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DEVELOPMENT OF JOB SATISFACTION INDEX FOR CONSTRUCTION EMPLOYEES IN DEVELOPING COUNTRIES BASED ON FREDERICK HERZBERG'S MOTIVATION THEORY

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Individuals exhibit different levels of job satisfaction and is mostly expressed subjectively. This has made the concept of job satisfaction complex, multifaceted, and generally difficult to measure. Using the fuzzy synthetic evaluation approach, this study aims to develop an index that quantifies the job satisfaction level of construction professionals. This study is based on Herzberg's two-factor theory of motivation. Adopting a 58-item job satisfaction list grouped into ten categories, a questionnaire survey was conducted with 63 construction professionals across six regions to develop the job satisfaction index. After applying the fuzzy synthetic evaluation, the resulting index consisted of eight critical job satisfaction categories. The study found that supervision is the most critical category, followed by the work itself, interpersonal relations, responsibility, achievement, recognition, advancement/growth, and working conditions. To considerably improve the job satisfaction levels of construction professionals, a supportive supervisory environment should be held as a top priority by the management/client. Top managers/clients in developing countries can use the developed index to determine the status of job satisfaction of construction professionals in their organizations/projects. In addition, the index provides the platform to compare relative job satisfaction of construction professionals in a project portfolio for benchmarking purposes. The developed index further eliminates any abstract notion of the concept of job satisfaction, since it can be measured.

Keywords: construction professionals, developing countries, fuzzy synthetic evaluation, Herzberg's motivational theory, job satisfaction index

INTRODUCTION

People generally spend at least a third of their day's activities on their jobs. If that job fails to provide satisfaction, the consequences can be dire not only for the individual's wellbeing but at the aggregate level for the economic wellbeing of

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organizations and the nation (Faragher et al., 2005). Employee job satisfaction is major among several factors that determine the effectiveness of an organization (Idiegbeyan-Ose et al., 2019). Employee satisfaction can lead to greater support of employees in achieving goals of the organization and creating a wider and larger market of products and services and higher profits (Urošević et al., 2016).

Job satisfaction is the result of staffs' perceptions about how their job provides the things they care about (Gholizade et al., 2014). Uddin et al. (2016) captured that several definitions by different authors have described job satisfaction as feelings of workers about their jobs and several job functions. Job satisfaction entails the employee's satisfaction with the general work characteristics, and how it affects the morale of workers. It also refers to the extent to which people like their jobs in relation to what they expect or value most. The strategic and fundamental position of job satisfaction is dependent on employees' attitude to work and is therefore cardinal in any setting or study (Idiegbeyan-Ose et al., 2019).

Past studies have identified a significant cross-pollination between the concept of job satisfaction and motivation. Hence, it is difficult to separate job satisfaction and motivation (Mccormick and Tiffin, 1974). The loss of motivation at work influences employee satisfaction and have a negative impact on employee performance (Octaviannand et al., 2017). Studies in the concept of job satisfaction cannot be effectively done if motivation is not considered. Essentially, it is key to explore further into motivation and its relationship with job satisfaction as these two concepts are mostly related (Singh and Tiwari, 2012).

One of the most prominent theories of motivation which provides the basis for this study is that propounded by Herzberg et al. (1959) and variously called "Two-Factor," "Dual" or Motivation-Hygiene theory. Frederick Herzberg and his research team gathered data through the critical incident recall interview method with over 200 Pittsburgh accountants and engineers. The interviewees were asked to recall situations when they felt "exceptionally good" or "exceptionally bad" about a job, either their present job or any other they had held. A content analysis of the critical incidents was done, and the results produced two set of factors which Frederick Herzberg and his team called satisfiers and dissatisfiers.

According to Herzberg et al. (1959), the satisfiers, which are also known as motivators, intrinsic and job content factors were related to the actual content of the job. The dissatisfiers, which are also known as hygiene, extrinsic and job context factors were related to the context in which an individual performed a job. They further suggested that the factors in a job situation which make people happy are not the same factors which make them unhappy.

Herzberg et al. (1959) asserted that rather than being opposing on a single continuum of satisfaction, they are two independent dimensions – that of satisfaction and dissatisfaction. The presence of the following motivators; achievement, recognition, work itself, responsibility, and advancement can lead to job satisfaction while their absence does not lead to dissatisfaction. Dissatisfaction tended to be associated with the following hygiene factors: company policy and administration, supervision, working conditions, interpersonal relations salary. Based on these findings the motivation-hygiene theory was established. One common survey instrument which subsumes these factors is that of Wood (1974) "Faculty Satisfaction/Dissatisfaction Scale.

The Herzberg et al. (1959) theory has brought home the important fact that not all factors in the workplace have the same potential for positively motivating behaviour. This concept prompted research in other occupational categories to determine what conditions must exist in different jobs to allow job satisfaction to exist. There have been studies in different careers such as education (Ataliç et al., 2016), construction (Fugar and Salam, 2007), clergy (Fugar, 2007b; Fugar, 2007a), health (Babić et al., 2014), banking (Sowmya and Panchanatham, 2011), insurance (Devina and Sreeradha, 2013), and so on.

The major concern of most managers are issues relating to motivation and job satisfaction (Urošević et al., 2016). However, research has been unable to really prove the effectiveness of these human resource management (HRM) techniques in the construction industry (Othman et al., 2012). These HRM techniques include training and development, employee engagement and motivation, recruitment, performance appraisal amongst others (Nicolescu, 2009; Huzooree and Ramdoo, 2015). Among these, motivation-related factors are the most prevailing challenge in the construction industry (Ameh and Daniel, 2017). Most employees tend to be dissatisfied at work due to lack of motivation (Ombima, 2014), where motivation is a more sustainable source of job satisfaction (Imna and Hassan, 2015). The measurement of job satisfaction is therefore vital to setting a suitable ground for management decisions in performance enhancement (Lepold et al., 2018).

Measuring job satisfaction

Drawing insights from the Herzberg's motivation theory, different factors in a job situation affects the satisfaction of employees. Conceptually, as employee satisfaction has been known to have a strong impact on operational performance, satisfying individual needs of employees is crucial to the success of an organization. However, tailoring satisfaction strategies to each employees' needs is near unattainable due to the extreme resources involved. In particular, the outcome of such an endeavour may rather detract the realization of organizational goals owing to potential high expenses and time in ensuring individual employee needs are met and personal goals are attained. To this end, it remains essential to provide a levelled-playing ground to benchmark the job satisfaction levels of employees. As an individual is not isolated from an organization, engaging an approach that coordinates all perceptions from employees is key to job satisfaction. Considering such collective views provides a tangible, sufficiently influential, and an objective reality of the external environment (Neal and Griffin, 2006). Furthermore, a collation of satisfaction views integrates the needs of all and forms a source of reference for assessing overall satisfaction (Nzekwe-Excel, 2012). One method which have been validated and tested in this regard is the development of a job satisfaction index (Saner et al., 2016).

Nevertheless, this initiative can be problematic depending on the technique used in developing such an index. This is because, approaches such as the traditional weighted method cannot handle evaluation involving multiple factors with nonsignificant weighting differences which may omit some essential information with smaller weighting (Hu et al., 2016). According to Piegat (2013), information obtained from people is usually of less precision (large granularity), while information delivered by measuring devices is of higher precision (small granularity). In other words, satisfaction is a subjective phenomenon that may be based on perceptions rather than on reality itself (Nkado and Mbachu, 2001).

Suggesting the need to consider the uncertainty and vagueness of acquired information from individuals (Aliev, 2013). Inaccuracy in measurement of satisfaction perceptions is much certain when questionnaire surveys are involved. Relevant to this discussion, job satisfaction evaluations, which are mostly assessed using questionnaire surveys are conducted based on subjective evaluations and substantially dependent on human interpretations (Rasmani and Shahari, 2007). This premise is further exacerbated when different groups of workers from various departments in an organization are surveyed. Implying different perceptions formed by or presented to construction professionals concerning their motivations and satisfaction needs towards their job. To this end, the onus of this premise is to identify an overall decision which satisfies all the participants involved (Akter and Simonovic, 2002). In providing an antidote to this chaos, the fuzzy set has been suggested as an excellent framework that deals with these challenges as well as the imprecise meaning of preferences and their subjective nature (Abiyev et al., 2016). Essentially, the fuzzy set can address decision-making with conflicting goals (Wang and Liang, 2004).

Considering these promising capabilities of the fuzzy set, a number of studies have been conducted in diverse fields as well as within the arena of job satisfaction. Using fuzzy set, Abiyev et al. (2016) measured job satisfaction of hotel employees in Turkey. Crocetta and Delvecchio (2007) employed the fuzzy set approach to measure the degree of satisfaction of graduates on the suitability of university education for working purposes in Italy. De Battisti et al. (2013) applied the fuzzy set to measure satisfaction concerning employees of a public administration in Italy. Rajareegamand and Doss (2013) used the fuzzy set evaluate the job satisfaction of teachers in engineering colleges in India. Hatipoğlu et al. (2013) adopted the fuzzy set to measure job satisfaction of shift workers in different manufacturing companies in Turkey. Li et al. (2013) used the fuzzy approach to evaluate stakeholder satisfaction during public participation in major construction projects in Hong Kong.

It is apparent that fuzzy set studies on measuring job satisfaction have mostly focused on Asian and European countries. This infers that, despite the pool of job satisfaction studies, little research has been conducted within Africa, and their construction industries (Yirenkyi-Fianko and Chileshe, 2012). As a result, the literature remains unclear about the extent to which job satisfaction features facilitate the improvement of construction professionals' well-being in Africa. This has led to an inferior understanding of how specific job satisfaction dimensions operate within the sub-Saharan Africa region. In effect, little is known about how to effectively measure job satisfaction of construction professionals and which job satisfaction feature is sensitive to significantly influence the well-being of construction professionals in the region. Using Ghana as a case study, this research aims to develop an index to quantify the level of job satisfaction among construction professionals using the fuzzy synthetic evaluation approach of the fuzzy set family. It can also be reasoned that construction organizations in Ghana are likely to share similar features with their counterparts in developing countries (Kheni et al., 2010). Arguably, the findings of this study are of relevance to other developing countries, particularly in the sub-Saharan Africa region.

FUZZY SYNTHETIC EVALUATION

Fuzzy set was developed in 1965 by Zadeh (1965) and has extensively been applied in many fields. The intuition behind the technique describes imprecision or vagueness (Zadeh, 1965). A key modelling technique of the fuzzy set is the fuzzy synthetic evaluation (FSE). The FSE uses fuzzy mathematics to transform and fathom unclear data, and has various attributes concerning evaluation of objects (Kuo and Chen, 2006). This technique is more suitable to the traditional weighted method since it can objectify and handle subjective judgements inherent in human cognitive process (Ameyaw and Chan, 2015). The application of the FSE deals with uncertainty, complexity of human behaviour, and the linguistic-scale measurement (Patel and Jha, 2016). These linguistic scales are often common with job satisfaction surveys, as they are often assessed on Likert scales. The FSE can deal effectively with multi-attributes and multi-dimensions (Boateng et al., 2020) present in job satisfaction surveys. Since the process of satisfaction measurement is complicated and uncertain, requiring approximate reasoning involving human intuition, a fuzzy approach is employed (Li et al., 2013). This study therefore uses constructs of job satisfaction with various attributes that require evaluations subject to human judgement on a linguistic scale, and therefore suitable to apply FSE approach to develop the Job Satisfaction Index (JSI).

METHODOLOGY

Consistent with fuzzy set and job satisfaction studies, this paper adopts a cross-sectional study and quantitative research design. A two-part questionnaire was used in the collection of the data from July 2018 to October 2018 within six regions (Greater Accra, Upper West, Upper East, Brong-Ahafo, Volta, and Ashanti). Part 1 of the questionnaire was used to collect demographic characteristics of the respondents. Part 2 consisted of Wood (1974) "Faculty Satisfaction/Dissatisfaction Scale as modified by the researchers to measure Herzberg et al. (1959) motivation-hygiene factors. The modified version of Wood's instrument consisted of 58-item six-point Likert scale responses ranging from 1 (very dissatisfied) to 6 (very satisfied). The 6-point Likert scale is consistent with job satisfaction studies. It ensures true/near-true choice by making respondents put deep thought into answering surveys rather than an "easy way out" on the neutral point. Put differently, studies have shown that social desirability bias, arising from respondent's desires to please the interviewer or appear helpful or not be seen to give what they perceive to be socially unacceptable answer, can be minimized by eliminating the mid-point (e.g. neither, neutral, uncertain, etc.) (Garland, 1991). Thus, this finding supports the use of even-numbered point Likert scales in certain circumstances. In consequence, researchers such as Murray (1999) have employed the 6-point Likert scale in evaluating job satisfaction. The items are categorized into 10 groups4, namely; achievement, recognition, the work itself, responsibility, advancement/growth, company policy and administration, supervision, salary, interpersonal relations, and working conditions. The respondents were purposively selected based on the following criteria: (1) must be working in a construction

[4] For the sake of brevity and to avoid replicating the work of others, sources of these groups have been provided in Table 1. Findings within this study are discussed in view of the main finding/group rather than re-summarizing the work of numerous authors from extant literature.

organization (2) must be in middle management (3) must be project manager, quantity surveyor, architect, or engineer and (4) must obtain at least Higher National Diploma (HND). The selected respondents were invited to answer the questions online and some questionnaires given by hand. Sixty-three (63) responses were valid for analyzes. This sample is close to Patel and Jha (2016) sample of 64 used in developing a project safety hazard index while employing the fuzzy set, hence adequate in the developing the JSI in this study. Besides, the sample size was deemed adequate because it further satisfied the recommendations of numerous researchers that a sample size of 30 for any group could be considered representative (Sproull, 2002).

A majority (54%) of the respondents were quantity surveyors, 28.6% were project/construction managers, and 11.1% were engineers. A group of respondents who indicated belonging to others comprised 6.3%. In terms of length of service, most of the respondents (66.7%) had been with their current company for less than 5 years. Around 23.8% had been with their current company for 5 – 10 years. Whereas 4.8% and 3.2% of the respondents had worked with their current company for 11 – 15 years and 16 – 20 years, respectively. Very few (1.6%) had more than 20-years' length of service with their current company. Regarding working experience in the construction industry, 41.3% had 5 – 10 years' experience, 31.7% had less than 5 years' experience, and 11.1% had 11-15 years' experience. 7.9% of the respondents had 16 – 20 years' experience while additional 7.9% had more than 20 years' experience. Measuring the satisfaction of a single group is not necessary very complicated (Rogers et al., 2013). However, difficulties arise when the number of groups involved in the evaluation process increases, as the objectives of each group in the project can be diverse and are often conflicting (Akter and Simonovic, 2002). As evident in the respondents' demographics, the diversity in relation to respondents' profession, length of service, and working experience clearly reinforces the need to employ the FSE approach by further echoing Akter and Simonovic (2002) assertion concerning the demand to satisfy the collective needs of all while incorporating individuals' views.

Mean score analysis, normalization, reliability analysis, and FSE analysis were performed to develop the job satisfaction index. Prior to developing the job satisfaction index, reliability analysis was performed to check the internal consistency of the 58 items under the 10 dimensions of job satisfaction index. Internal consistency was computed using the Cronbach alpha (Oyedele, 2012). The FSE modeling approach5 is given as follows (Xu et al., 2010):

1. Establish a basic set of criteria. $\Pi = \{f_1, f_2 \dots f_n\}$; where n is the number of criteria.

2. Label the set of grade alternatives as $k = \{k_1, k_2 \dots k_n\}$. The set of grade categories are the scale measurement. Eg. 1=very dissatisfied.

3. Set the weightings for each factor component. The weighting (W) is determined from the survey using the equation: $w_i = \frac{M_i}{\sum_{i=1}^{6} M_i}$, $0 < w_i < 1, \sum_{i=1}^{n} w_i = 1$.

[5] For more fundamental details of FSE and fuzzy set, interested readers should refer to Sadiq and Rodriguez (2004).

4. Apply a fuzzy evaluation matric for each factor component. The matric is expressed as $R_i = (r_{ij})_{mxn}$, where rij is the degree to which alternative kj satisfies the criterion fj.

5. Reach final FSE results for the evaluation by considering the weighting vector and the fuzzy evaluation matric using the equation: $D = w_i{}^{\circ}R_i$.

6. The final FSE evaluation matrix is normalized and a JSI for a particular factor component is computed using the equation: $JSI = \sum_{i=1}^{6} D \times k$.

RESULTS AND DISCUSSION

Cronbach alphas were calculated for the ten dimensions of job satisfaction to test reliability as shown in Table 1. Reliability coefficients of all job satisfaction dimensions were greater than 0.7 indicating internal consistency within variables (Hair et al., 1995). Hence, there was consensus among all participants regarding the list of job satisfaction dimensions and their attributes to evaluate job satisfaction levels construction employees.

Table 1: List of Job satisfaction dimensions and their attributes

Job satisfaction dimensions and their attributes	Alpha
Achievement: x_1 (Herzberg et al., 1959; Hagedorn, 2000; Wood, 1974; Oberman, 2005)	0.866
Your actual achievement of company goals and objectives, x_{11}	
Immediate results from your work, x_{12}	
The actual adoption by the suggestions you make or recommend toward a project, x_{13}	
Personal goal attainment, x_{14}	
Observing subordinates grow in the knowledge and practice of the skills you teach, $_{15}$	
The extent to which you are able to evaluate your accomplishments, x_{16}	
Recognition: x_2 (Herzberg et al., 1959; Hagedorn, 2000; Wood, 1974; Oberman, 2005)	0.899
Recognition of your accomplishments by your workers, x_{21}	
Recognition of your accomplishments by your project staff, x_{22}	
Recognition of your accomplishments by management, x_{23}	
The extent to which your subordinates appreciate your efforts and leadership, x_{24}	
Your recognition compared to recognition of your fellow project managers/engineers, x_{25}	
The work itself: x_3 (Herzberg et al., 1959; Hagedorn, 2000; Wood, 1974; Oberman, 005)	0.731
The construction management work in general, x_{31}	
The expectations of your subordinates, x_{32}	
Your level of enthusiasm about managing projects, x_{33}	
The extent to which your work utilizes your education and training, x_{34}	
Responsibility: x_4 (Herzberg et al., 1959; Hagedorn, 2000; Wood, 1974; Oberman, 2005)	0.877
The authority you have to get your job done, x_{41}	
The total amount of responsibility you have, x_{42}	
Your responsibility compared with those of your fellow managers/engineers, x_{43}	
Various other project management responsibilities, x_{44}	
Total number of workers for which you are responsible, x_{45}	
The number of work groups/trades for which you are responsible, x_{46}	
Responsibility at the local, and management levels, x_{47}	
Advancement/growth: x_5 (Herzberg et al., 1959; Hagedorn, 2000; Wood, 1974; Oberman, 2005)	0.908
Opportunities for increased responsibility in the organization, x_{51}	
Opportunities provided for growth in education compared with growth in other professions or companies, x_{52}	
Participation in in-service training and education, x_{53}	
Types and levels of programs available for training and education of project managers/engineers, x_{54}	
Opportunities for growth professionally through formal education, x_{55}	
Opportunity to attend professional conferences, seminars workshops, etc., x_{56}	
Company policy and administration: x_6 (Herzberg et al., 1959; Hagedorn, 2000; Wood, 1974; Oberman, 2005)	0.945
Your involvement in making decisions at all levels of management of the company, x_{61}	

Table 1 Continued: List of Job satisfaction dimensions and their attributes

The extent to which you are informed about matters affecting you, x_{62}	
The procedures for promoting workers to higher positions of responsibility in the company (e.g. Director of commercial unit, Director of Estimating, Technical Director), x_{63}	
The procedures for selecting workers for further education and training, x_{64}	
The administrative procedures used to carry out transfers of workers, x_{65}	
The administrative procedures for carrying out appraisal of workers, x_{66}	
The extent to which administrative policies and procedures are followed, x_{67}	
The extent to which the policies meet workers' needs, x_{68}	
Supervision: x_7 (Herzberg et al., 1959; Hagedorn, 2000; Wood, 1974; Oberman, 2005)	0.908
On-the-job supervision given by your superior, x_{71}	
Competence of your superior to give leadership, x_{72}	
The willingness of your superior to delegate authority, x_{73}	
Counsel and guidance given by your superiors, x_{74}	
The fairness of our superiors, x_{75}	
The sensitivity of your superiors to your needs, x_{76}	
Salary: x_8 (Herzberg et al., 1959; Hagedorn, 2000; Wood, 1974; Oberman, 2005)	0.929
The method used to determine your salary, x_{81}	
The range of salary paid to project managers/engineers, x_{82}	
The top salary available to project managers/engineers compared with other companies, x_{83}	
Your salary compared to that of people with similar training in other professions, x_{84}	
The amount of your salary, x_{85}	
The adequacy of other benefits (retirement, illness, vacation etc.), x_{86}	
Interpersonal relations: x_9 (Herzberg et al., 1959; Hagedorn, 2000; Wood, 1974; Oberman, 2005)	0.831
Your relationship with top management, x_{91}	
Your relationship with your colleagues in the company (other managers, engineers, quantity surveyors etc.), x_{92}	
Cooperation from project team members, x_{93}	
Friendliness of project team members, x_{94}	
Your relationship with the site workers, x_{95}	
Working conditions: x_{10} (Herzberg et al., 1959; Hagedorn, 2000; Wood, 1974; Oberman, 2005)	0.830
Number of hours spent each week on construction activities, x_{101}	
Your office facilities (e.g. computers, telephone etc.), x_{102}	
Adequacy of facilities for your duties, x_{103}	
Adequacy of support from top management for your work, x_{104}	
Your work schedule compared with other project managers, x_{105}	

Mean score analysis was used to rank the job satisfaction attributes in Table 2. Further, to determine the critical attributes of job satisfaction among the list, normalization was used. Normalized attributes greater than or equal to 0.50 are retained. This selection mechanism has been used by many previous studies to establish the most significant factors (Osei-Kyei and Chan, 2017). With this criterion, 39 attributes were deemed critical as presented in Table 2.

Table 2: Ranking of job satisfaction attributes

	Mean	Ranking	Normalization		Mean	Ranking	Normalization
x_{92}	5.11	1	1.00	x_{71}	4.40	30	0.65
x_{95}	5.02	2	0.95	x_{105}	4.40	31	0.64
x_{34}	5.02	3	0.95	x_{101}	4.35	33	0.62
x_{33}	4.98	4	0.94	x_{91}	4.35	32	0.62
x_{72}	4.92	5	0.90	x_{74}	4.35	34	0.62
x_{93}	4.90	6	0.89	x_{52}	4.32	35	0.60
x_{94}	4.89	7	0.89	x_{102}	4.29	36	0.59
x_{42}	4.89	8	0.89	x_{53}	4.25	37	0.57
x_{41}	4.89	9	0.89	x_{75}	4.22	38	0.55
x_{43}	4.87	10	0.88	x_{104}	4.18	39	0.53
x_{24}	4.86	11	0.87	x_{103}	4.06	40	0.48
x_{12}	4.86	12	0.87	x_{55}	4.05	41	0.47
x_{31}	4.83	13	0.86	x_{62}	3.94	42	0.41

Table 2 Continued: Ranking of job satisfaction attributes

x_{45}	4.82	14	0.86	x_{72}	3.89	43	0.39
x_{22}	4.76	17	0.83	x_{56}	3.89	44	0.39
x_{14}	4.76	16	0.83	x_{54}	3.86	45	0.37
x_{32}	4.76	15	0.83	x_{61}	3.84	46	0.37
x_{15}	4.75	18	0.82	x_{81}	3.79	47	0.34
x_{11}	4.73	19	0.81	x_{83}	3.76	48	0.33
x_{46}	4.71	20	0.80	x_{82}	3.73	49	0.31
x_{21}	4.70	21	0.79	x_{63}	3.71	50	0.30
x_{16}	4.70	22	0.79	x_{84}	3.70	51	0.29
x_{13}	4.65	23	0.77	x_{68}	3.68	52	0.29
x_{51}	4.62	24	0.75	x_{67}	3.65	53	0.27
x_{47}	4.60	25	0.74	x_{66}	3.55	54	0.22
x_{73}	4.59	26	0.74	x_{65}	3.49	55	0.19
x_{23}	4.56	27	0.72	x_{85}	3.43	56	0.16
x_{44}	4.54	28	0.72	x_{64}	3.35	57	0.12
x_{25}	4.46	29	0.67	x_{86}	3.11	58	0.00

*Normalized value = (actual value – minimum value)/(maximum value – minimum value).

Establishing the FSE tool for assessing employees JS

The fuzzy modelling consists of two levels. The first level is the eight JSGs and the second level is the 39 JSAs. Establishing the FSE tool determines the weightings of each JSG and JSA. The following sections present the adoption of the FSE in developing the JSI.

Calculate the weightings for each level

The appropriate weightings of JSAs and JSGs are calculated using Eq. (1) and presented in Table 3.

$$w_i = \frac{M_i}{\sum_{i=1}^{6} M_i}, \quad 0 < w_i < 1, \sum_{i=1}^{n} w_i = 1 \tag{1}$$

Where w_i = weighting function of a JSA or JSG, and M_i = mean score value of a JSA or JSG. Using Eq. (1) the weightings are calculated and presented in Table 3. For example, to compute the weighting for 'x11', Eq. (1) is adopted as:

$$w_{x_{11}} = \frac{4.73}{4.73 + 4.86 + 4.65 + 4.76 + 4.75 + 4.70} = \frac{4.73}{28.44} = 0.166$$

Therefore, the same procedure is employed to compute the weightings for the remaining JSAs and JSGs.

Table 3: Weightings for JSAs and JSGs for construction professionals

Dimensions of JS	Mean of JSA	Weighting of JSA	Total mean of JSG	Weighting of JSG
x_{11}	4.73	0.166		
x_{12}	4.86	0.171		
x_{13}	4.65	0.164		
x_{14}	4.76	0.167		
x_{15}	4.75	0.167		
x_{16}	4.70	0.165		
Achievement			28.44	0.156
x_{21}	4.70	0.201		
x_{22}	4.76	0.204		
x_{23}	4.56	0.195		
x_{24}	4.86	0.208		
x_{25}	4.46	0.191		
Recognition			23.34	0.128

Table 3 Continued : Weightings for JSAs and JSGs for construction professionals

x_{31}	4.83	0.246		
x_{32}	4.76	0.243		
x_{33}	4.98	0.254		
x_{34}	5.02	0.256		
The work itself			19.59	0.108
x_{41}	4.89	0.147		
x_{42}	4.89	0.147		
x_{43}	4.87	0.146		
x_{44}	4.54	0.136		
x_{45}	4.82	0.145		
x_{46}	4.71	0.141		
x_{47}	4.60	0.138		
Responsibility			33.32	0.183
x_{51}	4.62	0.350		
x_{52}	4.32	0.327		
x_{53}	4.25	0.323		
Advancement/growth			13.19	0.073
x_{71}	4.40	0.196		
x_{72}	4.92	0.219		
x_{73}	4.59	0.204		
x_{74}	4.35	0.193		
x_{75}	4.22	0.188		
Supervision			22.47	0.124
x_{91}	4.35	0.179		
x_{92}	5.11	0.211		
x_{93}	4.90	0.202		
x_{94}	4.89	0.202		
x_{95}	5.02	0.207		
Interpersonal relations			24.26	0.133
x_{101}	4.35	0.253		
x_{102}	4.29	0.249		
x_{104}	4.18	0.243		
x_{105}	4.40	0.255		
Working conditions			17.21	0.095
Total mean values of JSDs			181.82	

Define the membership functions for each level

The membership functions (MFs) are computed to determine the JSI for construction professionals. The membership functions of the second level (JSAs) are derived to facilitate the calculation of the first level (JSGs). Recall the six-point rating scale where 1=very dissatisfied, 2=moderately dissatisfied, 3=slightly dissatisfied, 4=slightly satisfied, 5=satisfied, and 6=very satisfied were used grade alternatives for evaluating the JSAs. The MF for each JSA is calculated using sample Eq. (2). Using 'your actual achievement of company goals and objectives, x11' for illustrate purposes, the survey results indicated that the respondents rate its satisfaction level as follows: 0% as 'very dissatisfied'; 4.8% as 'moderately dissatisfied'; 4.8% as slightly dissatisfied; 28.6% as 'slightly satisfied'; as 36.5% as 'satisfied'; and 25.4% as 'very satisfied'. Hence, the MF for x11 is derived as:

$$MF_{x_{11}} = \frac{0.000}{very\ dissatisfied} + \frac{0.048}{moderately\ dissatisfied} + \frac{0.048}{slightly\ dissatisfied} + \frac{0.286}{slightly\ satisfied} + \frac{0.365}{satisfied} + \frac{0.254}{very\ satisfied} \quad (2)$$

The MF can be defined as (0.000, 0.048, 0.048, 0.286, 0.365, 0.254). The MFs for the remaining JSAs are calculated using same procedure and presented in Table 4. Next, the MFs for the first level are computed using Eq. (3).

$$D = w_i \circ R_i \quad (3)$$

Where w_i is the weighting function of all JSAs for each JSG, ° is a fuzzy composite operation, and R_i is the fuzzy evaluation matrix. Using 'Advancement/growth, x5 as an example, the MFs of all JSAs in this group can be defined using Eq. (3) in a weighting function and fuzzy matrix as:

$$D_{x_5} = w_{x_5} \circ R_{x_5} = (w_{x_{51}}, w_{x_{52}}, w_{x_{53}}) \times \begin{vmatrix} MF_{x_{51}} \\ MF_{x_{52}} \\ MF_{x_{53}} \end{vmatrix} = (0.350, 0.327, 0.323) \times \begin{vmatrix} 0.016 & 0.016 & 0.143 & 0.190 & 0.429 & 0.206 \\ 0.048 & 0.095 & 0.048 & 0.302 & 0.317 & 0.190 \\ 0.032 & 0.063 & 0.206 & 0.190 & 0.333 & 0.175 \end{vmatrix} = (0.032, 0.057, 0.132, 0.227, 0.361, 0.191) \quad (4)$$

The MFs for the remaining JSGs are calculated using same procedure and presented in Table 4.

Table 4: Membership functions for JSAs and JSGs

Dimensions of J:	Weightings of JSAs	Membership function for level 2 (JSAs)	Membership function for level 1 (JSGs)
Achievement			
x_{11}	0.166	(0.000, 0.048, 0.048, 0.286, 0.365, 0.254)	(0.000, 0.037, 0.077, 0.217, 0.447, 0.222)
x_{12}	0.171	(0.000, 0.016, 0.079, 0.206, 0.429, 0.270)	
x_{13}	0.164	(0.000, 0.063, 0.048, 0.254, 0.444, 0.190)	
x_{14}	0.167	(0.000, 0.032, 0.079, 0.159, 0.556, 0.175)	
x_{15}	0.167	(0.000, 0.048, 0.079, 0.175, 0.476, 0.222)	
x_{16}	0.165	(0.000, 0.016, 0.127, 0.222, 0.413, 0.222)	
Recognition			
x_{21}	0.201	(0.000, 0.032, 0.095, 0.206, 0.476, 0.190)	(0.010, 0.037, 0.088, 0.200, 0.466, 0.198)
x_{22}	0.204	(0.016, 0.016, 0.095, 0.175, 0.461, 0.238)	
x_{23}	0.195	(0.000, 0.063, 0.111, 0.190, 0.476, 0.159)	
x_{24}	0.208	(0.016, 0.000, 0.063, 0.206, 0.460, 0.254)	
x_{25}	0.191	(0.016, 0.079, 0.079, 0.222, 0.460, 0.143)	
The work itself			
x_{31}	0.246	(0.000, 0.000, 0.048, 0.254, 0.524, 0.175)	(0.004, 0.008, 0.039, 0.229, 0.472, 0.247)
x_{32}	0.243	(0.000, 0.000, 0.079, 0.286, 0.429, 0.206)	
x_{33}	0.254	(0.000, 0.000, 0.016, 0.190, 0.587, 0.206)	
x_{34}	0.256	(0.016, 0.032, 0.016, 0.190, 0.349, 0.397)	

Table 4 Continued: Membership functions for JSAs and JSGs

Responsibility			
x_{41}	0.147	(0.000, 0.016, 0.079, 0.222, 0.365, 0.317)	(0.002, 0.016, 0.083, 0.233, 0.444, 0.221)
x_{42}	0.147	(0.000, 0.000, 0.063, 0.222, 0.476, 0.238)	
x_{43}	0.146	(0.000, 0.016, 0.048, 0.254, 0.413, 0.270)	
x_{44}	0.136	(0.000, 0.000, 0.127, 0.286, 0.508, 0.079)	
x_{45}	0.145	(0.000, 0.032, 0.032, 0.206, 0.540, 0.190)	
x_{46}	0.141	(0.016, 0.016, 0.095, 0.238, 0.381, 0.254)	
x_{47}	0.138	(0.000, 0.032, 0.143, 0.206, 0.429, 0.190)	
Advancement/growth			
x_{51}	0.350	(0.016, 0.016, 0.143, 0.190, 0.429, 0.206)	(0.032, 0.057, 0.132, 0.227, 0.361, 0.191)
x_{52}	0.327	(0.048, 0.095, 0.048, 0.302, 0.317, 0.190)	
x_{53}	0.323	(0.032, 0.063, 0.206, 0.190, 0.333, 0.175)	
Supervision			
x_{71}	0.196	(0.016, 0.063, 0.111, 0.270, 0.397, 0.143)	(0.026, 0.003, 0.018, 0.162, 0.519, 0.343)
x_{72}	0.219	(0.016, 0.032, 0.016, 0.206, 0.413, 0.317)	
x_{73}	0.204	(0.048, 0.000, 0.048, 0.333, 0.349, 0.222)	
x_{74}	0.193	(0.016, 0.032, 0.175, 0.334, 0.270, 0.175)	
x_{75}	0.188	(0.032, 0.032, 0.143, 0.381, 0.317, 0.095)	
Interpersonal relations			
x_{91}	0.179	(0.000, 0.032, 0.111, 0.460, 0.270, 0.127)	(0.000, 0.012, 0.046, 0.248, 0.448, 0.245)
x_{92}	0.211	(0.000, 0.000, 0.016, 0.190, 0.460, 0.333)	
x_{93}	0.202	(0.000, 0.016, 0.048, 0.206, 0.476, 0.254)	
x_{94}	0.202	(0.000, 0.016, 0.032, 0.190, 0.571, 0.190)	
x_{95}	0.207	(0.000, 0.000, 0.032, 0.222, 0.444, 0.302)	
Working conditions			
x_{101}	0.253	(0.016, 0.016, 0.190, 0.286, 0.365, 0.127)	(0.043, 0.020, 0.147, 0.317, 0.327, 0.146)
x_{102}	0.249	(0.063, 0.016, 0.190, 0.270, 0.222, 0.238)	
x_{104}	0.243	(0.063, 0.032, 0.095, 0.413, 0.270, 0.127)	
x_{105}	0.255	(0.032, 0.016, 0.111, 0.302, 0.444, 0.095)	

Afterwards, the MFs in level one are substituted into Eq. (5) to calculate the JSI for each category.

$$JSI = \sum_{i=1}^{6} D \times k \tag{5}$$

Where k is the adopted grade alternatives (i.e. 1=very dissatisfied to 6=very satisfied). Using 'achievement' for example, the JSI for x1 is calculated as:

$$JSI_{x_1} = (0.000 \times 1 + 0.037 \times 2 + 0.077 \times 3 + 0.217 \times 4 + 0.447 \times 5 + 0.222 \times 6) = 4.743$$

With same procedure, the index for each group is calculated and presented in Table 5. In Table 5, supervision ranked first suggesting its importance to employee job satisfaction. Followed by the work itself. Interpersonal relations ranked third, then responsibility at fourth. Achievement and recognition ranked fifth and sixth respectively. Whereas advancement and working conditions ranked seventh and eighth respectively. The second goal of this study was to determine which job satisfaction group is sensitive to significantly influence the well-being of construction professionals. The finding of this goal is discussed in this regard. The role supervision plays in job satisfaction influences both organizational performance and employee retention. Consistent with earlier study by Schroffel (1999) within the clinical field, workers were generally satisfied with their jobs when they were more satisfied with their supervision. These workers were much more satisfied when an ideal supervisory environment was exhibited. This suggests that the most important factor to consider when management/clients want to increase the satisfaction level of construction professionals is a supportive supervisory

environment. Whereas anecdotal evidence would have pointed to salary as a critical factor, empirical evidence from this current study suggest otherwise. The items within the salary group were not deemed critical in satisfying construction professionals.

Table 5: Job satisfaction index for each JSG

Job satisfaction groupings	Job satisfaction index (JSI)	Coefficients*	Ranking
Supervision	5.386	0.142	1
The work itself	4.898	0.129	2
Interpersonal relations	4.867	0.128	3
Responsibility	4.764	0.125	4
Achievement	4.743	0.125	5
Recognition	4.668	0.123	6
Advancement/growth	4.401	0.116	7
Working conditions	4.302	0.113	8
Total	38.028	1.000	

*Coefficient = (JSI for JSG/ $\sum JSI$ for JSG)

From the findings in this study, the JSI for evaluating employees JS levels can be expressed as:

$$JSI = (0.125 \times x_1) + (0.123 \times x_2) + (0.129 \times x_3) + (0.125 \times x_4) + (0.116 \times x_5) + (0.142 \times x_6) + (0.128 \times x_7) + (0.113 \times x_8) \quad (6)$$

This finding is quite interesting as it contradicts a recent study by Azeez et al. (2019) in the USA that surveyed construction trade workers. They found that the most important reward that satisfied workers is financial reward. This could further be explained that, in Ghana, as well as other developing countries, construction professionals are well paid than construction trade workers. Suggesting that, all other things being equal, professionals' needs differ from that of construction trade workers who are relatively at a lower economic bearing within the developing economies. Borrowing insights from Maslow's hierarchy of needs, individuals at the bottom of the hierarchy would prefer physiological needs such as food, shelter, and clothing. Unless other interventions exude, these needs can primarily be attained only through financial means. Whereas, construction professionals who have moved up the hierarchy may find themselves at the love/belongingness step, their need for an environment that provides the necessary supportive supervisory environment is paramount in fulfilling their satisfaction.

CONCLUSIONS AND IMPLICATIONS

In this study, a tool for evaluating job satisfaction levels of construction professionals has been proposed as shown in Eq. (6). Mainly, this paper presents an inclusive, timely, and objective technique in measuring construction professionals' job satisfaction in developing countries. The job satisfaction index provides construction organizations/clients to realistically and objectively assess the status of employee job satisfaction. Consequently, the ability to measure job satisfaction levels also eliminates any abstract notion of the concept. The study further found that, the provision of a supportive supervisory atmosphere is the topmost factor to consider when top management/clients attempts to improve the job satisfaction levels of construction professionals. For management/clients to evaluate the level of job satisfaction of construction professionals, these

professionals must rate the extent to which the critical 39-job satisfaction attributes under their corresponding dimensions of job satisfaction are crucial within a certain time period, project, or organization on the six-point rating system. The mean coefficients for individual JSG should be computed and substituted in the JSI model (Eq. 6) to determine the level of employee job satisfaction. Compilation of scores over diverse projects involving the organizations employees could be used for benchmarking purposes to foster initiatives in HRM. For academia, this study offers a dais in employing FSE to yield weightings that can be employed to formulate equations for evaluating job satisfaction of employees. Developed countries could adopt the FSE methodology used in this paper to develop job satisfaction assessment tools, implement performance evaluation mechanisms to benchmark, and compare with other already existing assessment tools. Further studies could consider larger participant samples from all the regions.

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