

DEVELOPMENT AND STANDARDISATION OF MOTIVATION MEASURE FOR DOCKYARD EMPLOYEES

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ABSTRACT

Motivation has been found to affect performance at all levels of management and therefore, is one of the most important variable to monitor and manage. The need based motivation theories proposed by Maslow and Alderfer have been found to be suitable where the motivation level of employees working at different levels need to be measured and managed. The current study was undertaken to develop and standardize a measure to evaluate motivation level of employees working in an industrial organization involved in repair and maintenance of equipment/system. The current study used Alderfer's Need based theory as the basis for developing the measure. A 16 item self designed questionnaire was prepared using Likert type scale of 1 to 5, where 5 indicated strongly agree and 1 indicated strongly disagree for measurement of the motivation levels of personnel. The data collected using the scale was put through Exploratory Factor Analysis using PASW-18. Confirmatory Factor Analysis (CFA) was applied using AMOS version 21 to evaluate how well the model fit the data. The CFA measurement model indicated high fit with normed chi-square value of (Cmin/df) 1.823; GFI value of 0.939; AGFI value of 0.916; NFI value of 0.905; CFI value of 0.954; and RMSEA value of 0.049. The study was undertaken in an industrial organisation involved in repair and maintenance of equipment/systems, with a sample size of 345 personnel (managers, supervisors and workers) belonging to three departments (Engineering, Hull and Electrical). The significance of difference in motivation levels of personnel based on their departments, category, age and years of service were analyzed using different statistical tests.

Keywords: Motivation, Performance, Need Base Theory of Motivation, Growth, Existence, Relatedness

INTRODUCTION

The word motivation has been derived from the Latin word 'movere', which means 'to move' (Kreitner and Kinicki, 1998). Motivation has been variously defined as, an internal drive to satisfy an unsatisfied need (Higgins, 1994 in Lindner, 1998); a predisposition to behave in a purposeful manner to achieve specific, unmet needs (Lindner, 1998); the psychological forces that determine the direction of a person's behavior in an organisation, levels of efforts and persistence in the face of obstacles (Jones & George, 2009); the force an individual has that accounts for the level of persistence and direction of the efforts expended at work (Schermerhorn et al., 2003); and the various processes, which account for an individual's continuity of efforts and intensity towards attaining the goal (Robbins, 2005). It is motivation, which makes us move from the state of dullness to interest. As per Bartol & Martin (1998), "motivation is a type of force that gives path to the behavior, energizes behavior and triggers the tendency to stick with". As per this definition, the individuals must be adequately energetic and stimulated, to have clarity in their minds as to what needs to be achieved and they should be ready to use their energies for a sufficient time in order to achieve their goals.

The subject of motivation has been deliberated and discussed in the literature over several decades. Many theories, though, have been developed and a plenty of research has been conducted, there are differing views about the factors that motivate people to perform well at work. The motivation theories postulated over the years have been categories as Needs Based, Extrinsic, Intrinsic and Management Theories of Motivation. The

Need Based theories of motivation include, Maslow's Hierarchy of Needs; Alderfer's ERG theory; Herzberg's two factor theory; and McClelland's acquired need theory. The Extrinsic factor theory has been explained by behavior reinforcement theory. The Intrinsic factor theory includes Adam's equity theory; Vroom's expectancy theory; and Locke's goal setting theory. The Management theories of motivation include, scientific management theory, McGregor's Theory 'X' and 'Y'; and Ouchi's 'Z' theory.

Alderfer's three categories of human needs are partly based on Maslow's model but they are not the same. As per Alderfer, the three needs (ERG needs) consist of existence, relatedness and growth needs. The first group (existence) is closely related to Maslow's physiological needs and partly to security needs (only physical security). The existence needs are usually limited but concrete in nature. Relatedness needs consist of the interpersonal security needs, the need for esteem and prestige from others. The satisfaction of relatedness needs requires development of relations and interactions with other people. The growth needs are corresponding to Maslow's self esteem and self actualization needs, but have some variations. Maslow suggested that self-actualization consists of a fulfillment of unique, innate potential, whereas Alderfer's growth needs contain desire to interact with environment by exploring, investigating and mastering it. As per the Alderfer's model, growth needs undergo change depending upon the environment (Pinder, 1998).

METHODOLOGY

The study was conducted in an industrial organisation responsible for undertaking repair and maintenance of various equipment/systems. The classification of respondents was based on their departments (Engineering, Hull, Electrical/Electronic); category (Managers, Supervisors and Workers); age; and years of service put in. The population for the study included all the technical personnel working in various workshops of the industrial organisation dealing in repair and maintenance of ships and submarines. The sampling frame for the study included all the technical personnel present and involved in undertaking repair and maintenance works, pertaining to Engineering, Hull and Electrical/Electronic equipment and systems fitted on board ships and submarines. The respondents were selected based on stratified random sampling technique, with departments as strata and respondents in each department being selected in a random manner. The sample size for the study was 345 personnel, which included 47 Managers, 83 Supervisors and 215 Workers.

Standardised measures developed for measurement of motivation (Guay, F., Magean, G., & Vallerand, R.J., 2003; George Shouksmith, 1989) of personnel are available in the literature. However, these instruments were developed for different settings and work environments, and none was found to be developed for industrial organisations dealing in repair and maintenance works in an Indian environment. Therefore, it was considered more appropriate to design the questionnaire relevant to the organisation under study post review of literature and extensive discussions with the subject experts, management of the organisation and the population under study. Therefore, self designed questionnaire was prepared for measurement of motivation levels of personnel in the organisation, using Likert type scale from 5 to 1, where anchor 5 indicated strongly agree and 1 indicated strongly disagree. The complete questionnaire contained a total of 19 statements for motivation measure. The statements in the survey instrument underwent various changes, in terms of clarity, readability, content and adequacy for making the statements precise, clear and unambiguous, post discussions with the management of the organisation; subject experts; faculties of AMU, Department of Business Administration, FMSR, Aligarh and Prestige Institute of Management, Gwalior; reviews by the internal and external guides; and findings during the pilot study with 35 respondents from the organisation.

N-way ANOVA was applied to evaluate the effect of three category variables viz; Age, designation and specialization of employees on their motivation level. The differences between different levels of the category variables (factors) were evaluated using Turkey-HSD post-hoc test.

ANALYSIS

Consistency Measure

The consistency of various statements in the questionnaire was checked through item to total correlation. The computed value of every item to total correlation was compared with the standard value of 0.4 (Nunnally, 1967). The items having their item to total correlation value less than 0.4 (critical value) were considered inconsistent and were dropped from the questionnaire. Three statements in the motivation questionnaire were dropped during Exploratory Factor Analysis (EFA) using SPSS software.

Reliability Measure

The reliability of the motivation measure was computed using SPSS software. Cronbach’s alpha and Guttman split half reliability coefficients were calculated to establish the reliability of measures. The Cronbach’s alpha value of more than 0.7 is considered good enough to consider the measure reliable. The motivation measure had Cronbach’s alpha values more than 0.7 and higher than Malhotra’s (1993) indicated limit of 0.60 for acceptable reliability in terms of internal consistency. Base on these results all the statements in the measure were treated as reliable. The reliability value of the motivation measure is as shown in Table 1 below.

Table 1: Cronbach’s Alpha Reliability Statistics for Motivation Measure

Measure	Cronbach’s Alpha	Guttman’s Split Half Reliability Coefficient	Number of Items / Statements
Motivation	0.891	0.832	16

Exploratory Factor Analysis

Kaiser–Mayer–Olkin measure of sampling adequacy (KMO) and Bartlett’s test of sphericity were used to ascertain the suitability of the data for factor analysis. The Principal Component Analysis with orthogonal rotation (Varimax) was used to retain variables, whose factor loading were found to be over 0.5 and Eigen values above one. An item is dropped, if it does not load above 0.50 on its own construct (Hair, et. al., 1998). The KMO and Bartlett’s test of sphericity for motivation measure are as shown in Table 2 below.

Table 2: Results of KMO and Bartlett’s Test for Motivation Measure

KMO and Bartlett’s Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.915
Bartlett’s Test of Sphericity	Approx. Chi-Square	1860.209
	df	120
	Sig.	.000

The KMO measure of sampling adequacy should be greater than 0.5 for satisfactory analysis. From the details in Table 2 it is evident that the KMO measure of sampling adequacy value of 0.915 is more than adequate and Bartlett’s test of sphericity is also significant as its associated probability is less than 0.05 (actually it is 0.000). These measures indicate that the item-to-item correlation matrix is not an identity matrix and that the data collected from respondents is suitable for factor analysis. The raw data collected from the respondents for motivation measure was, therefore, used for factor analysis to identify the factors, which contribute towards motivation of the personnel in an industrial organisation. Post factor analysis using rotated component matrix a total of three factors, with Eigen values greater than 1 and cumulative percentage of variance more than 50%, were identified as per details contained in Table 4 below. It can be seen that the alpha reliability of all the factors was also found to be above 0.7, thus indicating good reliability of the measure.

Table 3: Factor Analysis for Motivation Measure

Factors	Cronbach’s Alpha	Eigen Value			Variables Converged	Load
		Total	% of Var.	Cumulative % of Var.		
Growth	0.729	6.133	18.566	18.566	2. Effective performance appraisal system in my organisation.	0.740
					7. Recognition and appreciation of good work done.	0.699
					10. Interesting job.	0.658
					12. Challenging job.	0.586
					13. Job gives me adequate status and feelings of responsibility in the society.	0.534
15. Adequate opportunities for professional growth.	0.548					

Existence	0.760	1.280	18.071	36.63	1.	Sensitive management to the personal needs of the employees.	0.729
					4.	Adequate safety measures at work.	0.688
					5.	Maintenance of clean and tidy working environment.	0.644
					6.	Satisfied with the quality of food served in Canteens/Messes.	0.608
					8.	Satisfied with grievance handling system.	0.580
					14.	Adequate salary and perks.	0.525
Relatedness	0.708	1.101	16.579	53.25	3.	Good working relations with my co-workers/colleagues.	0.758
					9.	Full freedom to discuss professional issues with my superiors/bosses.	0.717
					11.	Enjoy full trust of my boss /supervisor.	0.662
					16.	Satisfied with the quality of supervision.	0.518

Discussions of Factors

A total of three factors emerged during EFA for motivation measure with a cumulative variance of 53.26%. The factors are enumerated as below.

- Growth (6.133):** This factor has emerged as the first determinant of motivation with a total variance of 18.556%. The various dimensions of this factor include effective performance appraisal system (0.740); appreciation and recognition of good work done (0.699); interesting job (0.658); challenging job (0.586); adequacy of status and feelings of responsibility in society (0.534); and adequate opportunities for professional growth (0.538). This factor has all the attributes and equates with Alderfer's **Growth** needs, which are responsible for satisfying an individual's striving for unique personal development and growth needs.
- Existence (1.280):** This factor has emerged as the second determinant of motivation with a total variance of 18.075%. The various dimensions of this factor include management sensitivity to the personal needs of the employees (0.729); safety of personnel at work place (0.688); clean and tidy working environment (0.644); satisfaction with the quality of food (0.608); satisfaction with grievance handling system (0.580); and adequate salary and perks (0.525). This factor has all the attributes and equates with Alderfer's **Existence** needs.
- Relatedness (1.101):** This factor has emerged as the third determinant of motivation with a total variance of 16.579%. The various dimensions of this factor include good working relations with colleagues/ co-workers (0.758); freedom to discuss professional issues with superiors (0.717); trust of boss/ supervisor (0.662); and satisfaction with the quality of supervision (0.518). This factor has all the attributes and equates with the Alderfer's **Relatedness** needs dealing with positive relationships with others in the work environment.

Confirmatory Factor Analysis

Having achieved highly reliable and satisfactory factors during EFA, it was decided to undertake confirmatory factor analysis, using AMOS Version 21 using maximum likelihood (ML) estimation techniques, to examine the unidimensionality, reliability and convergent validity of motivation measure. Despite, EFA producing good and statistically significant results, it may be necessary to make modifications to various items in the measure to ensure that the hypothesised model meets the Structural Equation Modelling (SEM) assumptions that data is free from outliers and is normally distributed. Further, CFA is a theory driven confirmatory technique, therefore, the planning of the analysis is driven by the theoretical relationships amongst the observed and unobserved variables. When a CFA is conducted, a hypothesized model is used to estimate a population covariance matrix that is compared with the observed covariance matrix, with an aim to reduce or minimize the difference between the estimated and observed matrices (Scheiber et. al., 2006).

CFA specifies the indicators that define each latent construct (Hair et al., 2006). Measurement analysis, discriminant analysis, composite reliability analysis and direct indirect impact analysis (mediating effect), testing the fit for the hypothesised structural model, revised model, competing model, and comparison analysis (Sentosa et al., 2012). Through modification indices, items that are cross-loaded in more than one dimension are relaxed one at a time as proposed by Long (1983) and insignificant parameters are excluded from the study. The approaches used in the CFA to assess the motivation measurement model, included Goodness of Fit (GoF) indices and evaluation of the validity and reliability of the measurement model.

SEM has three main types of fit measure indices, which include absolute fit indices, incremental fit indices, and parsimonious fit indices. CFA was performed on the motivation measurement model, post EFA, having three factors as shown in Table 4 above. Growth and existence factors had six items each and relatedness factor had 4 items. Results of these fit measures obtained for motivation measure and their recommended levels are shown in Table 4 below.

Table 4: CFA Results

	χ^2	df.	p-value	$\chi^2/df.$	GFI	RMSEA	NFI	CFI	AGFI
Criterion	-	-		$1 < \chi^2/df. < 3$	≥ 0.90	< 0.05	≥ 0.90	≥ 0.90	≥ 0.90
Obtained values	81.393	51	.004	1.596	0.961	0.049	0.941	0.977	0.941
χ^2	Chi- Square				df. - Degrees of Freedom				
GFI	Goodness of Fit Index				RMSEA- Root Mean Square Error Approx.				
NFI	Normated Fit Index				CFI - Comparative Fit Index				
AGFI	Adjusted Goodness of Fit Index								

The results revealed that chi square statistics ($\chi^2=81.393$, df. = 51) is significant at a significance levels of 0.004 indicating low fit of data with the model. However, it is not appropriate to rely on the sole indicator of chi-square statistics, as this statistic is sensitive to the sample size and also highly sensitive to the violations of the assumption of normality, and thus can be misleading. It is, therefore, more appropriate to use the other goodness of fit indices, viz. GFI, AGFI, NFI & CFI and badness of fit indices such as RMSEA, for assessing the model. It can be seen from the Table 5 above, that the values of various fit indices and RMSEA are as per the specified criterion (recommended values). These parameters clearly indicate that there is no requirement to refine the model.

Convergent Validity

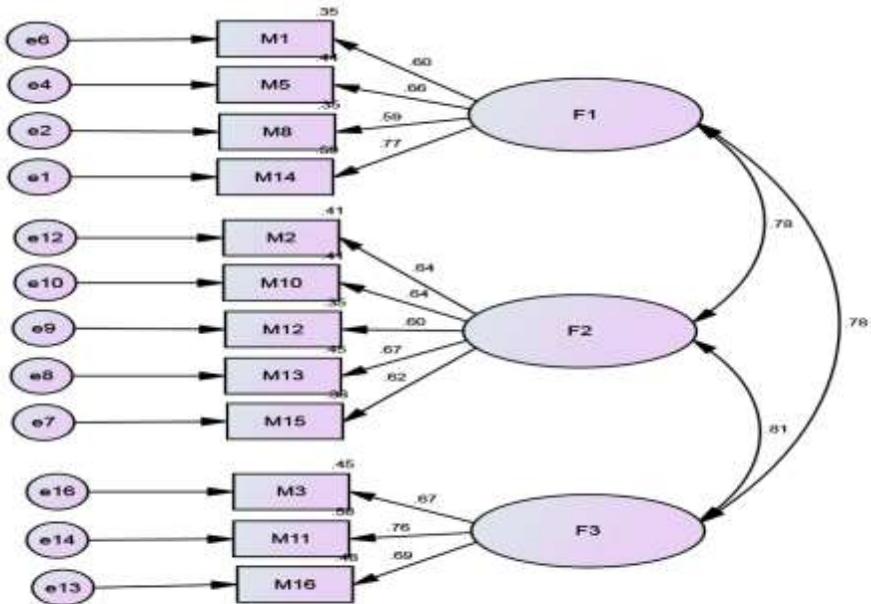
There are three measures that need to be evaluated for confirming convergent validity of the model. They are:

1. Factor loadings
2. Average Variance extracted (AVE)
3. Reliability

The factor loadings (regression weight estimates) of latent to observed variables need to be above 0.50 (Hair et al, 2006; Byrne, 2010). From the confirmatory factor analysis, it is evident that the factor loadings of all observed variables vary between 0.59 and 0.77 far above the recommended value of 0.5, thus confirming its construct validity. The average variance extracted (AVEs) for the three factors of motivation are between 0.40 and 0.50. They are slightly lesser than the recommended value (greater than 0.5 for two of the three factors). The construct reliabilities for the three factors are 0,752, 0.770 and 0.751, all above the recommended minimum value of 0.70. Thus, all the three criteria indicate high convergent validity for the motivation measure.

Regression weights define the variation in standard deviations by which the element varies when the value of the factor goes up by one standard deviation. It is evident from the various values of the indices and regressions weights that the fitness, validity and uni-dimensionality of the motivation measurement model stands established (Byrne 2010; Hair et al. 2006).

Figure 1: Hypothesised CFA Model of Motivation Measure



Motivation CFA Dia

Evaluating the effect of Age, Service Level (Designation) and Departmentation

The effect of age, service level and department (specialization) on motivation level was evaluated using Two-Way ANOVA. Since the cell sizes (number of respondents in each group) were not equal Type II sum of squares was used for computing the value of F.

Table 5: Showing results of homogeneity Test applied on Motivation Measure

Levene's Test of Equality of Error Variances			
Dependent Variable: Motivation			
F	df1	df2	Sig.
1.150	15	328	.310
Tests the null hypothesis that the error variance of the dependent variable is equal across groups.			
a. Design: Intercept + Age + Service + Dept + Age * Service + Age * Dept + Service * Dept + Age * Service * Dept			

Before interpreting the between groups ANOVA results the homogeneity of variance between all the groups formed on the basis of age and service level (designation) were evaluated using Levene's test of homogeneity. The results indicate that the F-value 1.150 was significant at 31.0% level of significance. Thus the null hypothesis assuming homogeneity of variance among groups formed on the basis of age and service was not rejected indicating homogeneity of variance among groups.

Table 6: Showing Between group ANOVA Results Applied on Motivation as Dependent Variable

Tests of Between-Subjects Effects					
Dependent Variable: Motivation					
Source	Type II Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	16039.400 ^a	15	1069.293	12.903	.000
Intercept	1440985.012	1	1440985.012	17388.604	.000
Age * Service * Dept	.000	0	.	.	.
Age * Service	.020	1	.020	.000	.987
Age * Dept	337.052	4	84.263	1.017	.399
Service * Dept	375.130	4	93.782	1.132	.341
Age	1152.067	2	576.034	6.951	.001
Service	515.598	2	257.799	3.111	.046
Dept	119.254	2	59.627	.720	.488
Error	26932.589	325	82.870		
Total	1483957.000	341			
Corrected Total	42971.988	340			

a. R Squared = .373 (Adjusted R Squared = .344)

The overall model tested through ANOVA has high model fit as indicated by R^2 value of 0.358 significant at 0% level of significance indicating a very high fit.

Ho1: There is no effect of age on motivation level of employees

The hypothesis was tested using two-way ANOVA. The effect of age of employees on motivation level was found to be significant as indicated by the value of F ((6.591) significant at 0.001 level of significance. Thus, the null hypothesis was rejected indicating significant effect of age on the motivation level of employees. However, it was surprising to note that the motivation level increase with age.

The Employees were divided in three age groups. The differences of motivation level of individual groups were evaluated using Turkey HSD post-hoc test. The differences between age group 1 and 2, 1 and 3 and 1 and 3 were all found to be significant as indicated by the level of significance (all three level of significances were found to be 0.000) and presented in the table below. Thus the employees of the dockyard differed in their motivation level and the differences were significant among the three age categories.

Table 7: Showing Post-hoc results based on category variable - Age

Multiple Comparisons						
Dependent Variable: Motivation						
	(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	
Tukey HSD	dimension 2	1.00	2.00	-9.4082 [*]	1.27338	.000
			3.00	-16.4476 [*]	1.22288	.000
	2.00	1.00	3.00	9.4082 [*]	1.27338	.000
			3.00	-7.0394 [*]	1.16351	.000
	3.00	1.00	2.00	16.4476 [*]	1.22288	.000
			2.00	7.0394 [*]	1.16351	.000

Based on observed means. The error term is Mean Square(Error) = 80.984.
*. The mean difference is significant at the .05 level.

Ho2: There is no effect of designation on the motivation level of the dockyard employees

The hypothesis was tested using two-way ANOVA. The effect of designation of employees on motivation level was found to be significant as indicated by the value of F ((3.111) significant at 0.046 level of significance. Thus, the null hypothesis was rejected indicating significant effect of designation on the motivation level of employees. The motivation level increased with designation level indicating that senior officers had higher motivation level than the junior ones.

The Employees were divided in three groups based on their designation. The differences of motivation level of individual groups were evaluated using Turkey HSD post-hoc test. The differences between designation levels 1 and 2, 1 and 3 and 2 and 3 were all found to be significant as indicated by the level of significance (all three

level of significances were found to be 0.000) and presented in the table below. Thus the employees of the dockyard differed in their motivation level and the differences were significant among the three service level categories.

Table 8: Showing Post-hoc results based on category variable - Designation

Multiple Comparisons							
Motivation Tukey HSD							
(I) Service	(J) Service	Mean Difference (I- J)	Std. Error	Sig.	95% Confidence Interval		
					Lower Bound	Upper Bound	
1.00	2.00	-9.7237 [*]	1.35803	.000	-12.9208	-6.5266	
		-16.8637 [*]	1.26765	.000	-19.8480	-13.8794	
	3.00	1.00	9.7237 [*]	1.35803	.000	6.5266	12.9208
		2.00	-7.1399 [*]	1.12357	.000	-9.7851	-4.4948
	3.00	1.00	16.8637 [*]	1.26765	.000	13.8794	19.8480
		2.00	7.1399 [*]	1.12357	.000	4.4948	9.7851

Based on observed means. The error term is Mean Square (Error) = 80.984.

*. The mean difference is significant at the .05 level.

H03: There is no effect of departments (Specializations) on the motivation level of the dockyard employees

The hypothesis was tested using two-way ANOVA. The effect of departments of employees on motivation level was found to be insignificant as indicated by the value of F ((0.720) significant at 0.488 level of significance. Thus, the null hypothesis was not rejected indicating insignificant effect of department on the motivation level of employees. The motivation of employees from different departments was similar. The differences between different departments were evaluated using post-hoc test and

CONCLUSION

The current study was carried out to develop and standardize a measure to evaluate motivation level of employees of a dockyard. The reliability of the measure was confirmed through computation of Cronbach’s Alpha coefficient of reliability and further confirmed through computation of construct reliability for each factor. The overall reliability and the construct reliability of all the factors were found to be higher than 0.7. The Confirmatory Factor Analysis carried out on the factors identified through Exploratory Factor Analysis found the model consisting of these factors having good fit. All the elements of goodness of fit and badness of fit were found to be in order. The construct validity of the measure was found to be high as indicated by high factor loadings, high construct reliabilities and high AVEs. The effect of age, designation and department were evaluated and age and service level were found to have significant positive effect on motivation level of employees and the ‘departmentation’ was found to have no effect on the motivation level of dockyard employees.

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