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Validation of the International Engineering Motivation Construct with Multigroup Analysis

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Abstract.

The purpose of this study was twofold. First, the study aimed to validate multicultural workforce motivation construct engineering. Second, it aimed to perform a subgroup analyses of the identified model to determine if the theoretical model is valid across demographics. Data were collected from a total of 268 employees working in the United States either as a natural citizen or with an Employment Authorization Document (EAD). The theoretical framework used in the study was Herzberg's Motivation-Hygiene Theory, which is suggested by many (Ben Slimane, 2017; Shuck and Herd, 2012; Singh & Bhattacharjee, 2019). The instruments used were Minnesota Satisfaction Questionnaire (MSQ) suggested by Weiss et al. (1967) and the Vancouver Index of Acculturation (VIA) suggested by Ryder et al. (2000). Data were collected using crowdsourcing agency. Both exploratory factor analysis (EFA) and confirmatory factor analyses (CFA) were used in the study. The model was tested with a specific bias test and for model invariance at both the global and local levels. A multi-group difference test was conducted on the participants' industry, position, birth country, ethnicity, gender, age group, and educational background to confirm or deny configural, metric and scalar invariance. The study validated the results from prior research that reported different number of factors for the motivation construct. The results of the study suggest that even old theories from a western country, such as Herzberg's Motivation-Hygiene Theory, still could be valid in multicultural organizations. Recommendations for future research are provided.

Keywords: Construct validation, Multicultural, International Engineering Motivation, Job Satisfaction.

1. Introduction

Herzberg's Motivational-Hygiene Theory is a job enrichment strategy to motivate workers based on a balance of job satisfaction and job dissatisfaction (Kermally, 2004). As more organizations embrace the world market, workforce is becoming more culturally diverse, and in Western organizations, more employees from other nations are in the workforce (Terry, 2007). In business, the relationships are deteriorating between clients and working teams leading to a multitude of organizational issues, such as fewer team members having long-term relationships with members in working teams and a decline in the quality of products (Ochieng & Price, 2009).

In organizations, new global workforce creates new dynamics, new opportunities, and new risks (Harvey et al., 2012). To increase organizational success, it is imperative for multicultural workforce and management teams to adjust to a cross-national environment and become capable of working with a global mindset to motivate repatriates, expatriates, and domestic workers in high performance working teams. Persuading multinational workforce to work efficiently in global business has become a major problem in terms of communication, dispute resolution, and team performance (Brett et al., 2007; Earley & Mosakowski, 2000).

Managers are often attempting to motivate employees and create scenarios where employees can meet both personal and organizational goals, but those attempts have been supported predominately by Western motivation theories (Reis & Pena, 2001). Nevertheless, a framework that can capture the motivation construct of engineers in multicultural workforce with varying levels of cultural integration has not yet been suggested. Understanding of the workforce motivation construct has been a topic of interest in the past, continues to be a topic of interest in recent times, and will likely be an area of interest in the future unless future projects strive to analyze multicultural work environments to gain a better understanding of the motivation construct (Earley, 1993, Earley, 1994; Ochieng & Price, 2009; Peterson, Smith et al., 1995; Leung & Wang, 2015; Paletz et al., 2014; Rozkwitalska & Basinska, 2015). This study is designed to explore the dimensionality of the motivation construct supported by Herzberg's Motivational-Hygiene Theory with a multicultural workforce in engineering.

2. Background

There are many motivational theories focusing on improving employees' job performance, and many agree research fails to determine the relationship between satisfaction and performance (Arnolds & Boshoff, 2002). Motivation is a topic that has been studied for many decades, and many of the earlier theories from the middle of the 19th century still hold value in worker motivation, and recent research leads back to internal and external elements of motivation (Bassett-Jones & Lloyd, 2005; Buitendach & Rothmann, 2009). Research explains that intrinsic elements consist of a variety of factors explaining the feeling individuals experience regarding the nature of the work or job tasks (Buitendach & Rothmann, 2009; Hirschfeld, 2000), but in theory, the more predominant elements are sense of achievement, feeling of recognition, working tasks, work related responsibility, advancement, and growth (Herzberg, 1987). Extrinsic elements, on the other hand, consist of factors affecting worker experiences consisting of basic needs, such as job security, position status, wages, working conditions, and other fringe benefits (Herzberg, 1987), and the basics of extrinsic elements seem to be aspects external to individual experiences, such as organizational policies, supervision, relationships, pay, personal life, status, and security. Intrinsic and extrinsic elements may also relate to individual experience or working conditions.

A number of studies investigating motivation with single cultures have supportive evidence of a two-factor construct structure for motivation (Buitendach & Rothmann, 2009; Dhammika et al., 2012; Hirschfeld, 2000; Kankaanranta et al., 2007; Schlett & Ziegler, 2014). These studies of motivation focus on intrinsic and extrinsic elements, intrinsic elements consisting of internal needs, such as working relationships, nature of the work, and security and extrinsic elements capturing the external needs pertaining to work environments and can include pay, company policies, and working conditions. Although, there is strong evidence suggesting motivation is a two-factor construct, there are many who disagree and conducted studies supportive of more construct dimensions: three-dimensions (Astrauskaite et al., 2011; Liu et al., 2008; Friedlander, 1963; Landy, 1971), five dimensions (Kismiantini et al., 2014; Ryan, 2014; Wang et al., 2010), six dimensions (Conklin & Desselle, 2007; Murrells et al., 2005), seven dimensions (AliAbadi et al., 2014; Saiti & Fassoulis, 2012), and eight dimensions (Hoyt et al., 2007; Li et al., 2014). Instruments reported in these studies were the Minnesota Satisfaction Questionnaire (Buitendach & Rothmann, 2009; Conklin & Desselle, 2007; Dhammika et al., 2012; Hirschfeld, 2000; Wang et al., 2010), Job Satisfaction Survey (AliAbadi et al., 2014; Astrauskaite et al., 2011; Li et al, 2014; Saiti & Fassoulis, 2012; Schlett & Ziegler, 2014), Index of Work Satisfaction (Murrells et al., 2005), Nurse Stress Index (Murrells et al., 2005), McCloskey/Mueller Satisfaction Scale (Murrells et al., 2005), Nurse Satisfaction Scale (Murrells et al., 2005), Measure of Job Satisfaction (Murrells et al., 2005), Measure of Job Satisfaction for Community Nurses (Murrells et al., 2005), Job Descriptive Index (Conklin & Desselle, 2007; Faye et al., 2013), Public Service Motivation Inventory (Liu et al, 2008), Small Business Workplace Learning Survey (Wang et al., 2010), Organizational Commitment Questionnaire (Wang et al., 2010), Expansion of Measure of Job Satisfaction (Faye et al., 2013), Measure of Motivational Sources (Ryan, 2014), Satisfaction Inventory (Landy, 1971), and various other created instruments (Friedlander, 1963; Hoyt et al., 2007, Kankaanranta et al., 2007).

3. Theoretical Framework

Previous research used a number of theories for exploring the motivation construct such as: Locke's Range and Affect Theory (Buitendach & Rothmann, 2009; Dhammika et al., 2012; Kankaanranta et al., 2007; Liu et al., 2008), Need for Affect Theory (Schlett and Ziegler, 2014), Herzberg's Motivational-Hygiene Theory (Friedlander, 1963; Conklin and Desselle, 2007; Faye et al., 2013; Hoyt et al., 2007), Existence, Relatedness, and Growth (ERG) Theory (Landy, 1971; Li et al., 2014), Maslow's Self-Actualization Theory (Kismiantini et al., 2014; Ryan, 2014), Hawthorne Effect (Wang et al., 2010), combination of Herzberg's Motivational Hygiene Theory and the Expectancy Theory (Murrells et al., 2005).

The theoretical framework of this study was Herzberg's Motivational-Hygiene Theory. Herzberg's Motivational-Hygiene Theory supports a two-factor structure of the workforce motivation construct. Motivational factors are identified as job satisfiers while hygiene factors are identified as job dis-satisfiers (Herzberg, 1965; Herzberg, 1987; Herzberg, 2000).

4. Methodology

4.1 Participants

268 participants were recruited from Amazon Mechanical Turk (MTurk), a crowdsourcing data collection agency. Crowdsourcing data has undergone rigorous research. Researchers suggested that collecting data through crowdsourcing has advantage for external validity, because it offers a wide range of diversity in the U.S. and internationally (e.g. Landers & Behrend, 2015). The fact that respondents received small incentive was not found to create a bias (Landers & Behrend, 2015). The MTurk samples do not seem to differ from traditional samples (Hsieh & Kocielnik, 2016), and the quality of the data obtained from MTurk participants is similar to traditional samples (Komarov et al., 2013, Goodman & Paolacci, 2017; Holden et al., 2013; Feitosa et al., 2015).

Higher percentage of participants in this study were born in the United States (58.1%), were white (55.3%), between ages 25 and 34 (61.6%), had a bachelor degree (53.1%), worked in the software industry (45.3%), were either a software engineer or in information technology field (40.6%).

5. Instrumentation

5.1 Measurement of Job Satisfaction

Job satisfaction was the measure in employees working in the United States that were born in the United States or born in foreign countries. The Minnesota Satisfaction Questionnaire was used as a measure of workforce motivation. The short-form version of the instrument consists of 20 items adopted from the 100 item long-form version of the Minnesota Satisfaction Questionnaire (Weiss et al., 1967). The short-form version of the instrument, the 20 items loaded on three factors: intrinsic (10 items), extrinsic (6 items), and general (4 items). In engineering, Weiss et al. (1967) reported a Cronbach's alpha of 0.92. Buitendach and Rothmann, 2009 validated the instrument in a South African context yielded a two-factor construct, and reporting a Tuckers phi coefficient of 0.81 for factor one and 0.86 for factor two.

The MSQ subscales initially were constructed through an empirical approach that relied on factor-analytic results (Weiss et al., 1967). Initially, some researchers also suggested that assigning MSQ short-form items to intrinsic and extrinsic subscales as specified by the MSQ manual (Weiss et al., 1967) results in a lower-than-optimal level of construct validity (e.g., Arvey, Dewhirst, & Brown, 1978; Cook, Hepworth, Wall, & Warr, 1981; Schriesheim, Powers, Scandura, Gardiner, & Lankau, 1993; Spector, 1997). However, research in later years also suggested that there exists empirical evidence involving the MSQ short-form subscales that is consistent with the theoretical distinction between intrinsic and extrinsic job satisfaction (e.g., Arvey, Bouchard, Segal, & Abraham, 1989; Arvey, McCall, Bouchard, Taubman, & Cavanaugh, 1994; Day & Bedeian, 1991).

Bledsoe and Brown (1977) performed a factor analysis of responses from 136 Georgia public school superintendents to the short-form Minnesota Satisfaction Questionnaire yielded a single factor, General Satisfaction, accounting for 43.5% of the variance. For this population Intrinsic Satisfaction and Extrinsic Satisfaction were correlated at $r = .74$ and were apparently not distinctive factors.

Schriesheim, Powers, Scandura, Gardiner and Lankau (1993) conducted a content assessment on MSQ using two content assessment panels and Q-factor analysis. The researchers concluded that the subscales MSQ-S form intrinsic and extrinsic job satisfaction subscales contain items which are theoretically misclassified, based upon Locke's (1976) definitions of intrinsic and extrinsic satisfaction. In this instance, a solution to the problem seems obvious: reassign the misassigned items to their proper subscales (and, possibly, omit the items which measure both intrinsic and extrinsic satisfaction or use them as part of the overall MSQ-S "general satisfaction" measure).

5.2 Measurement of Acculturation

In the United States, an acculturation measurement was used to identify two groups, one with heritage culture and one with mainstream culture. The instrument used to measure acculturation was the Vancouver Index of Acculturation (VIA) suggested by Ryder et al. (2000). The VIA is an instrument capable of measuring acculturation more accurately than a unidimensional model. The Vancouver Index of Acculturation was used to compensate for common method bias. The

Cronbach alpha coefficients for the Vancouver Index of Acculturation for the Heritage groups had a high internal consistency of 0.91, 0.92, and 0.91 for Chinese, East Asians, and miscellaneous samples respectively. The Mainstream groups in the Chinese, East Asians, and miscellaneous samples Cronbach alpha coefficients were 0.89, 0.85, and 0.87 respectively (Ryder et al., 2000).

The last section of the questionnaire was the Vancouver Index of Acculturation and was used to understand if participants born outside of the United States display signs of a cultural shift. The Vancouver Index of Acculturation Questionnaire was coded in four categories Heritage Culture (HC), Entertainment Culture (EC), Cultural Behavior (CB), and Cultural Intelligence (CI). The Vancouver Index of Acculturation was used for evaluating common method bias testing on the confirmatory factor analysis (Archimi et al., 2018).

5.3 Research Questions

The research questions in this study were as below:

RQ1: Would the current study achieve the same factor structure for the construct of multicultural workforce motivation in engineering as reported by Chileshe and Haupt (2006)?

In Chileshe and Haupt (2006) study, an EFA yielded a two-factor construct, which was validated with a CFA, but the CFA results were not reported.

RQ2: Would the current study yield a reasonable higher order factor structure for the construct of multicultural motivation in engineering?

Chileshe and Haupt (2006) did not report a higher order factor structure, and no other studies were found reporting a higher order factor structure for workforce motivation.

RQ3: Would the identified multicultural workforce motivation model yield the same factor structure when analyzed with subgroups?

In research practice, cross-group factorial invariance is tested widely for multi-group CFA. Once a model is identified based on the total sample, cross-group factorial invariance testing explains if the model can be confirmed with subgroups within the sample. The analyses performed in this study were: (a) exploratory factor analysis (EFA), (b) confirmatory factor analysis (CFA). Finally, a multigroup analysis was conducted to test the final model with configural, metric, and scalar invariance tests. Before performing the main analyses in the study an analysis for identifying multivariate normality was performed. Data were analyzed using IBM SPSS 25.0 and IBM AMOS Version 25.0. The models were created using the Pattern Matrix Model Builder Plugin (Gasking & Lim, 2016b) for IBM SPSS AMOS Version 25.0.

5.4 Multivariate Normality

Multivariate normality is a critical concept for multivariate analysis, and as research suggests (Tabachnick & Fidell, 2013) can often be difficult to detect. Violations of multivariate normality can yield inaccurate results, especially when Maximum Likelihood (ML) extraction methods are used. To test for multivariate normality, the Minnesota Satisfaction Questionnaire (MSQ) and the Vancouver Index of Acculturation (VIA) items were evaluated for skewness and kurtosis. The skewness and kurtosis on different items raged between +/-1.96, which seems to be acceptable (Field, 2013; Tabachnick & Fidell, 2013).

6. Results

6.1. EFA

An EFA was performed on the constructs of the MSQ and VIA. On the MSQ, the EFA was performed using three types of extraction methods: (a) the Maximum Likelihood (ML), (b) the Principal Axis Factoring (PAF), and (c) the Principal Component Analysis (PCA). With all three extraction methods the promax rotation was used and loadings below 0.30 were suppressed. Further in the text these models are referred to as ML, PAF, and PCA models respectively. The ML and PAF models yielded a three-factor construct (intrinsic, extrinsic, and general) (KMO = 0.914, $\chi2$ = 1602.067, degrees of freedom = 136, p-value < 0.001). The PCA model yielded a two-factor construct (intrinsic and extrinsic) (KMO = 0.906, $\chi2$ = 1293.180, degrees of freedom = 91, p-value < 0.001). An EFA was performed adding the heritage items from the VIA to the ML Model using the maximum likelihood extraction method, promax rotation, eigenvalues greater than one, and suppressing loadings below 0.30. The heritage construct was added to the model to test the motivation construct for common method bias (Podsakoff et al., 2003). The analysis yielded a four-factor construct (KMO = 0.908, $\chi2$ = 2465.802, degrees of freedom = 253, at a p-value < 0.001).

6.2. CFA

In CFA analysis, this study used the following indices for evaluating the model fit: (a) chi-square as an index of absolute fit, (b) the Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI) as indices of comparative or incremental fit (respectively) at 0.90 or above, (c) Goodness of Fit Index (GFI) at 0.95 or above, (d) the Root Mean Square Error of Approximation (RMSEA) at 0.60 or below, (e), the Standardized Root Mean Square Residual (SRMR) at 0.08 or below to measure the average discrepancy between correlations observed in the input matrix and the correlations predicted by the model, and (f) the index for identifying the close-fitting model (PCLOSE) at 0.05 or above (Brown, 2006). During the initial model fit checks, the modification indices were examined to determine which, if any, of the error terms of the observed variables would have require covariance lines to increase model fit following the suggestions in the literature (Matsunaga, 2010; Yong & Pearce, 2013; Jackson et al., 2009). Modification indices were calculated and examined for high thresholds between error terms connected to the same latent variable. Validity and reliability of the models were tested in IBM SPSS AMOS 25 using a plugin developed by Gaskin and Lim (2016a).

The results of the ML and PAF models were identical, but some convergent and discriminant validity concerns were identified. The PCF model had excellent model fit and failed both convergent and discriminant validity tests. The latent variable general in the ML model passed the model fit tests but following the suggestions from Keith (2015) and Yale et al. (2015) a second order factor was connected to intrinsic and extrinsic to address discriminant validity concerns. Another model was formed with a second-order factor motivation, which was connected to first-order latent variables intrinsic, extrinsic, and general dramatically improving the model fit. Examination of modification indices suggested the thresholds were identical to those in the ML model and the covariance lines were retained. When connecting to a second order factor Malhotra and Dash (2011) suggested examining the CR only, which yielded 0.916. The model fit indices are reported in Table 1.

Table 1. Model Fit Results

Model Description	χ^2	df	p-value	CMIN/DF	TLI	CFI	GFI	RMSEA	SRMR	PCLOSE	AIC
Expected				<5	>.9	>.9	>.9	<.06	<.06	>.05	
ML Model	169.748	113	<0.001	1.502	0.955	0.962	0.930	0.043	0.0424	0.789	249.748
PAF Model	169.748	113	<0.001	1.502	0.955	0.962	0.930	0.043	0.0424	0.789	249.748
PCA Model	103.052	73	0.012	1.412	0.970	0.976	0.949	0.039	0.0370	0.845	167.052
ML Model 2 Factor with 2nd Order	169.748	113	<0.001	1.502	0.955	0.962	0.930	0.043	0.0424	0.789	249.748
ML Model 1 Factor with 2nd Order	169.748	113	<0.001	1.502	0.955	0.962	0.930	0.043	0.0424	0.789	249.748

6.3. Common Method Bias

To test for common method bias two methods are used commonly, the common latent variable method and the specific bias test method. The identified model (ML 1 Factor with 2nd Oder Model), was tested for common method bias using a specific bias test (Chin et al., 2012; Podsakoff et al., 2003). The results were calculated using a plugin developed by Gaskin and Lim (2017). In this study, a marker variable heritage was used for a specific bias construct.

Specific Bias Test. Initially, the dimensionality of the model was evaluated in an EFA. The construct of heritage from Vancouver Index of Acculturation was used to conduct a specific bias test. The identified model was tested for model fit and validity. The model fit results yielded: $\chi 2$ = 355.421, df = 245, p-value < 0.001, CMIN/df = 1.451, TLI = 0.950, CFI = 0.955, GFI = 0.902, RMSEA = 0.041, SRMR = 0.0516, PCLOSE = 0.947. The validity and reliability tests suggested there was no concern related to convergent or discriminant validity or reliability. The specific bias construct heritage was connected to the satisfaction (SAT) manifest variables. The model was tested using a chi-square difference test on the paths between heritage and SAT manifest variables. A chi-square difference test was conducted on an unconstrained, zero constrained, and equally constrained models (Archimi et al., 2018). The chi-square difference test between the unconstrained and zero constrained models yielded: ($\Delta\chi2 = 66$, $\Delta df = 16$, p-value < 0.001). The chi-square difference test between the unconstrained and equally constrained models yielded: ($\Delta\ \chi2 = 6.196$, $\Delta df = 15$, p-value $= 0.976$). The results of the zero constrained model produced a significant p-value suggesting specific bias was present in the model (Archimi et al., 2018). The results of the chi-square difference test between the unconstrained model and the zero constrained model yielded a p-value = 0, which suggested specific bias was present. The chi-square difference test between the unconstrained model and the equally constrained model yielded a p-value = 0.976, which suggested the specific bias was evenly distributed, therefore, the specific bias construct was retained to compensate for the specific bias as presented in Figure 1.

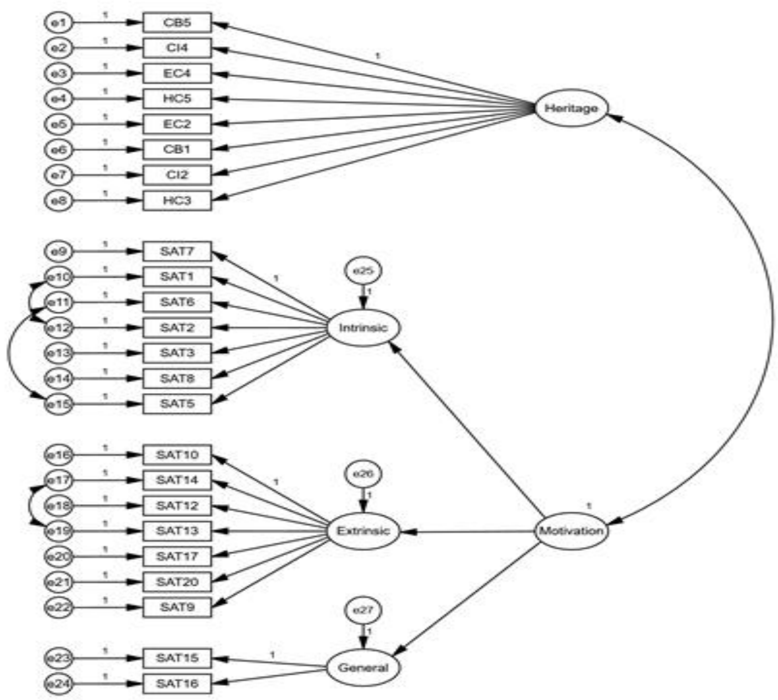

Figure 1. Model 6 Job Satisfaction Model with Heritage Specific Bias Construct

A decision was made to retain the specific bias construct heritage to compensate for common method bias.

6.4. Multigroup Invariance Test by Country, Ethnicity, and Age Group

Several sources emphasized the importance of CFA model invariance when evaluating for multi-group differences (Byrne & Stewart, 2006; Byrne & Watkins, 2003; Vandenberg & Lance, 2000; Schmitt & Kuljanin, 2008). When testing for invariance, many researchers test for configural and metric invariance, and do not conduct a scalar invariance test (e.g. Vandenberg & Lance, 2000). However, when testing multi-group differences, it is suggested to conduct configural, metric, and scalar invariance (Schmitt & Kuljanin, 2008). The scalar invariance tested the model at both the global and local level. A chi-squared difference test evaluated the model at the global level, and the beta-squared difference test evaluated the model at the local level. Thus, in this study configural, metric, and scalar invariance tests were performed.

Configural invariance explains an equivalency in groups between latent variables and patterns of latent variables (Vandenberg & Lance, 2000). When performing multi-group tests, configural invariance is determined by testing model fit for multiple groups. Measures compared are: $\chi2$, df, p-value, TLI, CFI, RMSEA, SRMR, and PCLOSE. Model fit was checked comparing unconstrained and equally constrained paths in those born in United States and India, because these were the two countries with enough participants to be statistically significant. The results suggested adequate model fit for subgroups country, ethnicity, age group, and gender, and inadequate model fit for subgroups education, position, and industry and because of this further analyses on education, position, and industry were not performed.

Metric Invariance Test. Metric invariance demonstrated the loadings for latent variables were equivalent between groups. A chi-square difference test was first used when determining metric invariance. Measures used for a chi-square difference test were $\Delta\chi2$, Δdf, p-value (Vandenberg & Lance, 2000; Schmitt & Kuljanin, 2008). Then, the chi-square difference test was compared to the measurement weights Δdf, $\Delta\chi2$, p-value, ΔNFI, ΔIFI, ΔRFI, and ΔTLI as suggested by Tshilongamulenzhe (2015).

Chi-Square Difference Test. The results of the chi-square difference tests for country, ethnicity, age group, and gender were supportive of insignificant differences between groups. Therefore, no differences were found between those born in the United States and those born in India, white and Asian, ages 25 to 34 and 35 to 44, and males and females.

Measurement Weights Indices. The results of the chi-square difference test were then compared to the measurement weights. The results of the measurement weights were also supportive of insignificant differences between groups country, ethnicity, age, and gender. Similarly, no differences were found between those born in the United States and those born in India, white and Asian, ages 25 to 34 and 35 to 44, and males and females. Table 2 below presents metric invariance test results through chi-square difference and measurement weight different coefficients.

Table 2. Summary of Metric Invariance Tests

Metric Invariance										
	Chi-Square Difference			**Measurement Weights**						
	$\Delta\ \chi^2$	Δdf	p-value	$\Delta\ \chi^2$	Δdf	ΔNFI	ΔIFI	ΔRFI	ΔTLI	p-value
Country	23.638	24	0.482	23.638	24	0.009	0.010	-0.003	-0.004	0.482
Ethnicity	17.120	29	0.843	17.120	24	0.006	0.007	-0.006	-0.007	0.843
Age	25.359	24	0.386	25.359	24	0.009	0.012	-0.003	-0.003	0.386
Gender	24.877	24	0.412	24.877	24	0.008	0.010	-0.003	-0.004	0.412

Scalar Invariance Test. Scalar invariance is a test of latent variable mean differences and is a justification the regression of the observed variables on latent variables are invariant or equal among groups. Byrne and Stewart (2006) suggested using scalar invariance tests with configural and metric invariance tests for multi-group analyses when testing for group differences. Scalar invariance was first calculated using a chi-square difference at the global level to identify differences between latent variables (Vandenberg & Lance, 2000). Then, a local invariance test is conducted to test path differences using a plugin developed by Gaskin and Lim (2018). In the next test step, local invariance, a comparison of models between groups is conducted and the values of Δdf, $\Delta\chi2$,, p-value, ΔNFI, ΔIFI, ΔRFI, and ΔTLI are evaluated for both measurement intercepts and structural covariances, and a nonsignificant p-value is desired suggesting differences are not significant (Milfont & Fischer, 2010).

Global invariance test. The global chi-square difference test was conducted between an unconstrained and constrained model for subgroups country, ethnicity, age group, and gender. The results were supportive of insignificant differences between those born in the United States and those born in India, subgroups white and Asian, ages 25 to 34 and 35 to 44, and males. Table 3 presents a summary of global chi-square difference tests.

Table 3. Summary of Global Chi-Squared Difference Tests

Global Chi-Square Difference			
Global Invariance Test	ΔX^2	Δdf	p-value
Country	0.889	3	0.828
Ethnicity	0.296	3	0.961
Age	2.007	3	0.571
Gender	1.928	3	0.587

Local Beta Difference Test by Country, Ethnicity, Age Group, and Gender. Multigroup local beta difference tests were performed on subgroups country, ethnicity, age group, and gender. The results indicated differences for subgroups country, ethnicity, and age group were insignificant. For gender, the standardized estimates for the following paths were identified: motivation --> intrinsic - for males 0.894 and for females 0.807; motivation --> extrinsic - for males 0.926 and for females 1.046; motivation --> general - for males 0.842 and for females 0.706. The results of the beta difference test for the path between motivation and intrinsic were: ΔBeta = 0.087, p-value = 0.077, between motivation and extrinsic they were: ΔBeta = -0.119, p-value = 0.044, and between motivation and general they were: ΔBeta = -0.135, p-value = 0.049. Further analyses on gender was not conducted, because invariance was not met as evidenced by a significant p-values for the path between motivation to extrinsic and the path between motivation and general. Table 4 presents the beta-square difference test for groups country, ethnicity, age, and gender.

Table 4. Summary of Local Invariance Tests – Beta-Squared Difference

Group	**Path Name**	**USA Beta**	**India Beta**	**ΔBeta**	**p-value**
Country	Motivation → Intrinsic	0.908	0.863	0.045	0.447
	Motivation → Extrinsic	0.980	0.900	0.080	0.630
	Motivation → General	0.836	0.817	0.018	0.877
		Male Beta	**Female Beta**	**ΔBeta**	**p-value**
Ethnicity	Motivation → Intrinsic	0.912	0.849	0.062	0.790
	Motivation → Extrinsic	0.974	0.898	0.076	0.950
	Motivation → General	0.828	0.830	-0.002	0.668
		25-34 Beta	**35-44 Beta**	**ΔBeta**	**p-value**
Age	Motivation → Intrinsic	0.863	0.947	-0.085	0.228
	Motivation → Extrinsic	0.942	0.978	-0.037	0.716
	Motivation → General	0.750	0.825	-0.075	0.512
		Male Beta	**Female Beta**	**ΔBeta**	**p-value**
Gender	Motivation → Intrinsic	0.894	0.807	0.087	0.077
	Motivation → Extrinsic	0.926	1.046	-0.119	0.044
	Motivation → General	0.842	0.706	0.135	0.049

Intercept and Structural Covariance Tests by Country, Ethnicity, and Age Group. The results of the measurement intercept test for country, ethnicity, and age group indicated differences between groups were significant as evidenced by the p-value. This suggests the model does not have intercept or structural invariance. To determine if the model had partial invariance for each subgroup, an evaluation was performed between groups for each path between the latent variables and each observed variable. The estimates from the intercept table were examined by calculating the absolute value of path differences between groups. Paths with the highest absolute value were freely constrained and retested until partial invariance was met. For subgroup country (i.e. US-born and born in India) two paths needed to be freely constrained to meet partial invariance: one path from the specific bias construct heritage and one from the latent variable intrinsic as evidenced by the p-value. For subgroup ethnicity, in groups Whites and Asians two paths needed to be freely constrained to meet partial invariance: one path from the specific bias construct heritage and one from the latent variable extrinsic as evidenced by the p-value. For subgroup age, in groups 25 to 34 and 35 to 44 three paths needed to be freely constrained to meet partial invariance one path from the specific bias construct heritage and two from the latent variable extrinsic as evidenced by the p-value. Table 5 presents the summary of intercept and structural covariance tests.

Table 5. Summary of Intercept and Structural Covariance Tests

Invariance Test	Group	X^2	df	ΔNFI	ΔIFI	ΔRFI	ΔTLI	p-value
Intercept Invariance Test	Country	79.306	48	0.029	0.035	0.006	0.007	0.003
	Ethnicity	65.301	48	0.023	0.028	0	0	0.049
	Age	78.602	48	0.029	0.036	0.006	0.007	0.003
Structural Covariance Test	Country	79.329	49	0.029	0.035	0.005	0.006	0.004
	Ethnicity	65.348	49	0.023	0.028	0	0	0.049
	Age	81.582	49	0.030	0.037	0.006	0.008	0.002
Intercept Invariance Test - Partial Invariance	Country	58.716	46	0.021	0.026	-0.001	-0.001	0.099
	Ethnicity	55.413	47	0.020	0.024	-0.003	-0.004	0.187
	Age	60.01	16	0.022	0.027	-0.001	-0.001	0.080
Structural Covariance Test - Partial Invariance	Country	58.738	47	0.021	0.026	-0.001	-0.002	0.117
	Ethnicity	55.458	48	0.020	0.024	-0.003	-0.004	0.214
	Age	62.95	47	0.023	0.029	0	0	0.060

7. Conclusions and Recommendations

The objective of this study was to perform a construct validation on the multicultural workforce motivation in engineering. The discussion below summarizes the results against research questions.

RQ1: Would the current study achieve the same factor structure for the construct of multicultural workforce motivation in engineering as Chileshe and Haupt (2006)?

The study conducted by Chileshe and Haupt (2006) intended to identify key variables influencing workforce motivation in the construction industry from a South African perspective, and to understand the effects of age on workforce motivation. The study was also comparing how motivation is derived through job satisfaction, and to understand the differences across generations. The study yielded a two-factor construct structure with three hygiene items and three motivation items. This study was not consistent with the two-factor structure identified by Chileshe and Haupt (2006). Nevertheless, the dimensionality of the model in this study had similarities, but this study compared the short-form Minnesota Satisfaction Questionnaire to a six-question study developed by Chileshe and Haupt (2006). Therefore, this study did not confirm the results of the study conducted by Chileshe and Haupt (2006).

RQ2: Would the current study yield a reasonable higher order factor structure for the construct of multicultural motivation in engineering?

The construct validation of multicultural workforce motivation in engineering yielded a three-factor structure during EFA, but when validating the results in CFA, it failed the validity tests. However, previous research also suggests that the results of EFA do not always agree with those in CFA (van Prooijen & van der Kloot, 2001). To improve validity of the model, a second order variable was established initially connecting it to two of the first order latent variables (intrinsic and extrinsic). With a higher order factor structure the results of the validity test improved substantially, but evidence of convergent validity issues was present. Therefore, the general latent variable was also added to the higher order factor. This created a difference when calculating the validity and reliability of the model, but it provided evidence of construct reliability and an acceptable AVE, which was recalculated during the specific bias test, because the heritage latent factor was added to the model providing the minimum two latent factors to calculate the validity and reliability tests. With the construct of multicultural workforce motivation in engineering yielding a higher order factor structure, and the study did reveal a higher order factor structure.

RQ3: Could the identified multicultural workforce motivation model yield the same factor structure when analyzed by multiple groups?

The identified model for multicultural workforce motivation yielded a three-factor structure with a second order factor and was tested for configural, metric, and scalar invariance for multi-group analyses. As a by-product of the study, multi-group analyses were conducted on subgroups industry, position, country of birth, ethnicity, gender, age group, and level of education. When testing multi-group differences with the identified model for gender, scalar variance was not met. A Heywood case for females on the path between motivation and extrinsic was noted. Heywood cases or negative variance estimates happen frequently in factor analyses (Kolenikov & Bollen, 2012), and occur when there is a misspecification in the structure of the model. The Heywood case invalidated the model and suggested another model configuration would work better for females than for males. The positive relationship between intrinsic and motivation and general and motivation are stronger for males than for females. The positive relationship between extrinsic and motivation is stronger for females than for males. When testing for multi-group differences with subgroups country, age group, and ethnicity the models met partial scalar invariance. One manifest variable needed to be unconstrained on latent variable intrinsic and two manifest variables needed to be unconstrained on latent variable extrinsic to meet partial scalar invariance.

Buitendach and Rothmann (2009) evaluated the Minnesota Satisfaction Questionnaire throughout organizations within South Africa to validate the construct of job motivation. The results also revealed a two-factor structure and conducted a multi-group analysis between Black and White ethnic groups. Some empirical research suggests that conducting separate analyses on subgroups is insufficient when conducting multi-group analyses (Byrne & Stewart, 2006; Byrne & Watkins, 2003; Vandenberg & Lance, 2000; Schmitt & Kuljanin, 2008). For this reason, a multi-group analyses were conducted using configural, metric, and scalar invariance tests. The exploratory step determined how well a theoretical model fits to the sample, but assessing the global and local levels indicated how well the theoretical model fits the data, which was needed to explain if data fits the model, and if the model replicated the hypothesized relation from the research questions (Morrison et al., 2017).

The subgroups country, ethnicity, and age group produced adequate configural and metric invariance with partial scalar invariance. When the theoretical model was adjusted by removing one item from the specific bias construct and three items from the MSQ an invariant model was established for subgroups country, ethnicity, and age group.

This study has the following limitations. First, the sample did not represent cultures equally within the dataset. With participants representing many cultures, only the United States and India had enough participants to be evaluated in a statistical model. Second, the study did not have control over cultural integration.

Construct validation is an ongoing process and we suggest that the study is replicated with engineers and with a much larger sample. Another recommendation for future research is to replicate the study with non-engineering samples to identify if the construct of workforce motivation yields similar results. While the criteria for selection for the study was those working in either engineering or IT related field, other professional or general functional departments could also be tested. Larger samples would increase the chance of testing between other demographics. A final recommendation would be to incorporate a similar study with a cause and effect analysis using structural equation modelling technique to test for moderation and mediation. The short-form of Minnesota Satisfaction Questionnaire worked well for this analysis, and it would be recommended to conduct a larger study with the same instrument to identify if similar results could be obtained. This study has identified a multicultural workforce motivation model yielding the same factor structure when analyzed by multiple groups.

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