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The implementation of health and safety practices: Do demographic attributes matter?

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Abstract

Purpose- The purpose of this study was to investigate the personnel attributes perception on reliable and valid health and safety (H&S) practices within small and medium construction enterprises (SMEs) in South Africa. It explores whether these valid and reliable H&S practices could be implemented based on the demographic attributes namely; years of experience in the construction industry, number of years working in the current organisation and educational level.

Design/methodology/approach- A mixed method approach was used to conduct this research namely; Delphi and questionnaire survey. A structured questionnaire consisting of 31 H&S practices categorised into five major H&S practices was developed from extensive literature review and the participation of 20 purposive sampled H&S experts. Sixteen H&S experts completed four iterations. A convenient sample of 1,450 SMEs was obtained. A total of 228 questionnaires were returned, of which 216 responses were usable for analysis. The data was analysed using exploratory factor analysis and confirmatory factor analysis to determine the validity, reliability and acceptability of the H&S practices. Finally, one-way analysis of variance (ANOVA) and t-test were conducted to determine personnel attributes perception on the implementation of the H&S practices.

Findings- The five major H&S practices (constructs) namely upper management commitment and involvement in H&S, employee involvement and empowerment in H&S, project supervision, project H&S planning and communication in H&S and H&S resources and training were retained as reliable and valid practices of H&S within construction SMEs at project level. One-way ANOVA established no statistical significant difference on the respondents' perception of the H&S practices. However, *t*–test revealed statistical significant difference on the respondents' perception on, upper management commitment and involvement in H&S and H&S resources and training. The respondents with post-matric qualification strongly agreed that upper management are committed and involved in H&S.

Originality/value- The findings may help construction SMEs to use these H&S practices to manage H&S in their projects. The SMEs may also consider the level of education of their personnel when implementing H&S practices of upper management and H&S resources and training.

1. Introduction

The South African small and medium construction enterprises (SMEs) sector is described as largely underdeveloped, lacking the managerial and technical skills and sophistication enjoyed by larger well established contractors. The SMEs are left on the periphery of the mainstream economy and do not participate fully in the economy (Department of Public Works, 1999). Martin (2010) opined that lack of

knowledge including knowledge of pricing procedures, contractual rights and obligations; law, management techniques and principles as well as technology were challenges to SMEs. Despite these general challenges faced by SMEs, the Construction Industry Development Board (CIDB) report 2009 highlighted specific challenges faced by small contractors in managing H&S. Anecdotally, the report indicated that medium to large contractors and subcontractors working with large contractors tend to address H&S to greater degrees than small contractors, emerging contractors, as well as the majority of housing contractors.

Financial resources for H&S were more likely to be catered for by contractors in the upper grading of the CIDB Register of Contractors who are normally large contractors namely in grade 7, 8 and 9, and suggests that SMEs did not cater sufficiently for H&S financial resources in their projects. Past studies in South Africa had revealed constraints and challenges of capacity and financial resources among SMEs (Agumba, *et al.,* 2005). Smaller contractors in grades 2 to 4, given their limited resources and capacity, would demonstrate poorer H&S practices (CIDB, 2004).

The effective implementation of H&S management systems, rules and procedures were further challenges facing small contractors. They were less likely to possess any formal H&S management systems. Furthermore management of H&S in SMEs would largely be less structured and based on the prior contract experience of the owners. It was also likely that these contractors would not be aware of the demands and requirements of the South African generic Occupational Health and Safety & Act and construction H&S legislative framework (CIDB, 2009).

Furthermore, small contractors were exposed to H&S risks when they used power tools and working where they could be struck by falling objects. These challenges reinforce the need to develop a H&S performance improvement model tailored for SMEs in the South African construction industry (CIDB, 2009). These challenges and constraints could exacerbate the current state of poor H&S performance of SMEs in South Africa.

1.1 Health and safety status of the South African construction industry

Construction sites in South Africa continue to be dangerous workplace in the economy (CIDB, 2004). The Department of Labour (DoL, 2012) indicated that in the period 2007 to 2010 the construction industry incurred 171 fatalities and 755 injuries. The industry further paid more than R287 million for occupational injuries in 2010/2011.These statistics are inclusive of SMEs.

The continuing poor H&S performance of the construction industry in terms of fatalities, injuries, and diseases, the number of large-scale construction accidents, and the general non-participation by key project stakeholders such as clients and designers, provided the catalyst for a new approach to construction H&S in the form of consolidated construction H&S legislation such as the Construction Regulations of 2003. This framework required new multi-stakeholder interventions (Smallwood and Haupt, 2005). However, according to the CIDB there was very limited commitment to complying with basic requirements, let alone promoting a culture of H&S. SMEs could barely maintain their tools and equipment and regarded H&S interventions as luxury items. Even where protective clothing and equipment were provided, workers often avoided their use (CIDB, 2004). This poor H&S performance

has therefore driven H&S stakeholders especially the South African government to take H&S seriously. Arguably, the poor performance could inevitably be helped by continuous monitoring and review of the H&S practices.

1.2 Measurement of construction health and safety performance

Health and safety performance measurement can be broadly classified in terms of two types of indicators, namely lagging indicators and leading indicators or positive performance indicators (PPIs) (Toellner, 2001). Leading indicators can either be subjective that is, perception measures or objective indicators that is, number of occasions an activity has been administered (Grabowski, *et al.,* 2007). Unfortunately the construction industry continues to rely heavily on traditional lagging indicators such as accident and workers compensation statistics (Mohamed, 2002).

When using leading indicators a more thorough and constant surveillance is required than when using lagging indicators. The real value of using leading H&S indicators on construction projects is that changes can be made and interventions introduced early to address the weakness before there is an accident. The use of leading indicators instead of lagging indicators is increasingly advocated (Hinze, 2005). Unfortunately there is no consensus of what elements and measuring indicators that are considered to be vital for improved H&S culture Fernandez-Muniz, *et al.,* (2007) which according to Grabowski, *et al.,* (2010) and Hinze *et al.,* (2013) is a leading indicator of H&S.

1.3 Previous H&S performance improvement models

Teo and Ling, (2006) developed a model to measure the effectiveness of H&S management of construction sites. The model was based on 3P + I, namely policy, process, personnel and incentive factors. These core factors were measured by 590 attributes. The large number of attributes might not be practical in the context of SMEs.

Fernandez-Muniz *et al.,* (2007) developed a positive H&S culture model that consisted of management commitment, employee involvement and H&S management system (SMS). The SMS included H&S policy, incentives, training, communication, planning and control. The model could be applied to more than one type of industry of different sizes.

Chinda and Mohamed, (2008) developed H&S culture model adapted from the European Foundation Quality Model (EFQM). The enablers that were identified were leadership, policy and strategy, partnerships and resources, and processes and H&S outcome or goals. The model was validated using large contractors in Thailand. It might be possible to test this model or a modified model within SMEs.

Molenaar *et al.,* (2009) established that for H&S performance to improve, that is, to experience reduction of accidents. The corporate H&S culture should comprise of: H&S commitment, H&S incentives, subcontractor involvement, H&S accountability and disincentives.

1.4 Elements of health and safety management

Many studies have indicated the importance of upper management commitment and involvement in H&S as a practice to improve H&S performance (Fernandez-Muniz *et al.,* 2007; Aksorn and Hadisukumo, 2008; Agumba and Haupt, 2008).

Employee involvement and empowerment has also been identified as important H&S practice that is influential in enhancing H&S performance improvement (Fernandez-Muniz *et al.,* 2007; Aksorn and Hadisukumo, 2008). It is important for employees to be empowered and be involved in H&S by, for example, being able to refuse to do dangerous and unsafe work (Teo, *et al.,* 2008; Agumba and Haupt, 2008). Workers should further be involved in developing H&S policy, providing written suggestions on H&S, being kept informed of the provisions of H&S plans, being involved in H&S inspections, being consulted when the H&S plan is compiled, and being involved in the development of H&S rules and safe work procedures (Teo, *et al.,* 2008; Agumba and Haupt, 2008).

For SMEs to further improve their H&S performance, upper management or owners and their workers need to adhere to the proper implementation of occupational H&S management systems (OHSMS). Eight practices or leading indicators were identified in the literature review that would constitute the OHSMS, namely;

- *Appointment of H&S staff* has been found to be important, to influence H&S performance (Sawacha, *et al.,* 1999; Findley, et al., 2004). The employment of staff member with H&S training on each project was advocated (Ng, *et al.,* 2005).
- *Formal and informal written communication* in the form of, written circulars or brochures that inform workers about the risks associated with their work and the preventive measures to reduce risk is necessary to improve H&S performance (Sawacha, *et al.,* 1999).
- *Formal and informal verbal (oral) communication* is important to improve H&S performance (Fernandez-Muniz *et al.,* 2007). Various forms of this type of communication include providing clear verbal instructions to both literate and illiterate employees about H&S, H&S information verbally communicated to workers before changes are made to the way their work activities are executed, organising regular meetings to verbally inform workers about the risks associated with their work and organising regular meetings to verbally inform workers about the preventive H&S measures of risky work.
- *H&S resources* namely; allocation of resources will include human, financial and personal protective equipment are important in improving H&S performance in construction sites (Abudayyeh, *et al.,* 2006; Fernandez-Muniz *et al.,* 2007).
- *Project planning of H&S* has been found to improve H&S performance and involves procedures to evaluate risks and establish necessary H&S measures to avoid accidents and include organised planning in case of emergencies (Sawacha, et al., 1999; Fernandez-Muniz *et al.,* 2007).
- *Project supervision* is an internal concept in the organisation that verifies the extent to which goals have been fulfilled, as well as compliance with internal norms or work procedures (Fernandez-Muniz *et al.,* 2007; Aksorn and Hadisukumo, 2008).
- *Training in H&S* is fundamental to any organisation that is eager to improve H&S performance as indicated by Ng *et al.,* (2005).

- *H&S policy* is necessary it includes a guide for proper implementation of H&S management system, written in-house H&S rules and regulations for all workers reflecting management concern for H&S, principles of actions to achieve H&S and objectives to be achieved (Fernandez-Muniz *et al.,* 2007).

1.5 Demographic influence of H&S practices

According to Vinodkumar and Bhasi, (2009) H&S practices perception has been found to vary among different groups in organisations. They established that the perception of H&S practices namely management commitment and actions for safety, workers' knowledge and compliance to safety, workers participation and commitment to safety, priority for safety over production, emergency preparedness and workers attitude towards safety, differed significantly based on the employees qualification level. They further established that employees perception based on age differed significantly on different H&S practices namely management commitment and actions for safety, workers' knowledge and compliance to safety, workers participation and commitment to safety and risk justification. Finally, based on the years of experience, the employees' perception differed significantly on management commitment and actions for safety, workers' knowledge and compliance to safety, workers participation and commitment to safety and risk justification. According to Cheng, et al., (2012) age significantly relate to safety management practices (SMP) i.e. safety management information, safety management process and safety management committees. The study established that the older the respondents, the higher they rated the importance level of the SMP variables. Furthermore, the study established that years of experience in current position, type of the firm, gender and size of the firm were not significantly related to SMP. In a separate study, Azimah et al., (2009) established no significant difference on workers perception on the H&S practices i.e. safety reporting, safety satisfaction and feedback, training and competence and management commitment between male and female. However, there was significant difference on safety involvement. Based on these findings, it was therefore decided to collect demographic data of the respondents to determine their perception in relation to the H&S practices implementation at project level of construction SMEs in South Africa.

1.6 The present study

It is evident from the previous research that no consensus has been reached on the dimensions of H&S practices. Moreover, personal attributes perception on H&S practices has been scantily researched, especially within the small and medium construction sector in South Africa. This paper therefore examines the validity and reliability of the H&S practices and the respondents demographic attributes perception on these H&S practices implementation in South African construction SMEs.

The specific objectives of the study are:

- To determine the reliability and validity of the determined H&S practices; and
- To investigate the perception between the H&S practices and the personal attributes of respondents namely, qualification, experience and tenure in the organisation.

2. Research methods

The research philosophy used for this study was pragmatic i.e. involving mixed method approach. It used a Delphi survey for H&S experts and a questionnaire survey for the contractors. Delphi method

straddles between qualitative and quantitative research methods. A questionnaire survey was developed from relevant literature and four rounds of Delphi survey were undertaken. Twenty H&S experts were purposively sampled of which 16 experts finished all the four rounds of Delphi. The H&S experts indicated that 31 H&S practices were very important and considered to have major impact to improve H&S performance at SMEs project level. These H&S practices comprised the final questionnaire presented to the SMEs in the South African construction industry. The 31 practices addressed five H&S core practice areas. The respondents were required to indicate their level of agreement with the H&S practices. The statements were rated on a five point Likert scale, where 1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree.

Other parts of the questionnaire were designed to profile the participants' demographic attributes and the organisations profile namely; type of business and geographic location. The questionnaire was piloted with eight SMEs upper management personnel and those knowledgeable of H&S practices at their project level. The final version was presented to 1,450 conveniently sampled SMEs. This approach was adopted to obtain the readily available respondents, to be part of the sample frame. Furthermore, it increases the number of completed questionnaires in a swift and cost effective manner (Leedy, et al., 2010; Zikmund, 2003). The data was collected using email and drop and collect method of which 228 questionnaires were returned representing 15.72% response rate. However, this was a low response rate. This low response rate concurs with findings of Kongtip *et al.,* (2008). Twelve, of the questionnaires were not comprehensively completed and were not included in the final number of questionnaires to be analysed. Hence, 216 questionnaires were deemed eligible for analysis. The statistical package for social science (SPSS) version 20 was used to conduct descriptive statistical analysis of the data computing the frequencies, mean scores and standard deviation. The SPSS was further used to determine the factor analyzability of the H&S practices. Exploratory factor analysis (EFA) was used to determine the unidimensionality and reliability of the H&S practices. Maximum Likelihood with Promax Rotation was selected as the extraction and rotation methods. Reliability was tested using Cronbach alpha with a cut-off value of 0.70 recommended by Hair *et al.,* (2006). Confirmatory factor analysis determined the acceptability of the H&S practices. The acceptability of the H&S practices were determined using Confirmatory Factor Analysis (CFI), Tucker Lewis Index (TLI) which should be greater than 0.90; Root mean square error of approximation (RMSEA) and Standardized root mean squared residuals (SRMR) less than 0.08; *p*-value less than 0.05 and normed chi-squared (x^2/df) less than 5. Finally one way analysis of variance (ANOVA) and t-test were conducted to determine the relationship between the H&S practices and personal attributes of respondents.

3. Results

3.1 Descriptive statistics on demographic information

The results suggested that in terms of qualifications 28% of the respondents had matric and only 58% of respondents had post-secondary school qualification. Thirty two percent (32%) had 6-10 years of experience in the construction industry and only 4% of respondents had over 36 years of construction experience. The result also indicates that 19% of the respondents had less than 6 years of construction experience. The result further indicates that 51% of respondents had worked in their current organisation for more than 5 years.

3.2 Validity and reliability

3.2.1 EFA for upper management involvement and commitment in H&S

The findings reported in Table 1 indicate Cronbach alpha was greater than 0.70 at 0.868 indicating acceptable internal reliability as recommended (Hair *et al.,* 2006). The Kaiser-Meyer-Olkin (KMO) of 0.890 with Bartlett's Test of Sphericity of $p<0.000$ were also obtained. Indicating consistency with the recommended KMO cut off value of 0.60 and Bartlett's Test of Sphericity of $p<0.05$ as suggested by Pallant, (2007). These results suggest that factor analysis could be conducted with the data. All eleven practices expected to measure the upper management commitment and involvement in H&S loaded together on this H&S practice. The factor loadings for all the practices were greater than 0.452 as reported in Table 1, which were greater than the recommended value of 0.40 as suggested by Field (2005) and Hair *et al.,* (2006). An Eigenvalue greater than 5.107 was established which explained 46.427% of the variance in the data. Therefore, sufficient evidence of convergent validity was provided for this H&S practice. This finding was in line with the study of Fernandez-Muniz *et al.,* (2007) and Findley *et al.,* (2004).

3.2.2 EFA for employee involvement and empowerment in H&S

The findings for this practice are reported in Table 1. The findings indicate that the Cronbach alpha was greater than 0.70 at 0.842 indicating acceptable internal reliability as recommended by Hair *et al.,* (2006). The Kaiser-Meyer-Olkin (KMO) of 0.819 with Bartlett's Test of Sphericity of $p<0.000$ were also obtained. Indicating consistency with the recommended KMO cut off value of 0.60 and Bartlett's Test of Sphericity of $p<0.05$ as suggested by Pallant, (2007). These results suggest that factor analysis could be conducted with the data. The factor loadings for all practices were greater than 0.458 reported in Table 1, which were greater than the recommended value of 0.40 as suggested by Field (2005) and Hair *et al.,* (2006). An Eigenvalue greater than 3.079 was established which explained 61.557% of the variance in the data. Therefore, sufficient evidence of convergent validity was provided for this H&S practice. This finding concurs with the study of Fernandez-Muniz *et al.,* (2007) and Agumba *et al.,* (2008).

3.2.3 EFA for project health and safety planning and communication

The result in Table 1 indicates that the Cronbach alpha was greater than 0.70 at 0.852 indicating acceptable internal reliability as indicated by Hair *et al.,* (2006). The Kaiser-Meyer-Olkin (KMO) of 0.764 with Bartlett's Test of Sphericity of $p<0.000$ were also obtained. Indicating consistency with the recommended KMO cut off value of 0.60 and Bartlett's Test of Sphericity of $p<0.05$ as suggested by Pallant, (2007). These results suggest that factor analysis could be conducted with the data. The factor loadings for all practices were greater than 0.665 reported in Table 1, which were greater than the recommended value of 0.40 as suggested by Field (2005) and Hair *et al.,* (2006). An Eigenvalue greater than 2.786 was established which explained 69.644% of the variance in the data. Therefore, sufficient evidence of convergent validity was provided for this H&S practice.

3.2.4 EFA for project supervision

The result for this H&S practice in Table 1 indicates that the Cronbach alpha was greater than 0.70 at 0.868 indicating acceptable internal reliability (Hair *et al.,* 2006). The Kaiser-Meyer-Olkin (KMO) of

0.868 with Bartlett's Test of Sphericity of $p<0.000$ were also obtained, indicating consistency with the recommended KMO cut off value of 0.60 and Bartlett's Test of Sphericity of $p<0.05$ as suggested by Pallant, (2007). These results suggest that factor analysis could be conducted with the data. All six practices expected to measure the factor project supervision loaded together on this factor. The factor loadings for all items were greater than 0.666 reported in Table 1, which was greater than the recommended value of 0.40 as suggested by Field (2005) and Hair *et al.,* (2006). An Eigenvalue greater than 3.640 was established which explained 60.662% of the variance in the data. Therefore, sufficient evidence of convergent validity was provided for this H&S practice. This finding was in line with the study of Fernandez-Muniz *et al.,* (2007).

3.2.5 EFA for health and safety resources and training

The result in Table 1 indicates Cronbach alpha was greater than 0.70 at 0.864 indicating acceptable internal reliability as suggested by Hair *et al.,* (2006). The Kaiser-Meyer-Olkin (KMO) of 0.801 with Bartlett's Test of Sphericity of $p<0.000$ were also obtained. Indicating consistency with the recommended KMO cut off value of 0.60 and Bartlett's Test of Sphericity of $p<0.05$ recommended by Pallant, (2007). These results suggest that factor analysis could be conducted with the data. All five practices expected to measure H&S resources and training loaded together on this factor. The factor loadings for all the practices were greater than 0.708 reported in Table 1, which were greater than the recommended value of 0.40 as suggested by Field (2005) and Hair *et al.,* (2006). An Eigenvalue greater than 3.281 was established in this factor which explains 65.628% of the variance in the data. Therefore, sufficient evidence of convergent validity was provided for this H&S practice. This finding was supported by Choudhry *et al.,* (2007) and Agumba *et al.,* (2008).

3.3 Confirmatory factor analysis

The results in Table 2 indicate that the H&S constructs were acceptable measures of H&S practice at project level of SMEs. However, four of the five practices tested were not fitting in some of the proposed indices and they were re-specified. The re-specified H&S practices were management commitment & involvement, project supervision, project H&S planning and communication, H&S resources and training. It should be noted that majority of the H&S constructs *p*-value were not acceptable. This was because of the large number of data analysed which tends to produce significant results. It has therefore been argued that *p*-value cannot be used as a solitary measure to determine the acceptability fit of constructs.

The fit indices for management commitment and involvement were fitting after the re-specification of the construct, apart from the *p*-value. The *p*-value indicated significant result greater than 0.05. The normed chi-square was less than 5 that is 1.37 indicating good fitting construct. The CFI and TLI were greater than 0.90 indicating a good fit construct. The RMSEA and SRMR shows values of 0.041 and 0.043 respectively indicating the H&S practice had a good fit. This result concurs with the finding of Fernandez-Muniz *et al.,* (2007).

The fit indices for employee involvement and empowerment were fitting, apart from the *p*-value. The *p*-value indicated significant result greater than 0.05. Furthermore this construct was not re-specified. The normed chi-square was less than 5 that is 1.80 indicating good fitting construct. The CFI and TLI were greater than 0.90 indicating a good fit construct. The RMSEA and SRMR shows values of 0.061 and

0.033 respectively indicating the construct had a good fit. This result concurs with the finding of Fernandez-Muniz *et al.,* (2007).

The fit indices for project supervision and project H&S planning and communication were fitting after the re-specification of the construct, apart from the *p*-value. The *p*-value indicated significant result greater than 0.05. The normed chi-square was less than 5 indicating good fitting construct. The CFI and TLI were greater than 0.90 indicating a good fit construct. The RMSEA and SRMR indicated the construct had a good fit as the values were less than 0.08.

The fit indices for H&S resources and training were fitting after the re-specification of the construct, apart from the TLI. The *p*-value indicated non-significant result less than 0.05. The normed chi-square was less than 5 indicating good fitting construct. The CFI was greater than 0.90, whereas TLI was less than 0.088 indicating weak fit construct. The RMSEA indicated a close fit with a value of 0.088 and SRMR indicated a good fit with a value of less than 0.08.

3.4 Determining the relationship of the H&S practices using one-way analysis of variance

The perception based on the demographic variables on the H&S practices i.e. upper management commitment and involvement in H&S, workers involvement and empowerment in H&S, project H&S planning and communication, project supervision and H&S resources and training were determined using one-way ANOVA. The demographic variables tested were: *Number of years involved in the construction industry (experience); and number of years in the current organisation.* Five null hypotheses *(H°)* were formulated and tested:

H°1 There is no relationship between the demographics variable and the perceived upper management commitment and involvement in H&S.

The result in Table 3 indicates that 70 respondents who had level of experience between 1 to 8 years' had an average perception agreement of 4.30 (*SD*=0.48). The 62 respondents with level of experience between 9 to 15 years had an average perception agreement of 4.34 (*SD*=0.50), and 58 respondents who had over 16 years of experience had an average perception agreement of 4.35 (*SD*=0.48). The results in Table 3 suggest an insignificant effect of years of experience in the construction industry on perception of upper management commitment and involvement on H&S at the $p < 0.05$ level, for the three conditions of years of experience in the construction industry [$F(2, 187) = 0.14$, $p = 0.872$]. Therefore the null hypothesis *(H°1)* could not be rejected.

The result in Table 3 indicates that 69 respondents who had worked in the current organisation for 1 to 4 years had an average perception agreement of 4.33 for upper management commitment and involvement in H&S (*SD*=0.50). 68 respondents who had worked between 5 to 9 years for the organisation had an average perception agreement of 4.34 (*SD*=0.47), and the 50 who had over 10 years working for the organisation had an average, perception agreement of 4.34 (*SD*=0.49). The results in Table 3 suggests an insignificant effect of the number of years working in particular organisation on the perception of upper management commitment and involvement in H&S at the $p < 0.05$ level, for the three conditions of

years working in the current organisation [F (2, 184) = 0.004, p = 0.996]. Therefore the null hypothesis *(H°1)* could not be rejected.

H°2 There is no relationship between the demographics variable and the perceived worker involvement and empowerment in H&S.

The result in Table 3 indicates that 79 respondents who had level of experience between 1 to 8 years had an average perception agreement of 3.82 (*SD*=0.72). The 63 respondents in the level of experience 9 to 15 years had an average perception agreement of 3.93 (*SD*=0.71), and the 62 respondents who had over 16 years of experience had an average perception agreement of 3.96 (*SD*=0.77). The result in Table 3 suggest an insignificant effect of years of experience in the construction industry on perception of employee involvement and empowerment in H&S at the $p < 0.05$ level, for the three conditions of years of experience [F (2, 201) = 0.71, p = 0.494]. Therefore the null hypothesis *(H°2)* could not be rejected.

The 75 respondents who had worked in the organisation for 1 to 4 years had an average perception agreement of 3.86 (*SD*=0.79). The 71 respondents who had worked in the organisation for 5 to 9 years had an average perception agreement of 3.88 (*SD*=0.69), and the 55 who had over 10 years working for the organisation had an average perception agreement of 3.99 (*SD*=0.72). The results in Table 3 therefore suggests an insignificant effect of number of years working in the particular organisation on perception of worker involvement and empowerment in H&S at the $p < 0.05$ level, for the three conditions of years working in the current organisation [F (2, 198) = 0.49, p = 0.616]. Therefore the null hypothesis *(H°2)* could not be rejected.

H°3 There is no relationship between the demographics variable and the perceived project H&S planning and communication.

Table 3 indicate that 77 respondents who had the level of experience between 1 to 8 years had an average perception of agreement of 4.26 (*SD*=0.56). The 65 respondents in the level of experience 9 to 15 years had an average perception of agreement of 4.16 (*SD*=0.72), and the 61 respondents who had over 16 years of experience had an average perception of agreement of 4.13 (*SD*=0.73). The result in Table 3 suggests an insignificant effect of years of experience in the construction industry on project H&S planning and communication at the $p < 0.05$ level, for the three conditions of years of experience [F (2, 200) = 0.73, p = 0.484]. Therefore the null hypothesis *(H°3)* could not be rejected.

The 75 respondents who had worked in the organisation between 1 to 4 years had an average perception agreement of 4.23 (*SD*=0.65). The 69 respondents who worked in the organisation for 5 to 9 years had an average perception agreement of 4.18 (*SD*=0.61), and 56 who had over 10 years working in the organisation had an average perception agreement of 4.15 (*SD*=0.74). The results in Table 3 suggests an insignificant effect of number of years working in the organisation on perception of project H&S planning and communication at the $p < 0.05$ level, for the three conditions of years working in the current organisation [F (2, 197) = 0.216, p = 0.806]. Therefore the null hypothesis *(H°3)* could not be rejected.

H°4 There is no relationship between the demographics variable and the perceived project supervision.

Table 3 illustrates the result of one-way ANOVA. The 74 respondents who had level of experience between 1 to 8 years had an average perception of agreement of 4.21 (*SD*=0.61). The 64 respondents in the level of experience 9 to 15 years had an average perception of agreement of 4.10 (*SD*=0.65), and the 64 respondents who had over 16 years of experience had an average perception of agreement of 4.11 (*SD*=0.66). The result in Table 3 suggests an insignificant effect of years of experience in the construction industry on project supervision at the $p < 0.05$ level, for the three conditions of years working in the organisation [F (2, 198) = 0.61, $p = 0.544$]. Therefore the null hypothesis *(H°4)* could not be rejected.

The 70 respondents who had worked in the organisation between 1 to 4 years had an average perception of agreement of 4.20 (*SD*=0.62). The 71 respondents who had worked in the organisation for 5 to 9 years had an average perception of agreement of 4.14 (*SD*=0.63), and the 57 who had over 10 years working for the organisation had an average perception of agreement of 4.10 on project supervision (*SD*=0.67). The results in Table 3 therefore suggests an insignificant effect of number of years working in particular organisation on perception of project supervision at the $p < 0.05$ level, for the three conditions of years working in the current organisation [F (2, 195) = 0.38, $p = 0.688$]. Therefore the null hypothesis *(H°4)* could not be rejected.

H°5 There is no relationship between the demographics variable and the perceived H&S resources and training.

Table 3 illustrates the result of a one-way ANOVA. The 77 respondents who had level of experience between 1 to 8 years had an average perception of agreement of 4.54 (*SD*=0.60). The 67 respondents in the level of experience 9 to 15 years had an average perception of agreement of 4.52 (*SD*=0.53), and the 64 respondents, who had over 16 years of experience had an average perception of agreement of 4.48 (*SD*=0.56). The result in Table 3 suggests an insignificant effect of years of experience in the construction industry on H&S resources and training at the $p < 0.05$ level, for the three conditions of years of experience [F (2, 205) = 0.214, $p = 0.807$]. Therefore the null hypothesis *(H°5)* could not be rejected.

The 75 respondents who had between 1 to 4 years working in the organization had an average perception of agreement of 4.55 (*SD*=0.57). The 71 respondents working in the organisation for 5 to 9 years had an average perception of agreement of 4.47 (*SD*=0.60), and 59 respondents who had over 10 years working for the organisation had an average perception of agreement of 4.52 (*SD*=0.51) on H&S resources and training. The results in Table 3 suggests an insignificant effect of number of years working in the organisation on perception of H&S resources and training at the $p < 0.05$ level, for the three conditions working in the current organisation [F (2, 202) = 0.334, $p = 0.716$]. Therefore the null hypothesis *(H°5)* could not be rejected.

3.5 Education level perception on H&S practices determined using t-test analysis

T-tests were performed to determine whether the respondents' perceptions of the H&S major practices, i.e. on upper management commitment and involvement in H&S, worker involvement and empowerment in H&S, project H&S planning and communication, project supervision and H&S resources and training varied with regard to educational level namely those with post-matric qualification (tertiary) and those with matric (high school certificate) and those without high school certificate.

The following null hypotheses were formulated, namely:

- *H°1* There is no difference between the mean scores of education level and the perceived upper management commitment and involvement in H&S.
- *H°2* There is no difference between the mean scores of education level and the perceived worker involvement and empowerment in H&S.
- *H°3* There is no difference between the mean scores of education level and the perceived project H&S planning and communication.
- *H°4* There is no difference between the mean scores of education level and the perceived project supervision.
- *H°5* There is no difference between the mean scores of education level and the perceived H&S resources and training.

Table 4 indicates that the assumed equal variance had not been violated for upper management commitment and involvement in H&S as the Levene test for equality of variances was greater than the cut-off point of 0.05 at 0.544. However, there was a slight significant difference of the means. On average, post-matric respondents had slight higher perception on upper management commitment and involvement in H&S at their project level (M=4.40, SD=0.46) than those who do not have post-matric qualification (M=4.23, SD=0.50). This difference was statistically significant, $t(190) = 2.42$, $p < 0.05$ that is 0.017, therefore rejecting the null hypothesis *(H°1)* and accepting the alternative hypothesis that respondents who had a post-matric qualification had a higher perception that upper management are committed and involved in H&S at their project level. Furthermore, the magnitude of the difference in the means due to sample size difference (mean difference = 0.169, 95% CI 0.031 to 0.307) was very small as indicated by Cohen's d or eta squared = 0.0298. Cohen (1988) indicated that for sample size to have moderate to major effect on the significance of the result the cohen "d" should be greater than 0.60.

The results in Table 4 indicates that the assumed equal variance has not been violated for employee involvement and empowerment variable as the Levene test for equality of variance is greater than the cut-off point of 0.05 at 0.222. On average, post-matric qualified respondents had lower perception of employee involvement and empowerment in H&S (M=3.88, SD=0.76) than those without post-matric qualification (M=3.92, SD=0.69). This difference was not significant, $t(190) = 2.42$, $p = 0.05$ that is 0.721, indicating the respondents perception of workers involvement and empowerment in H&S of post-matric qualified respondents and those without post-matric qualification was more than what would have been expected due to chance and hence accept the null hypothesis *(H°2)*. The magnitude of the difference in the means due to sample size difference (mean difference = -0.0398, 95% CI -0.240 to 0.1667) was very small as indicated by Cohen's d or eta squared = 0.0006.

The results in Table 4 indicates that the assumed equal variance has not been violated for project H&S planning and communication variable as the Levene test for equality of variance is greater than the cut-off point of 0.05 at 0.395. However, on average, post-matric qualified respondents had slightly higher perception of project H&S planning (M=4.24, SD=0.67) than those without post-matric qualification (M=4.12, SD=0.66). This difference was not significant, $t(204) = 1.26$, $p = 0.05$ that is 0.210, indicating that the perception of project H&S planning and communication of post-matric qualified respondents and those without post-matric qualification was more than what would have been expected due to chance and hence accept the null hypothesis *(H°3)*. The magnitude of the difference in the means due to sample size (mean difference = 0.117, 95% CI -0.067 to 0.302) was very small as indicated by cohen's d or eta squared = 0.0077.

The results in Table 4 indicates that the assumed equal variance has not been violated for project supervision variable as the Levene test for equality of variance is greater than the cut-off point of 0.05 at 0.245. However, on average, post-matric qualified respondents had slightly higher perception of project supervision (M=4.15, SD=0.64) than those without post-matric qualification (M=4.13, SD=0.63). This difference was not significant, $t(202) = 0.204$, $p = 0.05$ that is 0.839, indicating that the perception of project supervision at project level by post-matric qualified respondents and those without post-matric qualification was not different hence accept the null hypothesis *(H°4)*. Furthermore, the slight difference on the magnitude of the difference in the means due to sample size (mean difference = 0.018, 95% CI -0.161 to 0.197) was very small as indicated by Cohen's d or eta squared = 0.0002.

The results in Table 4 indicates that the assumed equal variance has not been violated for H&S resource and training variable as the Levene test for equality of variances is greater than the cut-off point of 0.05 at 0.072. However, on average, post-matric qualified respondents had slightly higher perception of H&S resource and training at their project level (M=4.58, SD=0.52) than those without post-matric qualification (M=4.41, SD=0.60). This difference was statistically significant, $t(210) = 2.179$, $p < 0.05$ that is 0.030, therefore rejecting the null hypothesis *(H°5)* and accepting the alternative hypothesis that respondents who had a post-matric qualification had a higher perception of provision of H&S resources and training at their project level. The magnitude of the difference in the means due to sample size (mean difference = 0.168, 95% CI 0.061 to 0.320) was very small as indicated by Cohen's d or eta squared = 0.0221.

4. Discussions of results

This research established that the H&S practices that is; upper management commitment and involvement in H&S, employee involvement and empowerment in H&S, project supervision, project H&S planning and communication in H&S and H&S resources and training identified through literature review, H&S experts using Delphi process and a pilot survey with eight construction SMEs were valid and reliable H&S practices of the SMEs in the South African construction industry. It can further be indicated that the H&S practices are acceptable practices of H&S within construction SMEs determined using confirmatory factor analysis. In line with these findings, these H&S practices are proactive measures and could inform SMEs of their H&S performance. As proactive measures they could also be used to alert the contractors of the chances of accidents or incidents before they occur. Furthermore, they

reflect the H&S culture of SMEs at their project level in South Africa construction industry. This finding concurs with the findings of Fernandez, et al., (2007). These proactive H&S practices will be driven by the attitude and behaviour of the SMEs contractor personnel. This will ensure they achieve the desired outcome of preventing accidents or incidents in the workplace.

Furthermore, one-way analysis of variance (ANOVA) established no significant difference between the number of years in the construction industry (experience) and their perception towards, upper management commitment and involvement in H&S, worker involvement and empowerment in H&S, project H&S planning and communication, project supervision and H&S resources and training. This finding was contrary to that of Vinodkumar and Bhasi (2009) who found significant differences in perception in various elements of H&S climate in particular, management commitment, actions for safety, workers knowledge and compliance to safety, worker participation and commitment to safety and risk justification.

The current finding was an indication that the number of years spent in the construction industry does not change the perception of the respondents in relation to the H&S practices that depict the H&S culture of the organisation. Despite Vindokumar and Bhasi (2009) who found that vast experience can influence attitude towards work and especially towards H&S in the workplace.

Furthermore, there was no significant difference between the number of years the respondents had worked in the current organisation (length of time working in the current organisation) and their perception towards, upper management commitment and involvement in H&S, worker involvement and empowerment in H&S, project H&S planning and communication, project supervision and H&S resources and training. It can be suggested that the number of years an employee or owner was employed in a particular organisation does not change their perception towards the H&S practices. This finding is supported by Cheng, et al., (2012).

The perception of H&S practices and the demographic variable namely education level was established. The education level of the respondents was categorised as those with post-matric qualification (tertiary level), and those who did not have tertiary qualification (matric qualification, that is high school certificate) and those who did not have high school certificate.

The findings revealed a statistically significant difference in the perception of respondents' relative to upper management commitment and involvement in H&S. Respondents with post-matric qualification (tertiary qualification) agreed more strongly that upper management personnel of the organisation were committed and involved in H&S at project level. This result was supported by the study of Vinodkumar and Bhasi (2009).

Furthermore, there was statistical significant difference on the perception of respondents relative to H&S resource and training. Respondents with post-matric qualification (tertiary qualification) agreed more strongly that H&S resources and training were available in their projects. The significant differences based on education level need to be addressed in South Africa construction industry. The importance of training and provision of resources should be informed within the owners of SMEs where accidents are

prevalent. There was no statistical significant difference on the perception of the respondents pertaining to employee involvement and empowerment in H&S. The result was contrary to the results of Vinodkumar and Bhasi (2009), and Azimah et al., (2009) who found significant differences. Furthermore, there perception on project H&S planning and communication, and project supervision practices were not perceived to be different in terms of practice. In light of this finding project supervision is akin to the success of project delivery. The supervision of H&S at project level is mandatory to ensure no accidents take place.

5. Conclusions and recommendations

This research established that the H&S practices that is; upper management commitment and involvement in H&S, employee involvement and empowerment in H&S, project supervision, project H&S planning and communication in H&S and H&S resources and training were valid and reliable H&S practices for the SMEs in the South African construction industry. These practices are proactive measures and could inform SMEs of their H&S performance. As proactive measures they could alert H&S personnel of accidents or incidents before they occur, hence reducing fatalities and injuries on site. They are also perceived to reflect the H&S culture of SMEs at their project level in South Africa.

The number of years the respondent was involved in the construction industry (experience) and their perception towards,, upper management commitment and involvement in H&S, worker involvement and empowerment in H&S, project H&S planning and communication, project supervision and H&S resources and training were not different. This finding suggests that newly employed personnel within SMEs will be able to detect if H&S is practiced or not. Moreover, the number of years the an employee or employer had worked in the current organisation (length of time working in the current organisation); and their perception towards, upper management commitment and involvement in H&S, worker involvement and empowerment in H&S, project H&S planning and communication, project supervision and H&S resources and training were not different. In view of this finding SMEs should be confident that whoever is tasked to manage H&S will ensure that H&S is implemented no matter their length of service in the organisation.

The difference in the respondents' perception on upper management commitment and involvement in H&S and H&S resources and training, was based on the level of education. Respondents who had tertiary qualification strongly agreed that these H&S elements were practiced than those who had not acquired tertiary qualification. It can be argued that the higher the education level the higher the possibility of perception differences in these two H&S practices. In line with this finding it is paramount that H&S training and resources be consistently provided among SMEs employees in order to curb the poor H&S performance in the construction industry. The need to identify H&S training providers is recommended. Furthermore, upper management commitment and involvement in H&S should transcend to all employers and employees in the construction industry in order to ensure effective H&S performance.

6. Contributions of the study

Contributions from this study can be seen from two aspects: methodological and managerial.

6.1 Methodological contribution

Most studies either do not validate their instrument or only focus on construct validity using exploratory factor analysis (EFA). This study takes a different perspective by using content validity and construct validity to validate the instrument used in order to meet the standards for rigorous research. To achieve content validity of the H&S practices, 16 H&S experts completed four iterations in the Delphi survey and a further pilot study was conducted with eight SMEs. Construct validity was achieved using two types of validation test: exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) using Mplus.

6.2 Managerial contributions

The H&S practices determined are valid and reliable measures for H&S at project level of SMEs. However, the years of experiences and years working in the organisation will not change the perception of the personnel in the way in which H&S practices are implemented in the SMEs organisation. However, the difference in the level of perception on the practice of H&S training and resources, advocates for H&S training, especially for the SMEs owners who are the custodians of employment. This could be done through H&S training providers, at further education and training institutions. Furthermore, upper management commitment and involvement in H&S should be evidenced to both employers and employees with different levels of qualification. It can therefore be concluded that, the findings of this study advances the area of H&S knowledge in the South African construction industry, which has been scantly researched within SMEs.

7. Future research

A multiple linear regression analysis is recommended in future studies to determine if the demographic attributes influence H&S practices.

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Table 1 H&S practices

Eigen value 5.107 **% of variance 46.427** Upper management commitment and involvement in H&S		
Action	Factor loading	Rank
I/We communicate regularly with workers about H&S	0.786	1
I/We actively monitor the H&S performance of the projects and workers.	0.778	2
I/We encourage discussions on H&S with employees	0.728	3
I/We regularly visit workplaces to check work conditions or communicate with workers about H&S	0.717	4
I/We actively and visibly lead in H&S matters by e.g. walk through the site.	0.672	5
I/We take responsibility for H&S by e.g. stopping dangerous work on site etc.	0.667	6
I/We ensure that the H&S equipment is bought e.g. hardhats, overall etc.	0.618	7
I/We conduct toolbox talks with the workers regularly	0.604	8
I/We accord workers H&S training when there is less work in the project.	0.491	9
I/We reward workers who make extra effort to do work in a safe manner.	0.465	10
I/We encourage and support worker participation, commitment and involvement in H&S activities.	0.452	11
Eigen value 3.079 **% of variance 61.577** Employee involvement and empowerment in H&S		
Action	Factor loading	Rank
Our workers are involved in the production of H&S policy	0.863	1
Our workers help in developing of H&S rules and safe work procedures.	0.839	2
Our workers are consulted when the H&S plan is compiled	0.814	3
Our workers are involved in H&S inspections.	0.598	4
Our workers can refuse to work in potentially unsafe, unhealthy conditions.	0.458	5
Eigen value 2.786 **% of variance 69.644** Project health and safety planning and communication		
Action	Factor loading	Rank
Our firm uses procedures to identify possible H&S dangers on site	0.833	1
I/We include H&S in our projects program	0.822	2
I/We consider H&S when layout of site is done	0.769	3
I/We organize regular meetings to verbally inform workers about the risks and preventive measures of their work.	0.665	4
Eigen value 3.640 % of variance 60.662 Project supervision		
Action	Factor loading	Rank
I/we allow supervision of work by staff trained in H&S.	0.786	1
I/we undertake informal H&S inspection of the work place daily.	0.781	2
One of our employees trained in H&S identifies dangerous activities.	0.718	3
I/we undertake formal H&S inspection of the work place daily.	0.714	4
I/We allow local authorities and H&S enforcement agencies to visit sites for inspection.	0.693	5
I/we regularly undertake H&S audits of projects	0.666	6
Eigen value 3.281 **% of variance 65.628** Health and safety resources and training		
Action	Factor loading	Rank
I/we provide correct tools, equipment to execute construction work.	0.782	1
I/we ensure that workers are trained to do the work safely	0.771	2
I/We ensure our workers are properly trained to take care and use personal protective equipment	0.763	3
I/we conduct induction of all workers on H&S before commencing work on a particular site	0.751	4
I/We buy hardhats, gloves, overall etc. for workers	0.708	5

Table 2 Confirmatory factor analysis

H&S Practices	No. of Items	x^2	*Df*	x^2/df	*p-value*	RMSEA	CFI	TLI	SRMR
Management commitment & involvement	11	58.980	43	1.37	0.053	0.041	0.965	0.956	0.043
Employee involvement & empowerment	5	9.00	5	1.80	0.1091	0.061	0.982	0.964	0.033
Project supervision	4	12.506	8	1.563	0.1300	0.051	0.982	0.966	0.033
Project H&S planning & communication	6	2.227	1	2.227	0.1356	0.075	0.993	0.961	0.011
H&S resources & training	5	10.699	4	2.68	0.0302	0.088	0.941	0.853	0.040

Table 3 One way analysis of variance on demographic variables on H&S practices

Upper management commitment and involvement in H&S							
Demographic variables	**Respondent grouping**	**N**	**Mean**	**Standard deviation (SD)**	**Df**	**F-value**	**Sig.(*p*)**
Experience in the construction industry	Less than 8years 9 to 15years 16years and above	70 62 58	4.30 4.34 4.35	0.48 0.50 0.48	2, 187	0.137	0.872
Length of time in the current organization	Less than 4years 5 to 9 years 10 years and above	69 68 50	4.33 4.34 4.34	0.50 0.47 0.49	2, 184	0.004	0.996
Worker involvement and empowerment in H&S							
Demographic variables	**Respondent grouping**	**N**	**Mean**	**Standard deviation (SD)**	**Df**	**F-value**	**Sig.(*p*)**
Experience in the construction industry	Less than 8years 9 to 15years 16years and above	79 63 62	3.82 3.93 3.96	0.72 0.71 0.77	2, 201	0.709	0.494
Length of time in the current organization	Less than 4years 5 to 9 years 10 years and above	69 68 50	3.86 3.88 3.99	0.79 0.69 0.72	2, 198	0.486	0.616
Project H&S planning and communication							
Demographic variables	**Respondent grouping**	**N**	**Mean**	**Standard deviation (SD)**	**Df**	**F-value**	**Sig.(*p*)**
Experience in the construction industry	Less than 8years 9 to 15years 16years and above	77 65 61	4.26 4.16 4.13	0.56 0.72 0.73	2, 200	0.727	0.484
Length of time in the current organization	Less than 4years 5 to 9 years 10 years and above	75 69 56	4.23 4.18 4.15	0.65 0.61 0.74	2, 197	0.216	0.806
Project supervision							
Demographic variables	**Respondent grouping**	**N**	**Mean**	**Standard deviation (SD)**	**Df**	**F-value**	**Sig.(*p*)**
Experience in the construction industry	Less than 8years 9 to 15years 16years and above	74 64 64	4.21 4.10 4.11	0.61 0.65 0.66	2, 198	0.611	0.544
Length of time in the current organization	Less than 4years 5 to 9 years 10 years and above	70 71 57	4.20 4.14 4.10	0.62 0.63 0.67	2, 195	0.375	0.688
H&S resources and training							
Demographic variables	**Respondent grouping**	**N**	**Mean**	**Standard deviation (SD)**	**Df**	**F-value**	**Sig.(*p*)**
Experience in the construction industry	Less than 8years 9 to 15years 16years and above	77 67 64	4.54 4.52 4.48	0.60 0.53 0.56	2, 205	0.214	0.807
Length of time in the current organization	Less than 4years 5 to 9 years 10 years and above	75 71 59	4.55 4.47 4.52	0.57 0.60 0.51	2, 202	0.334	0.716

Probability>0.05; N= Number of respondents

Table 4 Respondents education level perception on H&S practices

Upper management commitment and involvement in H&S			
H&S practices	**Levene test of equality of variances**	***t*-value**	**Sig.(*p*)**
Upper management commitment and involvement in H&S	0.544	2.417	0.017
Worker involvement and empowerment in H&S, project H&S planning and communication, project supervision and H&S resource and training			
H&S practices	**Levene test for equality of variances**	***t*-values**	**Sig.(*p*)**
Employee involvement and empowerment in H&S	0.222	-0.358	0.721
Project H&S planning and communication	0.395	1.257	0.210
Project supervision	0.245	0.204	0.839
H&S resources and training	0.072	2.179	0.030

Probability>0.05