14% (*n*=15)
Religion (*n*=108)	2% (*n*=2)
Gender (*n*=111)	7% (*n*=8)
Sexual preference (*n*=106)	3% (*n*=3)
Discriminated against by your colleagues because of your:	
Language (*n*=137)	6% (*n*=8)
Ethnicity (*n*=139)	17% (*n*=24)
Religion (*n*=137)	2% (*n*=3)
Gender (*n*=137)	10% (*n*=13)
Sexual preference (*n*=129)	2% (*n*=3)
Underpaid for your efforts due to your:	
Language (*n*=165)	4% (*n*=6)
Ethnicity (*n*=166)	16% (*n*=27)
Religion (*n*=164)	0% (*n*=0)
Gender (*n*=164)	10% (*n*=16)
Sexual preference (*n*=162)	1% (*n*=1)
Job security affected/threatened due to your:	
Language (*n*=163)	7% (*n*=11)
Ethnicity (*n*=166)	43% (*n*=71)
Religion (*n*=163)	1% (*n*=1)
Gender (*n*=163)	13% (*n*=21)
Sexual preference (*n*=161)	0% (*n*=0)

Note: These statistics exclude 'not applicable' responses.

For discrimination, the response data reveal slightly higher incidence levels, with 14% (*n*=15) and 17% (*n*=24) of the respondents indicating that they had experienced discrimination from their line managers and colleagues, respectively, because of ethnicity. A further 16% (*n*=27) of the respondents felt that they were underpaid due to their ethnicity, and 43% (*n*=71) felt that their ethnicity affected their job security. For gender-based discrimination, 7% (*n*=8) and 10% (*n*=13) of the respondents report that they have been discriminated against by their line managers and colleagues, respectively. A further 10% (*n*=16) felt that they were underpaid because of their gender and 13% (*n*=21) felt their job security was adversely affected by their gender. Discriminatory experiences involving colleagues were reported to be more frequent than those involving line managers.

Significant differences were also found between males and females, with significantly more women (proportionately) reporting gender-based discriminatory behaviour or harassment from both line managers and colleagues ($p<0.039$ in all instances).

Differences in harassment and discrimination experiences between 'Whites' and 'Non-Whites' were significant in terms of harassment from line managers on the basis of ethnicity ($p=0.013$) and harassment from colleagues on the basis of religion (culture) ($p=0.037$). In all instances, proportionately more 'Non-Whites' than 'Whites' believed that they were being harassed. Differences were not significant in terms of discrimination either by line managers or colleagues, job security, or feeling underpaid for work done. It is noteworthy ($p=0.057$) that more 'Whites' maintain that their job security is compromised because of their ethnicity than do their 'Non-White' counterparts, thus indicating the possible presence of a 'reverse-apartheid' anxiety arising in the construction professions post-1994.

When harassment and discrimination are considered in terms of age, none of these factors are significantly related to age. However, proportionately more older than younger respondents feel underpaid due to their race ($p=0.013$).

4.4 The relationship between harassment, discrimination and stress

The relationship between the level of perceived workplace stress and the harassment and discrimination factors was initially explored using Pearson's correlation coefficients (data analyses for these factors is not tabulated, in this instance). The findings show that workplace stress is significantly correlated with gender, age, feeling harassed by colleagues due to one's religion, and feeling underpaid due to

one's gender (discrimination). Stress is not significantly correlated with race. Correlations are noteworthy (p<0.10) with respect to feeling harassed by colleagues due to one's sexual preference, and experiencing job insecurity due to one's religion (discrimination). These patterns of correlations support more detailed analysis.

The Mann-Whitney U Test was used to examine the differences in perceived workplace stress for respondents who did, and did not, indicate that they had experienced various forms of harassment and/or discrimination at work in the twelve months preceding the administration of the survey.

Table 4 shows the median perceived stress scores for respondents who did, and did not indicate that they had experienced various forms of harassment at work.

Table 4: Perceived stress levels among respondents who reported they either had or had not experienced harassment at work ('Yes'/'No')

Survey question	*Median stress score ('Yes')*	*Median stress score ('No')*	*'U' value*	*'z' value*	*p-value*	*'r' value (effect size)*
Have you had unwanted suggestions about, or reference to sexual activity directed at you by your:						
Line manager? (n=101)	6.00	6.00	179	-0.26	0.79	0.03
Colleagues? (n=123)	7.00	6.00	375	-0.88	0.38	0.08
Have you had unwanted physical contact by your:						
Line manager? (n=103)	6.50	6.00	194	-0.08	0.94	0.01
Colleagues? (n=126)	7.00	6.00	287	-0.85	0.40	0.08
Have you had unwanted physical contact of a sexual nature by your:						
Line manager? (n=104)	6.00	6.00	145	-0.14	0.89	0.01
Colleagues? (n=126)	7.00	6.00	92	-0.63	0.53	0.06

Survey question	*Median stress score ('Yes')*	*Median stress score ('No')*	*'U' value*	*'z' value*	*p-value*	*'r' value (effect size)*
Have you ever felt you were harassed by your line manager due to your:						
Language (*n*=107)	7.50	6.00	57	-1.12	0.27	0.11
Race (*n*=108)	6.00	6.00	215	-0.64	0.53	0.06
Religion (*n*=106)	4.50	6.00	72	-0.76	0.45	0.07
Gender (*n*=105)	7.00	6.00	189	-0.23	0.82	0.02
Sexual preference (*n*=103)	-	6.00	-	-	-	-
Have you ever felt you were harassed by your colleagues due to your:						
Language (*n*=133)	7.00	6.00	429	-0.12	0.90	0.01
Race (*n*=134)	7.00	6.00	958	-0.57	0.57	0.05
Religion (*n*=133)	4.00	6.50	174	-1.75	0.08	0.15
Gender (*n*=132)	7.00	6.00	525	-0.74	0.46	0.06
Sexual preference (*n*=125)	8.00	6.00	70	-1.85	0.06	0.17

Notes: Scale values for 'Stress': 1=minimum stress; 10=maximum stress (no intermediate scale interval definitions). These statistics exclude 'not applicable' responses. Mann-Whitney U Test for between-groups comparisons.

The Mann-Whitney U Test revealed no significant differences in the level of perceived stress between people reporting that they had, or had not experienced the various forms of harassment. The effect size (*r*-value) is considered very small, using Cohen's criteria (Pallant, 2010: 230). Whilst not significant, noteworthy differences were found in respect of harassment by colleagues on the basis of religion (p=0.080) and sexual preference (p=0.064). Respondents, who indicated harassment by colleagues because of their religion (culture), presented lower median stress scores than their counterparts (4.00 versus 6.50). Conversely, those reporting harassment from colleagues on the basis of sexual preference had higher median stress levels (8.00 versus 6.00). Religion is the only variable for which the median stress scores of respondents experiencing harassment on the basis of religion are lower than those of their counterparts.

Table 5 shows the median perceived stress scores for respondents who did, and did not indicate that they had experienced various forms of discrimination at work in the twelve months preceding the administration of the survey.

Table 5: Perceived stress levels among respondents who reported that they either had, or had not experienced discrimination at work ('Yes'/'No')

Survey question	*Median stress score ('Yes')*	*Median stress score ('No')*	*'U' value*	*'z' value*	*p-value*	*'r' value (effect size)*
Have you ever felt that you were discriminated against by your line manager due to your:						
Language (*n*=107)	7.50	6.00	154	-0.87	0.38	0.08
Race (*n*=106)	6.50	6.00	600	-0.42	0.68	0.04
Religion (*n*=104)	4.50	6.00	71	-0.75	0.45	0.07
Gender (*n*=107)	7.00	6.00	332	-0.77	0.44	0.07
Sexual preference (*n*=102)	8.00	6.00	90	-1.18	0.24	0.12
Have you ever felt that you were discriminated against by your colleagues due to your:						
Language (*n*=132)	7.00	6.00	447	-0.47	0.64	0.04
Race (*n*=133)	7.00	6.00	1025	-1.45	0.15	0.13
Religion (*n*=132)	5.00	7.00	109	-1.31	0.19	0.11
Gender (*n*=132)	7.00	6.00	656	-0.91	0.36	0.08
Sexual preference (*n*=124)	8.00	6.00	105	-1.27	0.21	0.11
Have you ever felt that you are underpaid for your efforts due to your:						
Language (*n*=158)	7.00	6.00	394	-0.57	0.57	0.05

Survey question	*Median stress score ('Yes')*	*Median stress score ('No')*	*'U' value*	*'z' value*	*p-value*	*'r' value (effect size)*
Race (*n*=159)	7.00	6.00	1359	-1.74	0.08	0.14
Religion (*n*=157)	-	6.00	-	-	-	-
Gender (*n*=157)	8.00	6.00	583	-2.91	<0.01	0.23
Sexual preference (*n*=155)	8.00	6.00	25	-1.19	0.24	0.10
Have you ever felt that your job security is affected or threatened due to your:						
Language (*n*=157)	7.00	6.00	660	-0.99	0.32	0.08
Race (*n*=159)	6.00	6.00	2719	-1.36	0.18	0.11
Religion (*n*=157)	2.00	6.00	11	-1.51	0.13	0.12
Gender (*n*=157)	7.00	6.00	1288	-0.73	0.47	0.06
Sexual preference (*n*=155)	-	6.00	-	-	-	-

Notes: Scale values for 'Stress': 1=minimum stress; 10=maximum stress (no intermediate scale interval definitions). These statistics exclude 'not applicable' responses. Mann-Whitney U Test for between-groups comparisons.

Respondents who felt that they were underpaid for their efforts because of their gender reported significantly (p=0.004) higher levels of stress than those who did not feel this way. None of the other factors of job security, discrimination by line managers, or discrimination by colleagues was significantly related to higher levels of workplace stress. Again, religion is the only variable for which the median stress scores of respondents experiencing discrimination on the basis of religion are lower than those of their counterparts.

5. Discussion

5.1 Levels of workplace stress

Quantity surveyors in South Africa appear to experience high levels of workplace stress, confirming the findings of Leung *et al.* (2007: 1072) relating to the Hong Kong construction industry. Stress is significantly related to gender, but not to race or age. This finding is also consistent with previous research which revealed that women working in the

construction industry experience higher levels of stress than males in similar employment (e.g., Goldenhar *et al*., 1998: 20; Caven, 2004: 519; Sang *et al*., 2007: 1305). This warrants further investigation of the role played by family status and life stage in determining stress levels and coping among quantity surveyors.

5.2 Harassment and discrimination

The findings show that 'Non-White' professionals in South Africa continue to experience harassment and discrimination in residual forms of apartheid. Of the respondents, 14% indicated that they had recently experienced harassment; 17% reported experiencing discrimination, by their colleagues because of their ethnicity; 14% also indicated experiencing discrimination by their line manager because of their ethnicity; 16% felt that they were underpaid for their efforts because of their ethnicity, and 43% felt that their job security was threatened because of their ethnicity. Thus, harassment and discrimination based on ethnicity are apparently experienced to a concerning degree across the quantity-surveying profession in the sample. These findings align strongly with those of Loosemore & Chau (2002: 96), Wadsworth *et al*. (2007: 18), and Bowen & Cattell (2008: 266). While South Africa continues to undergo considerable change in this respect in the post-apartheid era, there is clearly still a long way to go in an industry known for its conservatism.

Notwithstanding the evidence of continuing post-apartheid discrimination on racial grounds, this research also confirmed a paradox particular to South Africa. 'White' respondents, in particular males, reported noteworthy more experiences of feeling discriminated against in terms of job security than did 'Black' respondents. This may be explained as a 'White' perception of 'reverse apartheid' arising from official affirmative action and 'Black' employment and empowerment (BEE) policies adopted by the post-apartheid (i.e., since 1994) governments in South Africa. These findings accord with those of Bowen, Cattell & Distiller (2008: 14). Longer term re-testing would help to determine whether these effects (residual apartheid and reverse apartheid) are transitional and will slowly disappear as the current workforce in South Africa ages, or whether they are more deeply engrained. Currently, a persistent anecdotal perception encountered in South Africa is that if you are 'White', male and over 40, your job/career prospects are poor.

The results also provide preliminary evidence that workplace harassment and discrimination in quantity-surveying practices are both associated with work stress. Respondents who had experienced unwanted physical contact (whether of a direct sexual nature or

not) by colleagues reported significantly higher stress levels than those who had not. This is consistent with previous research by Schneider *et al*. (1997: 411) who report that even low levels of sexual harassment have a significant negative impact on mental health. Previous research has highlighted the additive effects of racial and gender-based adverse treatment in the workplace on stress (Raver & Nishii, 2010: 238).

Respondents who felt underpaid because of their gender reported higher levels of work stress than respondents who did not report such discrimination. It is interesting to note that respondents who felt that their job security (as opposed to remuneration) was adversely affected by their race or gender did not report significantly higher levels of stress than those who did not. Thus, it appears that work stress is likely to be strongly related (at least in terms of gender) to forms of discrimination that have a material impact upon respondents' income. These findings are consistent with previous research in the field of organisational justice, which found that perceptions of working in a just and procedurally fair organisational environment are associated with lower levels of stress and burnout (Elovainio, Kivimäki & Helkama, 2001: 421; Brotheridge, 2003: 253). Future research into the relationship between discrimination and stress in the quantity-surveying profession could incorporate measures of organisational justice to examine, in more detail, the relationship between discrimination, organisational justice and stress.

While the results indicate that respondents who had experienced discrimination at the hands of either line managers or colleagues did not report significantly higher stress levels than those who had not, the findings evidence a strong relationship between perceived levels of workplace stress and harassment in terms of religion (culture). The noteworthy correlation between harassment at work and religion supports the earlier comment in this article concerning the interface in South Africa between culture and discrimination. This finding tends to support those of Ferfoija (2005).

The research findings provide some insights into how the problem of workplace harassment and discrimination may be addressed. In particular, organisational support services and programmes to assist people to address harassment and discrimination with problem-based strategies can be of benefit (Rospenda, Richman & Shannon, 2006: 380). Previous research reveals that developing a sense of personal control in workers mediates the relationship between the experience of discrimination and psychological distress (Landry & Mercurio, 2009: 197), thereby providing a protective 'buffer'

against the damaging impact of discrimination. This suggests that programmes designed to instil in minority groups a sense of personal control could be a useful mitigation strategy circumventing the damaging outcomes of discriminatory behaviour. However, as well as striving to develop resilience in workers, it is also essential that quantity-surveying practices seek to address the root cause of the problem and strive to eradicate harassment and discrimination. It may be helpful to provide equal employment opportunity training for all employees and to implement just and fair organisational processes to manage instances of harassment/discrimination, if they are identified.

Statistically, the relatively small response sample does not permit these research findings to be generalised to the entire quantity-surveying profession in South Africa. However, validly generalisable findings are not the real issue in this instance, in that even one incident of harassment or discrimination diminishes the status of the entire profession.

6. Conclusions

It is cause for concern that experiences of harassment and discrimination still pervade the quantity-surveying profession in the South African construction industry; that female professionals are more harassed and discriminated against than their male counterparts, and that discrimination on the grounds of ethnicity continues to occur. This research provides preliminary evidence that the experience of harassment and discrimination is linked to higher levels of stress among quantity surveyors. Clearly, the quantity-surveying profession has a considerable way to go in eradicating harassment and discrimination as stress factors among its ranks. In order to achieve this, harassment and discrimination issues must be acknowledged and addressed by the SACQSP and the Association of South African Quantity Surveyors (ASAQS) at a macro-level, and by professional practices at a micro-level.

While the research findings provide evidence that harassment and discrimination exist and are related to work stress, their value is limited by the self-reporting methods utilised for the survey. They do not provide insight into how or why individuals experience harassment or discrimination in the way that they do. Further case-based qualitative research is planned.

This should provide a more comprehensive insight into the experiences of South African quantity surveyors, allow a more

in-depth exploration of their different experiences of harassment and discrimination, and better inform the development of appropriate prevention strategies.

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Fanie Buys & Martyn le Roux

Causes of defects in the South African housing construction industry: Perceptions of built-environment stakeholders

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Abstract

This article emanates from research investigating the biggest cause that leads to defects in houses; the most common type of defect, and why projects fail in project-management terms (due to defects). Results of quantitative research among architects, consulting engineers and building contractors within the construction industry in the Western and Eastern Cape provinces of South Africa, as well as a literature review, form the basis of this study. Architects, consulting engineers, and general building contractors are randomly selected and surveyed using an online questionnaire. The study reveals that inadequate artisan skills are the biggest cause leading to defects in houses, and that cracks are the most frequent type of defect occurring. Projects fail in project-management terms because of defects as the construction time of the projects is prolonged. The study also reveals that construction-related causes of defects dominate over design-related causes. The results should be of value to both construction industry professionals and their clients.

Keywords: Defects, rework, quality management

Abstrak

Die artikel spruit voort uit 'n navorsingsprojek om te bepaal wat die grootste oorsaak van defekte in woonhuise is; watter defek die meeste voorkom, en waarom projekte misluk in terme van projekbestuur (as gevolg van defekte). Resultate van 'n kwantitatiewe ondersoek tussen argitekte, raadgewende ingenieurs en boukontrakteurs asook 'n literatuurstudie vorm die grondslag van die studie. Argitekte, raadgewende ingenieurs en boukontrakteurs is ewekantsig geselekteer en ondervra deur middel van 'n Internet-aanlynvraelys. Die ondersoek wys daarop dat onvoldoende ambagsvaardighede die grootste oorsaak van defekte in woonhuise is en dat krake die meeste voorkom. In terme van projekbestuur lei projekte daaronder deurdat defekte die kontrakperiode verleng. Die studie toon ook aan dat konstruksieverwante defekte meer dominant is as ontwerpverwante defekte. Die studie behoort insiggewend te wees vir beide konstruksie professionele persone sowel as kliënte.

Sleutelwoorde: Defekte, herdeurwerk, kwaliteitsbestuur

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1. Introduction

Douglas & Ransom (2007: xv) state that, despite the growing awareness as to many of the common causes and consequences, failures still seem to bedevil the building industry in the United Kingdom (UK) and elsewhere in the developed world. There is a perception that defects within the South African construction industry in newly completed buildings are increasing and becoming a serious problem, as increasingly more buildings are being built. Despite the fact that a great deal of technical and legislative information on good house construction practices is available, unacceptable construction quality is apparent throughout the entire spectrum of housing in South Africa. The National Home Builders Registration Council (NHBRC) rectified more than 200 houses at an estimated cost of R40 million in the 2010/2011 financial year (Mahachi, 2010: 56). Corruption is currently identified as one of the major barriers to achieving construction quality in South Africa (CIDB, 2011b: 8).

The South African construction industry experienced a boom in 2009 and 2010, with many infrastructure developments taking place in the country as a result of the 2010 Soccer World Cup held in South Africa. There is a shortage of skilled people in the South African construction industry; local and international companies within the construction industry are joining forces in order to meet the current demand (Makhene & Thwala, 2009: 130). Worldwide, the South African government is one of the governments that have delivered the highest number of houses to the poor by means of various delivery mechanisms; this forms part of their vision to provide adequate housing for all, as reflected in the National Housing Policy Framework (Ndawonde, 2009: online).

Housing is meant to address the basic human need for shelter and security. Since 1994, the South African government has initiated and implemented several housing delivery programmes as well as subsidy mechanisms to provide houses to the poor (RSA DH, 1994). It also states that the country's vision is to increase housing's share in the total state budget to 5% and to increase housing delivery on a sustainable basis to a peak level of 338.000 units per annum, in order to reach the Government of National Unity's target of 1,000.000 houses within five years (RSA DH, 1994). Pottie (2003: 429) states that "while considerable housing delivery has occurred since 1994, housing expenditure as a proportion of national expenditure has not yet reached its stated goals".

Research by Olaosebikan (2010: 3) indicates that the government's focus was initially on quantitative housing delivery with qualitative

shortcomings; however, this focus has now shifted to the quality of the end product that is delivered. It also shows that defects in houses manifest primarily through cracking, dampness, detachment, and water leakages.

Defects are categorised as being deficiencies in design, material, construction or subsurface (FindLaw, 2011: online). The latter can be either patent or latent. Patent defects can be clearly recognised during inspection, the construction period or the project's defects liability period. Latent defects appear over time, usually once the building has been occupied (Che Mat, Hassan, Isnim, Mohidisa & Sapeciay, 2011: 238).

It may be argued that the risk of defects occurring in housing projects is greater, due to incompetent and unqualified construction professionals. This may be ascribed to the great demand for houses, government policies for job creation and the assistance of emerging construction-industry professionals. This article presents part of the findings of a research project, the primary aim of which is to establish the factors that relate to defects occurring in housing projects in the Western and Eastern Cape provinces of South Africa.

2. Review of the literature

The public perception of what constitutes a building 'defect' is often inconsistent with the legal definition of a 'defect'. Problems as a result of the natural ageing of a building and its components or a lack of proper maintenance are referred to as 'defects' by law, whereas they do not, in fact, represent defects for which producers will be liable. 'Defects', liable by producers, are those representing a blemish in design, materials or workmanship (Alhajeri, 2008: 420).

According to Alhajeri (2008: 421), the word 'defect' is defined in the Oxford English Dictionary as the lack of something essential or required, an imperfection. It is also defined as "failing in", as a "shortcoming" or a "blemish" whereby something falls short. The word 'defective' is defined as having a defect or defects, i.e. a state of being incomplete, imperfect, faulty, lacking or deficient. In the construction context, the term 'defect' is generally refers to construction faults that exceed ordinary imperfections, affecting a basic structural element of the building works, and turning the building, installation, or structure into a state of functional ruin (Alhajeri, 2008: 421).

According to the Webster's Dictionary, a defect is defined as the lack of something necessary for completeness; a shortcoming. It is

also defined as an imperfection, fault, or blemish (Ahzahar, Karim, Hassan & Eman, 2011: 250).

A building defect may include any problem that reduces the value of a home, condominium, or building. Building defects can be the result of design errors by professionals, a manufacturing flaw, defective materials, improper use or installation of materials, not conforming to the design by the contractor, or any combination of the above (Ahzahar *et al*., 2011: 250).

2.1 Housing standards in South Africa

Housing is an important part of people's lives. It provides shelter during windy and rainy seasons and keeps many families warm during the cold winter months. It is, therefore, important that due diligence be applied during the construction of a house. According to Balchin & Rhoden (1998: 214-215), there are a range of standards applied to housing. These include building regulations and target standards. The following criteria must be met if a dwelling is to be considered fit for human habitation:

- Structural stability;
- A lack of dampness;
- The provision of adequate heating, lighting and ventilation;
- Adequate piped supply of water, and
- An effective drainage system.

Where a dwelling fails to meet any of these criteria and is not considered suitable for occupation, the premises will be considered unfit for human habitation. The local authority is then obliged to consider the most satisfactory course of action to deal with the problem (Mkuzo, 2011: 33).

According to Lund (2007: 20), poorly built houses impact negatively on the government's striving towards sustainable development. South Africa is a resource-scarce country and every available Rand in the government's coffers needs to be spent as wisely as possible. The article also mentions that all the nine provinces in South Africa have different challenges regarding the delivery of houses. A total of 40.000 defective RDP houses (nationwide) have had to be flattened and rebuilt at a cost of more than R1 billion (this amounts to approximately 10% of the National Housing Department's annual budget), due to poor quality. Lund (2007: 20) also refers to the (then) Minister of Finance, Trevor Manual, stating: "One of the examples of the shortfall in delivery of government housing was the

poor quality of homes being built". Until 2009, the Department of Human Settlements spent R863.9 million nationwide on fixing more than 131.000 RDP houses. The Department also demolished and rebuilt poorly built houses totalling 2.489 in the 2010-2011 financial year. More than 5.000 houses with faults were fixed in the 2010-2011 financial year at a cost of R971.1 million. So far (2009), 131.380 houses have been corrected. These houses did not need to be rebuilt, but certain aspects had to be fixed in order to conform to quality standards.

Ndaba (2010: online) mentions that it has been acknowledged that fraud, delays, corruption, absentee contractors, ghost houses, shoddy workmanship and corruption in respect of waiting lists are chronic impediments to the proper delivery of housing. He also states that poor housing quality derails government's ability to improve the lives of all South Africans, especially the poor. Millions of Rands have been allocated to fixing defects and rebuilding houses due to poor workmanship and maladministration. In the Eastern Cape's Queenstown area alone, the NHBRC ordered that 700 RDP houses be rectified at a cost of R3.4m (Human Settlements South Africa, 2009). Human Settlements Minister, Tokyo Sexwale, stated that "the cost of demolishing and rebuilding defective RDP houses has shot up to R1.3 billion after a national housing audit uncovered shoddily built homes in every province" (Mkhwanazi, 2009: 3).

2.2 Quality in the South African construction industry

Joubert, Cruywagen & Basson (2005: 39) conclude that the South African building industry has a negative image in terms of achieving quality and that it neglects the use of Quality Management Systems (QMSs). They also state that "it is abundantly clear that South African companies can absolutely not postpone the institution of adequate systems any longer". Zunguzane, Smallwood & Emuze (2012: 20) state that quality is a fundamental term in the construction industry; the non-achievement of such a crucial aspect of construction can result in the failure of a construction project and in the dissatisfaction of clients and/or building occupants.

Quality with regard to construction projects is a major concern to clients and, therefore, the non-achievement of quality leads to client dissatisfaction (Auchterlounie, 2009: 250). Hanson, Mbachu & Nkado (2003: 198) state that client dissatisfaction poses a serious threat to the sustainability of the South African construction industry. Crosby (1979: 250-251) regards quality as the parameter that makes the difference between success and failure. Love & Edwards (2004:

270) mention that general contractors, who implement a QMS, experience a significant reduction in rework and a competitive superiority among client stakeholders.

Research conducted in South Africa among general contractors reveals that the majority of these contractors do not implement documented QMSs and rely on informal actions to achieve quality (Smallwood & Rwelamila, 1998: 1786).

There is a significant need in South Africa for the implementation of QMSs within the construction industry. General contractors do not implement strategic quality planning, such as ISO 9000 accreditation. They are fully aware of the system and the successes that it has achieved, but lack competent senior management and organisational structures to implement and sustain the systems (Smallwood & Rwelamila, 1998: 1787).

2.3 Defects in construction

In general terms, defects or defective work occur when the standard and quality of workmanship and materials, as specified in the contract, are deficient (Georgiou, 2010: 371). Defects can be classified into two main categories, namely patent defects and latent defects. Atkinson (1999: online) defines defects as a breach of the terms and conditions of the contract by contractors. Defects may occur in any part of a construction project and at any stage of construction. Douglas & Ransom (2007: 6) define a 'defect' as a shortfall in performance occurring at any time in the life of the product, element or building in which it occurs.

In considering issues within the defect domain, it is important to define what constitutes faults, failure and defects, and what types of failures are evident. The Building Regulations and British Standards do not differentiate between faults and failures and define these as:

- Fault: A departure from design requirements where these were not themselves at fault.
- Defect or failure: A shortfall in performance occurring at any time in the life of the product, element or dwelling in which it occurs (Ilozor, Okoroh, Egbu & Archicentre, 2004: 328).

Atkinson (1987), cited by Mills, Love & Williams (2009: 12), provides a clear definition between a failure and a defect: "A failure is a departure from good practice, which may or may not be corrected before the building is handed over. A defect, on the other hand, is a shortfall in performance which manifests itself once the building is operational". Mills, Love & Williams (2009: 13) suggest that defects

can be classified as being minor or major. Minor defects are those that arise from poor workmanship or defective materials used in the erection or construction of a building, but do not render the building unsafe, uninhabitable, or unusable for the purposes for which the building was designed or intended. If the building is unsafe, uninhabitable, or unusable for the purposes for which the building was designed or intended, it is classified as a major defect. Knocke (1992: 50) mentions that defects are fundamentally the physical manifestation of an error or omission.

Defective construction works can be defined as works that fall short of complying with the express descriptions or requirements of the contract. The majority of modern buildings and civil structures are complex and involve the use of a great variety of engineering methods and processes. Therefore, most projects face the possibility of defects and defective work, which generally result in structures that cannot perform their originally intended roles (Ojo, 2010: 3).

Defective construction contributes to both the final cost of a project and the cost of maintenance, which can be substantial. Defective construction includes activities such as compaction not done to specifications, which leads to ground movement and eventual failure of foundations. This may lead to the complete failure of a structure (Zietsman, 2008: 108).

According to Rhodes & Smallwood (2002: 12), the methods of defect detection include observation, inspection, checking work and test samples. The following are some warning signs of possible defects in houses:

- Deep cracks in the foundation or basement walls: This may be a sign that the foundation was laid on a poorly compacted base or poorly graded soil;
- Sagging floors or leaning walls: A shifting foundation or structural problems (with support beams) could be the problem;
- Windows and doors that never sit well in frames or close properly: This problem could be due to beams and joists not being correctly sized or assembled;
- Cracks in interior walls: Wide cracks could signal a foundation problem. Generally, fine cracks are cosmetic due to normal ageing. Ahzahar *et al*. (2011: 250) state that structural defects resulting in cracks are a common type of building defect. A case study undertaken by Rhodes University's Public Service Accountability Monitor (PSAM) also identified that different

kinds of cracks were a common structural quality defect in houses within the Ngqushwa Local Municipality (South Africa) (CIDB, 2011b: 9). Results of a survey in England and Wales also revealed that the most common type of defect in houses was cracking of walls (Baiche, Walliman & Ogden, 2006: 288). A study undertaken by Fauzi, Yusof & Abidin (2011: 496) in Malaysia also identified cracking of walls and floors as the most common type of defect in houses;

- Water damage: Warning signs include mould, rot, paint peeling, staining, corrosion, swelling or discoloration of interior walls. Possible causes: improperly installed roofing, no waterproof barrier or done incorrectly, lack of a drainage space behind brick wall, poorly installed windows and doors. Although a study by Rhodes & Smallwood (2002: 13) identified that cracking is the most common type of defect, they also state that dampness-related types of defects dominate the industry. The study also reveals that maintenance contractors spent the most amount of time rectifying dampness-related defects. A study undertaken in Malaysia by Ahzahar *et al*. (2011: 253) ranked corrosion of steel as the second highest occurring type of defect in buildings;
- Flooding, sewer and drain backups;
- Switched hot and cold water, and
- Lack of required permits: This indicates that building authorities have not performed the required inspections (Consumers Union, 2004: 27).

The conditions under which housing construction takes place are most often far from ideal, with the main focus on speedy delivery. Defects resulting from inaccurate construction can be avoided by ensuring that proper inspection mechanisms are in place. All activities taking place in the construction process can be clearly described and each activity can be independently inspected for accuracy. Although the inspection of accuracy forms part of the overall quality-assurance techniques, there is little emphasis on this (Zietsman, 2008: 113).

Defects result in customer dissatisfaction and could result in rework, which contributes to the cost of construction and thus reduces profitability. Quality management, which includes quality assurance, quality control, and quality improvement, can mitigate and prevent the occurrence of defects (Rhodes & Smallwood, 2002: 1).

Construction defects usually include any deficiency in the performing of the design, planning, supervision, inspection, construction, or observation of construction of any new home or building. The building is deficient if there is a failure during construction – in other words, if the building does not perform in a manner that was intended by the buyer (FindLaw, 2011: online).

The results of the 2011 Construction Industry Indicators (CIIs) (that measure the performance of the South African construction industry) show that approximately 86% of the projects surveyed in 2011 were apparently defect free or had few defects at practical completion/ handover; 12% of the projects had some defects, and 2% had major defects or were totally defective (CIDB, 2011a: 6). The study also indicates that clients were satisfied with the resolution of defective work during the construction period on 82% of the projects, and were neutral or dissatisfied on 18% of the projects surveyed. Satisfaction with the resolution of defects as well as the reduction of defects observed was significantly better than observed in the previous years (CIDB, 2011a: 6).

2.4 Types of defects

Manning (2005: online) mentions that all types of defects can typically be grouped into the following four major categories: design deficiencies, material deficiencies, construction deficiencies and subsurface deficiencies. Findlaw (2011: online) describes the major categories as follows:

- Design deficiencies: Buildings and systems (designed by professionals such as engineers) do not always work as specified; this can result in a defect. Typical design deficiencies relate to building outside the specified code. A typical design defect is roofs that result in water penetration, poor drainage or inadequate structural support.
- Material deficiencies: The use of inferior building materials can cause significant problems such as windows that leak or fail to perform even when properly installed.
- Construction deficiencies: Poor quality workmanship can result in long lists of defects, e.g. plumbing leaks.
- Subsurface deficiencies: Many houses are built on hills or other areas where it is difficult to provide a stable foundation. A lack of a solid foundation may result in cracked foundations or floor slabs as well as other damage to the building. Subsurface conditions that are not properly compacted or prepared

may cause problems – these include improper settling to the ground or the shifting of a structure (e.g. a house).

2.5 Causes of defects

Stephenson, Morrey, Vacher & Ahmed (2002: 398) state that the causes of defects fall into the following basic categories:

- Natural phenomena such as storms, resulting in damage from floods, exceptionally high winds, lightning, earthquakes;
- Design errors;
- Workmanship errors;
- Faulty materials;
- Procedural errors;
- Failure to maintain properly, and
- Abuse or misuse of the building.

They also mention that, although defects caused by 'natural phenomena such as storms, resulting in damage from floods, exceptionally high winds, lightning, earthquakes', 'failure to maintain properly' and 'abuse or misuse of the building' are not the direct responsibility of the designer or builder. It is important to recognise and be aware of these types of problems, as they also provide causes of possible defects.

According to Rhodes & Smallwood (2002: 13), the causes of defects can be related to design, construction, procurement and prevailing environmental conditions. They also describe the origin of defects as being inadequate management and technical skills.

Weldon (1998: 199) states that building defects or failures may arise due to a variety of factors, including poor design, failure of the material, poor construction, and lack of maintenance.

3. Research methodology

This article presents part of the findings of a research project on defects in buildings, using a descriptive quantitative research approach. It first involved an in-depth study of the current theory of defects and quality management systems by means of a literature review. The review of the existing theory focused on categories of defects, causes of defects, consequences of defects, quality assurance and defect costs.

The second part of the research entailed a web-based survey to secure primary data from built environment stakeholders (architects,

consulting engineers and building contractors). A quantitative method of research was implemented to analyse ordinal scales by means of nonparametric statistical tests, using the mean scores, as advocated by Jamieson (2004: 1217). For the purpose of distributing the questionnaire, electronic mail (e-mail) was used and SurveyMonkey was used for collecting the results. The results of the questionnaire were stored within the SurveyMonkey platform and later downloaded for analysis.

The questionnaire was designed to determine built-environment stakeholders' views on two aspects:

- The causes of defects in buildings.
- The type of defects mostly occurring in buildings.

Questionnaires were completed anonymously to ensure a true reflection of the respondents' views and to meet the ethical criterion of confidentiality. It was assumed that the respondents were sincere in their responses as they were assured of their anonymity. A 5-point rating scale, also known as a Likert-type scale (Leedy & Ormrod, 2005), was used to elicit participants' opinions on various statements.

The population consisted of 400 randomly selected professionals, from whom 102 questionnaires were completed on-line, representing a 25.5% response rate. The response group included contractors (50%), architects (29%), engineers (17%) and 'other' (4%) (developers and municipal officials) from the Western Cape (52%) and Eastern Cape (48%) provinces. The majority (64%) of the respondents were between 36 and 55 years old and 48% had more than 20 years' experience in the construction industry. The majority of the respondents (60%) are directors within their firms. This respondent profile indicates that respondents have the necessary experience and knowledge to provide reliable information.

4. Results and discussion

For the purpose of analysis and interpretation, the following terminology was used regarding mean scores: 'strongly disagree' or 'very seldom' (≥1.0 & ≤1.8); 'disagree' or 'seldom' (>1.8 & ≤2.6); 'neutral' or 'average' (>2.6 & ≤3.4); 'agree' or 'often' (>3.4 & ≤4.2) and 'strongly agree' or 'very often' (>4.2 & ≤5.0).

4.1 Causes of defects

Respondents were requested to state to what extent they agreed that the listed items are causes of defects in houses, where 1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree.

Table 1: Causes of defects

Causes of defects	*Mean*	*Rank*
Inadequate artisan skills*	4.25	1
Unqualified contractors*	4.20	2
Lack of quality management during construction*	4.19	3
Lack of inspection during construction*	4.02	4=
Lack of management of construction process*	4.02	4=
Inadequate labourer skills*	3.98	6
Contractor errors*	3.86	7
Non-compliance with specifications**	3.81	8
Inappropriate specifications**	3.55	9
Unqualified designers**	3.52	10
Lack of communication between designer and contractors***	3.45	11
Lack of motivation of contractor (resulting in forgetfulness or carelessness)*	3.41	12=
Defective materials used*	3.41	12=
Lack of quality management during design**	3.41	12=
Design errors**	3.37	15
Conflicting details on drawings**	3.17	16
Lack of motivation of designer (resulting in forgetfulness or carelessness)**	3.12	17
* Contractor related ** Consultant related *** Both		

Table 1 shows that respondents rated 'inadequate artisan skills' as the biggest cause that leads to defects in houses; this was indicated by the mean value of 4.25 signifying 'strongly agree' on the Likert scale. 'Unqualified contractors' was ranked as the second biggest cause of defects; this reflected a mean value of 4.20, signifying 'agree', while 'lack of quality management during construction'

was ranked as the third highest cause of defects; this had a mean value of 4.19 (also signifying 'agree'). Rhodes & Smallwood (2002: 11) conducted a study in South Africa in which they rated the 'lack of quality management' as the biggest cause leading to defects on construction projects. Zietsman (2008: 113), however, rates the 'lack of inspection during construction' as the biggest cause. Ali & Wen (2011: 68) rank 'lack of experience and competency of labourers' highest in the Malaysian construction industry. Zunguzane, Smallwood & Emuze (2012: 36) rank 'poor workmanship' highest as the main cause of defects in low-income housing.

'Lack of motivation of designer (resulting in forgetfulness or carelessness)' was ranked as the lowest cause of defects in buildings; this being indicated by a mean value of 3.12 ('Neutral'), while 'conflicting details on drawings' was ranked as the second lowest cause (Mean value 3.17 ('Neutral') and 'design errors' as the third lowest cause of defects (Mean value 3.37 ('Neutral').

It is noted that the first seven ranked causes identified were construction related. This should serve as a warning to industry professionals with regard to the causes of defects. Utilising competent people within all construction-related areas is vital to ensure sustainable quality and reduction of defective works. The literature also states that construction-related causes are significant with regard to defective works.

4.2 Types of defects

Respondents were requested to state the frequency of their involvement in the following types of defects in housing projects, where 1=very seldom, 2=seldom, 3=average, 4=often and 5=very often.

Table 2: Types of defects

Types of defects	*Mean*	*Rank*
Cracks (e.g. in floors, walls and beams)+	4.00	1
Dampness	3.86	2
Roof problems++	3.64	3
Water leaks (plumbing)+	3.49	4
Detachment (e.g. plaster from walls, paint peeling)+	3.35	4
Structure instability (e.g. foundation problems)++	3.18	6
Insulation problems++	2.99	7

Types of defects	*Mean*	*Rank*
Electrical problems	2.86	8=
Blemishes (e.g. scaling, honeycomb)++	2.86	8=
Corrosion (steel)++	2.68	10
+ See Table 3 ++ See Table 3		

Table 2 shows that respondents ranked 'Cracks (e.g. floors, walls and beams)', indicated by the mean value of 4.00, as the most frequent type of defect in houses. Further analysis indicated that 31% of the respondents stated that cracks occur 'very often' in houses, while 47% indicated 'often'; thus, 78% of the respondents either indicated 'often' or 'very often' that cracks were the most common defect on housing projects.

Dampness (with a mean of 3.86) is ranked as the second most common type of defect in houses, indicating 'agree' on the Likert scale. The lowest ranked type of defect on housing projects is 'Corrosion', with a mean of 2.68, indicating 'average' on the Likert scale.

Cracking is normally a structural deficiency, but the nature and causes thereof might be for different reasons, e.g. material deficiencies, subsurface deficiencies or conditions. Cracks and other defects can also be the result of poor workmanship (incompetent or shortage of skilled artisans) and possibly a consequence of non-compliance with building regulations during the construction of houses. It is for this reason that the quality of site supervision is very important to ensure that defects are limited; the implementation of a quality management system will assist this process.

The results correspond with the results discussed in the literature.

The various causes of defects (Table 1) were grouped into two categories, i.e. contractor related* and consultant related**. The various types of defects (Table 2) could not be grouped together easily and an exploratory factor analysis (EFA) was conducted whereby a 2-factor solution was found to be most suitable. The EFA excluded 'Dampness' and 'Electrical problems'. Cronbach's alpha coefficient of reliability (Nunally, 1979: 85) was determined for each of the scale scores derived from the grouped items, as indicated in Tables 1 and 2. The results are shown in Table 3.

Table 3: Cronbach's alphas for scale scores

Scale scores	*Number of items*	*Cronbach's alpha*
Causes of defects*: Contractor related	9	0.80
Causes of defects**: Consultant related	7	0.79
Types of defects+: Cracks, detachment, water leaks	3	0.72
Types of defects++: Corrosion, blemishes, insulation problems, structure instability, roof problems	5	0.83

Cronbach's alpha interpretation levels as evidence of reliability (internal consistency) are described as 'Good' (0.70-0.79) and 'Excellent' (0.80-0.99) (Nunally, 1978: 85). The values shown in Table 3 thus indicate either good or excellent levels of internal consistency for the scale scores. Descriptive statistics for the scale scores are presented in Table 4.

Table 4: Frequency distributions

	Mean	*Rank*
Causes of defects*: Contractor related	3.92	1
Causes of defects**: Consultant related	3.43	2
Types of defects+: Cracks, detachment, water leaks	3.86	1
Types of defects++: Corrosion, blemishes, insulation problems, structure instability, roof problems	3.33	2

Inferential statistics confirmed that contractor-related causes of defects were more prevalent than consultant-related causes ($t = 5.56$, d.f. = 80, $p = <.0005$; Cohen's $d = 0.62$, medium practical significance) and that defects such as cracks, detachment and water leaks were more prevalent than defects such as corrosion, blemishes, insulation problems, structure instability and roof problems ($t = 5.58$, d.f. = 81, $p = <.0005$; Cohen's $d = 0.62$, medium practical significance).

5. Conclusion

The results of the survey among professionals (architects, contractors and engineers) showed that the biggest contributing factor towards defects is inadequate artisan skills. The study also identified cracking as the most frequently occurring defect. This relates to being a structural deficiency, although the nature and causes of cracking

might be for different reasons. The study also revealed that projects fail in project-management terms, due to defects prolonging the construction time of projects.

The literature indicated that cracking is a frequently occurring manifestation of defects, and dampness-related manifestations predominate. This is confirmed, to a degree, by the empirical results from this research. Dampness was rated as the second most frequently occurring type of defect in houses. Respondents also rated dampness as the biggest problem about which residents complained, and that contractors spent the most time rectifying dampness-related defects in houses.

Defects result from non-conformance to requirements and invariably result in rework. The overall causes of defects can be attributed to design, construction, material and subsurface conditions. Ultimately, the origin of defects lies in inadequate management or inadequate technical skills. The descriptive survey reflects a degree of denial with respect to the liability of designers for defects, but it clearly indicates that construction-related causes dominate.

Quality assurance can reduce or eliminate defects by implementing a quality-management system. This, however, requires that designers, contractors and clients have the requisite skills. Procurement-related interventions may mitigate the occurrence of defects.

In summary, within the South African construction industry, factors relating to defects can potentially be avoided if qualified professionals are appointed to exercise due diligence and if professional teams are given the opportunity to guide contractors during the contract. The cost of appointing reputable professionals in their advisory capacity has to be weighed against the cost of both social and economic constraints. The appointment of qualified construction-industry professionals to implement and maintain quality-management systems will alleviate the current problems in respect of housing delivery within the country.

The serious shortage of competent people at both local and national government level to evaluate and administer construction projects and identify contractual irregularities on all sides ultimately contributes to defective construction. Contracting and subcontracted bodies must take the responsibility to identify and report questionable BEE practices so that institutions such as the CIDB can remove them from their databases as reputable practices; this alone will reduce and ensure more sustainable housing delivery.

Although not discussed in this article, corruption within the South African construction industry may also contribute to irregularities with regard to procurement. The full extent of how it contributes to defects is, however, not yet clearly documented. The authors are of the opinion that, in some circumstances, irregularities during procurement can directly be related to the appointment of incompetent contractors. However, respondents did not rate procurement-related factors as a major contributor to defective construction. This, however, might change in future, due to the large number of corrupt activities currently being exposed within the construction industry. Bowen, Edwards & Cattell (2012: 885) state that corruption is a pervasive stain on the construction industry in many countries, and South Africa is no exception. They also state that factors instrumental in corruption include the skills shortage within the industry, a perceived absence of deterrents and sanctions, and poor ethical standards.

Although the research results are limited to the views of respondents in the Western and Eastern Cape provinces only, there is no reason to believe that this is not the same for the other provinces in South Africa.

6. Recommendations

First, with regard to the causes of defects, it is recommended that professionals, especially contractors, concentrate on improving or implementing an effective quality-management system. They should also consider the factors relating to defects more deeply, so that preventative action can be taken at the outset of a project, as well as in the long term. Defects must be viewed as a risk, due to the likely financial implications.

Secondly, the professional teams must ensure that they become more knowledgeable with regard to the effects of defects. Defects do increase the project parameters of time and cost and affect other elements such as quality.

Thirdly, although contractors are aware of the shortage of skills within the construction industry, more should be done to encourage education and training. Contractors should take the initiative to encourage their employees to obtain further education or training. This must been regarded as growth within the organisation and not as an expense or a burden.

Fourthly, professionals must ensure that they concentrate on identifying and exposing corrupt activities within the construction industry. Corrupt activities within the industry portray a negative

image of South Africa to the rest of the world and decrease our investment potential. This has a negative effect on all construction professionals. The MBA and CIDB also have a role to play in countering corruption by informing members about the consequences of corruption as well as identifying and reporting corrupt practices to the authorities.

Lastly, pertaining to defective construction, professionals must ensure that they reduce or eliminate defective work within the industry. Competent people must be appointed to ensure that the technical requirements are being met. Professionals must be familiar with the relevant requirements of building standards and codes; if they are not, they must be educated or trained. Experienced construction-industry professionals must be utilised to educate the youth to ensure that lessons learnt in the past can be applied in future.

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