Factor Analysis Approach of Job Demands and Resources Model

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Abstract

This study aims to examine the model of job demands and resources on employees' job performance by using factor analysis approach. Using a sample of 183 employees, the study investigated four variables of job demands including quantitative, problem solving, attention and responsibility demands and five variables of job resources including skill variety, task significance, task identity, job security and feedback via factor analysis approach. Confirmatory factor analyses in the sample supported the superiority of the proposed model and the results suggest that the scales of model are valid instruments for testing the model of job demands and resources.

Keywords
Job Demands, Job Resources, Employees and Factor Analysis Approach.

1. Job Demands-Resources (JD-R) Model

The job demands-resources (JD-R) model is an occupational stress model that suggests strain is a response to imbalance between demands on the individual and the resources he or she has to deal with those demands (Moodie et al., 2014). The JD-R model became highly popular among researchers (Moodie et al., 2014). The current version of the model proposes that high job demands lead to strain and health impairment (the health impairment process), and that high resources lead to increased motivation and higher productivity (the motivational process). The JD-R model developed by Demerouti and his associates (Demerouti et al., 2001), the JD-R model can be used as a tool to manage human resources in organizations because it can be applied to a wide range of occupations to improve employee wellbeing and job performance (Bakker et al., 2013).

JD-R model argues that the factors or characteristics salient in a work environment determine the performance of employees at work (Moodie et al., 2014). According to this model, there are two general categories of work environment i.e. job demands and job resources study (Moodie et al., 2014; Bakker et al., 2013). Job demands are the physical, psychological, social and organizational factors which require constant physical and psychological efforts or skills and are therefore linked to physical and psychological costs whereas job resources are the physical, psychological, psychological, social and organizational aspects of a job which enable the achievement of goals and objectives while at the work place, reduce the negative effects associated with job demands to encourage personal growth, learning and development" (Luo et al., 2015).

The model also proposes two psychological processes that take place as a result of the existence of perceived job demands and resources (Michelle, 2013). These processes relate to health deficiency and motivation. The health impairment process occurs when jobs are designed badly or those whose demands chronically deplete a worker's mental and physical resources which reduce energy and degrade health situation (Michelle, 2013). The motivational process is where job resources brings forth their motivating potential and cause the workers to show high levels of

work engagement, low levels of cynicism and above performance (Luo et al., 2015; Michelle, 2013). Therefore, the present paper focused the impact of job demands on employees' job performance only.

1.1 The Early JD-R Model

The JD-R model was first published under that label by Demerouti et al., (2001) in an attempt to understand the antecedents of burnout. Their model drew upon Lee & Ashforth's (1996) meta-analysis, in which eight "job demands" and thirteen "job resources" were identified as possible causes of burnout, and on the "structural model of burnout" that was presented in the Maslach Burnout Inventory test manual (Maslach et al., 1996). Demerouti et al. (2001) defined job demands as "those physical, social, or organizational aspects of the job that require sustained physical or mental effort and are therefore associated with certain physiological and psychological costs". Examples of job demands are work overload, heavy lifting, interpersonal conflict, and job insecurity. Following Hockey's (1997) model of compensatory control, the JD-R model assumes that when job demands are high, additional effort must be exerted to achieve the work goals and to prevent decreasing performance. This obviously comes with physical and psychological costs, such as fatigue and irritability. Workers may recuperate from mobilizing this extra energy and the associated costs by taking a break, switching tasks, or performing less demanding activities, for instance. However, when recovery is inadequate or insufficient, the result is a state of sustained activation that gradually exhausts the employee physically and/or mentally (Steven et al., 2018; Luo et al., 2015; Michelle, 2013; Knardahl & Ursin, 1985). Job resources were defined as "those physical, social, or organizational aspects of the job that may do any of the following: (a) be functional in achieving work goals; (b) reduce job demands and the associated physiological and psychological costs; (c) stimulate personal growth and development" (Demerouti et al., 2001). Examples of job resources are feedback, job control, and social support.

2. The Revised JD-R Model

Three years after its introduction, Schaufeli & Bakker (2004) presented a revised version of the JD-R model as shown in Figure 2.4. This model included work engagement in addition to burnout and considered burnout and work engagement to be mediators of the relation between job demands and health problems, and job resources and turnover intention, respectively. By doing so, Schaufeli & Bakker (2004) gave a positive-psychological twist to the JD-R model. That is, the revised JD-R model not only sought to explain a negative psychological state (burnout) but also its positive counterpart (work engagement). Work engagement refers to a positive, fulfilling, work-related state of mind that is characterized by vigor (that is, high levels of energy and mental resilience while working), dedication (referring to a sense of significance, enthusiasm, and challenge), and absorption (being focused and happily engrossed in one's work) (Bakker et al., 2013). Analogous to the early JD-R model, the revised model assumes that burnout results from high job demands and poor job resources, except that now burnout is treated as a unitary instead of a two-dimensional construct (Bakker et al., 2013). Moreover, in line with the burnout literature (Bakker et al., 2013; Michelle, 2013), it is assumed that burnout will lead to health problems, such as depression, cardiovascular disease, or psychosomatic complaints. Thus, burnout is expected to mediate the relation between job demands and employee health and well-being (at least partly), through the gradual draining of mental resources (burnout). This is the energetic or health impairment process of the revised JD-R model. Similarly, a motivational process operates that is sparked by abundant job resources. The revised JD-R model emphasizes the inherently motivational qualities of job resources. Following effort-recovery theory (Michelle, 2013), work environments that offer many resources foster workers' willingness to dedicate their efforts and abilities to the work task. Thus, job resources play an extrinsic motivational role, because they initiate the willingness to spend compensatory effort, thereby reducing job demands and fostering goal attainment. That is, job resources are instrumental in achieving work goals. However, they also play an intrinsic motivational role, because they satisfy basic human needs for autonomy, relatedness, and competence (Torrente et al., 2012).

3. Research Design

Research design spells out how the research is carried out toward the accomplishment of research objectives and answering of questions. In other word, research design constitutes the outline for the collection, measurement and analysis data (Cooper and Schindler, 2013). Zikmund et al. (2012) defined research design as a master plan that outlines the methods and procedures for collecting and analyzing data. Moreover, research design helps the researcher in the allocation of inadequate resources by posing vital choices in methodology (Cooper and Schindler, 2013). The main research design employed in the present research was survey. Survey is defined as a measurement process that utilises a measurement tool called a questionnaire, measurement instrument, or interview schedule (Cooper and Schindler, 2013). Surveys attempt to describe what is happening or to study the reasons for an exacting business activity (Zikmund et al., 2012). The questionnaire is the most common information collection tool in business research (Cooper and Schindler, 2013). The questionnaire is the most extensively used information collection technique in a survey study (De Vaus, 2013). Questionnaire is an organized set of questions or measures used by respondents or interviewers to record answers data (Hair et al., 2010).

According to Cooper and Schindler (2013), sampling is the process whereby some elements from the population are selected to represent the whole population. Sample size is the number of units that is required to get accurate findings (Fink, 2003). For the purpose of this paper, the sample size was 183.

According to Sekaran (2003), there are many methods that can be possibly used to collect data from respondents such as interviews and questionnaires. Interviews involve unstructured and structured approach. Interviews can differ from being highly unstructured to highly structured. Unstructured interviews are usually conducted by an extremely flexible approach. A questionnaire, on the other hand, is a pre-written set of questions that respondents are required to answer, which is generally within close defined alternatives (Sekaran, 2003). A questionnaire is an efficient data collection mechanism but only when the researcher is aware of what is required and the measures of the variables involved (Sekaran, 2003). In the present paper, questionnaires were used because the researcher was interested in getting specific responses on the issues at hand i.e., job demands and job performance via specific measurements.

4. Research Findings and Data Analysis

This section provides background information of the respondents that participated in the survey. The examined characteristics of the respondents were gender, age, marital status, education level, tenure, and job status. The above-mentioned distributions were illustrated in Table 1. The distribution of respondents based on their gender from the four companies was shown in the Table 1. The gender distribution shows 68.9% representation of male in a sample of 183 employees, while 31.1% of the employees were female. Likewise, the age distributions of employees of the Somaliland telecommunication companies were described. The majority of the respondents 36.1% (n=66) were in the age group 30-34 years, while the least respondents of 2.7% (n=5) were in the age group of above 50 years. Second largest group were in the age group of 25-29 (n=42; 23%). The remaining 25 (13.7%), 28 (15.2%) and 17 (9.3%) respondents fall in the age categories 21-24 years, 35-39 years and 40-49 years respectively. Similarly, Table 1 exemplifies the marital status of the respondents of the employees in which the total number of the respondents of 183; who participated, 48.6% (n=89) of them were married, while 40.1% (n=75) were unmarried (singles). The rest of the respondents 6.6% (n=12) and 3.8% (n=7) were divorced and widowed respectively. In the same way, Table 4.2 illustrated the education level of the employees. The Table depicts that the majority of the respondents, 57.4% (n=105) had a degree educational level while only 1.8% of respondents (n=3) had a PhD level. The rest of the respondents of 24.6% (n=45), 10.9% (n=20) and 8.3% (n=15) were secondary school graduates,

master holders and others respectively. Equally, Table 1 has shown the number of years spent by the respondents serving in the Somaliland telecommunication companies. It can be viewed that majority of the respondents 39.9% (n=73) fall in the category of less than 1 year while the smallest percentage of respondents of 3.3% (n=6) fall in to the category of above 10 years. Finally, Table 1 shows the job status distributions of the employees of Somaliland telecommunication companies. 90.2% (n=165) of the respondents of the companies have permanent jobs while 9.8% (n=18) of the employees have contract job in the companies.

Table 1: Respondent Demographic Analysis

No.	Demographic Characteristics	Frequency	Percentage (%)
1	**Gender**		
	Male	126	68.9
	Female	57	31.1
2	**Age (in Years)**		
	21-24	25	13.7
	25-29	42	23.0
	30-34	66	36.1
	35-39	28	15.2
	40-49	17	9.3
	Above 50	5	2.7
3	**Marital Status**		
	Married	89	48.6
	Single	75	40.1
	Divorced	12	6.6
	Widowed	7	3.8
4	**Education Level**		
	Secondary	45	24.6
	Degree	105	57.4
	Masters	20	10.9
	PhD	3	1.8
	Other	15	8.3
5	**Tenure (in Years)**		
	Less than 1	73	39.9
	1-2	55	30.1
	3-5	38	20.7
	6-10	11	6.0
	Above 10	6	3.3
6	**Job Status**		
	Permanent	165	90.2
	Contract	18	9.8

4.1 Factor Analysis of Job Demands and Job Resources

The first output from the factor analysis is job demands variables. The job demands construct dimensions were measured using 23 averaged items responded by employees. The criterion developed by Igbaria et al., (1995) was

used in the present study for cross loading. They recommended that a given item should load .50 or higher on a specific factor. The summary of Factor Analysis of job demands was shown in Table 2. The criterion developed by Igbaria et al., (1995) was used in the present study for cross loading. They recommended that a given item should load .50 or higher on a specific factor and whose loading is lesser than .35 on other factors. The Kaiser-Meyer-Olkin criterion was applied to extract the number of factors with only an eigenvalues equal or greater than one can be extracted (Kaiser, 1960). As a result, four factors with an eigenvalue of more than 1 were extracted. Table 2 shows that the Kaiser-Meyer-Olkin measures of sampling adequacy (KMO) for the four dimension solutions was .810, with a significant Bartlett's Test of Sphericity, which is a "statistical test for the overall significance of all correlations within a correlation matrix" is (Sig= .000) (Hair et al., 2014). Bartlett's Test of Sphericity and Kaiser-Meyer-Olkin measures of sampling adequacy (KMO) are both tests that can be used to determine the factorability of the matrix as a whole. If Bartlett's Test of Sphericity is large and significant, and the Kaiser-Meyer-Olkin measures of sampling adequacy (KMO) is greater than .6, then factorability is assumed (Maryam & Mohammad, 2016). This indicates that the data are suitable for factor analysis (Gour & Samai, 2014; Hair et al., 2014). The four extracted factors explained 94.696%% of the variance in the construct. Gour & Samai, (2014) stressed that in social science research it is common to consider a solution that accounts for 60% or, in some instances, even less, of the total variance, as satisfactory. In the present study, the factor loading in the components met the criteria by Igbaria et al. (1995), that is, a given item should load .50 or higher on a specific factor and have a loading no higher than .35 on other factors. The first factor (quantitative demands) consisted of nine items and explained 42.48% of the variance in job demands construct. The second factor (problem solving demands) consisted of five items and explained 19.85% of the variance in job demands construct. The third factor (responsibility demands) consisted of five items and explained 17.85% of the variance in job demands construct. The fourth and last factor (attention demands) consisted of four items and explained 14.52% of the variance in job demands construct. In short, the results of the factor analysis provide evidence that the job demands construct is meaningful in a theoretical sense.

Table 2: Summary of Factor Analysis of Job Demands

No		Item	Component			
			1	2	3	4
Factor Quantitative Demands	**1:**	Do you have to work very fast?	.773	-.008	.144	.166
		Do you have too much work to do?	.978	.117	.100	.049
		Do you have to work extra hard to finish a task?	.978	.125	.096	.040
		Do you work under time pressure?	.978	.118	.100	.048
		Do you have to rush?	.980	.130	.084	.038
		Do you have to deal with a backlog at your work?	.974	.082	.112	.064
		Do you have problems with the pace of work?	.979	.095	.099	.051
		Do you have problems with the workload?	.980	.092	.098	.054
		Do you wish you could work at easier pace?	.959	.129	.075	.025
Factor Attention Demands	**4:**	Does your work need your undivided attention?	.061	.087	-.028	.967
		Do you have to keep track of more than one process at once?	.084	.096	.016	.969
		Do you have to concentrate to watch for things going wrong?	.104	.074	.023	.973
		Do you have to react quickly to prevent problems arising?	.083	.080	.008	.959
Factor Problem Solving Demands	**2:**	Are you required to deal with problems which are difficult to solve?	.132	.974	.085	.074
		Do you have to solve problems which have no correct answer?	.133	.981	.083	.074

	Prevent problems arising in your job?	.102	.979	.090	.071
	Require a thorough knowledge in your area?	.119	.979	.087	.073
	Problems you have not met before?	.125	.977	.074	.090
Factor 3: Responsibility Demands	Damage to equipment or machinery?	.148	.089	.937	.035
	error damage to equipment or machinery	.104	.067	.969	.002
	alertness prevent expensive damage	.118	.065	.957	-.007
	alertness prevent loss of output	.142	.103	.947	.003
	Failed to notice a problem, would it result in costly loss?	.113	.080	.925	-.007
Eigen values		9.77	4.57	4.1	3.34
Percentage of variance Explained=94.696%		42.48	19.85	17.85	14.52
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.810			
Bartlett's Test of Sphericity Approx. Chi-Square		11812.226			
df		253			
Sig.		.000			

The factor analysis of the items of job resources construct including skill variety, task identity, task significance, feedback and job security were analysed in this section. As indicated in Table 3, to assess the underlying structure of five variables of job resources, 22 items were submitted to principle component method and varimax rotation analysis. Table 3 shows the loadings of the 22 items on the five factors extracted. The higher loading of more than .5 which contributes to the variables were only considered in analysis. Those items load less than .5 on their respective factors were dropped from further analysis. Like job demands construct, the Kaiser-Meyer-Olkin criterion was applied to extract the number of factors and five factors with an eigenvalue of more than 1 were extracted as shown in Table 3. The documented KMO of job resources construct was .677. The five extracted factors explained 73.541%% of the variance in the construct. The first factor (job security) consisted of six items and explained 25.539% of the variance in job resources construct. The second factor (feedback) consisted of four items and explained 16.757% of the variance in job resources construct.

Table 3: Summary of Factor Analysis of Job Resources

No	Item	Component					Status
		1	2	3	4	5	
Factor 5: Skill Variety	Variety of my skills and talents	.047	.119	.073	.212	.773	
	high level of skills	.037	.142	.146	.392	-.398	Drop
	tasks are simple	.121	-.055	.032	.072	.792	
	wide range of my talents or abilities	.292	.156	.179	.237	.433	Drop
Factor 4: Task	How well well my work gets done	-.001	-.131	-.123	.687	.219	

Significance	my work can affect other peoples ability to do their work	-.020	.131	.015	.740	.268
	my job facilitates other peoples work	.010	.290	-.081	.733	-.212
	my job enhances other peoples work development	.083	-.072	-.013	.679	-.037
Factor 3: Task Identity	my job is arranged so that i do an entire work	.076	.084	.929	-.072	.123
	my job generally provides me to finish my work	.077	.123	.958	-.006	.009
	my job usually involves a complete piece of work	.028	.131	.931	.017	.098
	my job generally guides me the direction to reach my career	.005	.063	.902	-.070	-.167
Factor 2: Feedback	information about my work performance	.127	.895	.109	.037	.105
	I know whether i performed it well	.110	.947	.131	.095	.085
	figure out how well i am doing	.106	.914	.086	.050	-.046
	i know whether I contributed to my friends	.068	.957	.091	-.001	.087
Factor 1: Job Security	Safe from dismissal	.809	.068	.100	.076	-.001
	company will remain steady place of employment	.835	.178	.103	.169	.091
	I feel uneasy about the security in my present job	.894	.031	.006	-.061	-.105
	to be laid off at this company	.941	.082	.023	-.018	.056
	I am worried about my future with this company	.832	-.018	-.028	-.043	.052
	I am worried about my job security	.862	.131	.015	.040	-.079
Eigen values		5.619	3.687	3.013	2.136	1.725
Percentage of variance Explained=73.541%		25.539	16.757	13.696	9.709	7.840
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.677				
Bartlett's Test of Sphericity Approx. Chi-Square		3829.397				
df		231				
Sig.		**.000**				

The third factor (task identity) consisted of four items and explained 13.696% of the variance in job resources construct. The fourth factor (task significance) consisted of four items and explained 9.709% of the variance in job resources construct. The last factor (skill variety) consisted four items and explained 7.840% of the variance in job resources construct. However, two items of skill variety such as item 2 and 4 loaded below .50 and were dropped from further analysis.

5. Conclusion

The present study showed that the instruments that are broadly used to measure job demands and job resources are meaningful, when these instruments are used. The factor analysis results from SPSS suggest that job demands and job resources are valid instruments for testing the model. In addition, the findings of factor analysis provided evidence supporting the reliability and the-factor structure of the JD-R model Scale for employees when evaluated with a Somaliland Telecommunication employees' sample in this study. Thus, it is appropriate to use the JD-R model for the assessment of the job demands and job resources of the employees.

References

Bakker, A. B., Demerouti, E., de Boer, E., & Schaufeli, W. (2013). Job demands and job resources as predictors of absence duration and frequency. Journal of Vocational Behavior, 62, 341–356.

Bakker, A. B., Oerlemans, W., & Ten Brummelhuis, L. L. (2012). Becoming fully engaged in the workplace: What individuals and organizations can do to foster work engagement. In R. Burke & C. Cooper (Eds.), the fulfilling workplace: The organization's role in achieving individual and organizational health. Farnham: Gower.

Dieter V. & Elsy V., (2016),"Over education and job satisfaction: the role of job demands and control", International Journal of Manpower, Vol. 37 Iss 3 pp. 456-473.

Katrien V.; Paul G. & Deva R., (2016),"Engaged customers as job resources or demands for frontline employees?", Journal of Service Theory and Practice, Vol. 26 Iss 3 pp. 363 -383.

Kazlauskaite, R., Buciuniene, I. & Turauskas, L. (2012), "Organisational and psychological empowerment in the HRM-performance linkage", Employee Relations, Vol. 34 No. 2, pp. 463 -483.

Klein, H.J., Molloy, J.C. & Brinsfield, C.T. (2012), "Reconceptualising workplace commitment to redress a stretched construct: reversing assumptions and removing confounds", Academy of Management Review, Vol. 37 No. 1, pp. 130-151.

Kristina S.; & Thomas S. J., (2014),"Multiple affective commitments: quitting intentions and job performance", Employee Relations, Vol. 36 Iss 5 pp. 516 – 534.

Livia L.; Barakat Melanie P.; Lorenz Jase R.; Ramsey Sherban L.; & Cretoiu. (2015),"Global managers: An analysis of the impact of cultural intelligence on job satisfaction and performance ", International Journal of Emerging Markets, Vol. 10 Iss 4 pp. 781 – 800.

Luo Lu Hui Yen Lin Chang-Qin Lu Oi-Ling Siu, (2015),"The moderating role of intrinsic work value orientation on the dual-process of job demands and resources among Chinese employees", International Journal of Workplace Health Management, Vol. 8 Iss 2 pp. 78 – 91.

Marieke T.; & Jeroen J., (2014),"Job demands-resources and employee health and wellbeing", Career Development International, Vol. 19 Iss 1 pp. 101 – 122.

Michelle T., (2013),"The development of a work-life fit model: a demands and resources approach", International Journal of Managing Projects in Business, Vol. 6 Iss 4 pp. 792 – 801.

Moodie S., Dolan S.L., Burke R., (2014). Exploring the causes, symptoms and health consequences of joint and inverse states of work engagement and burnout, Management Research: the Journal of the Iberoamerican Academy of Management, (in press).

Murphy, L. A. (2011). A Macroergonomics approach examining the relationship between work-family conflict and employee safety. Portland State University.

Rich, B. L., Lepine, J. A., & Crawford, E. R. (2010). Job engagement: Antecedents and effects on job performance. The Academy of Management Journal (AMJ), 53(3), 617-635.

Schaufeli, W. B., & Bakker, A. B. (2004). Job demands, job resources, and their relationship with burnout and engagement: A multi-sample study. Journal of Organizational Behavior, 25, 293–315.

Shaikh, M., Bhutto, N. and Maitlo, Q. (2012), "Facets of job satisfaction and its association with performance", International Journal of Business and Social Science, Vol. 3 No. 7, pp. 322-326.

Spagnoli, P. & Caetano, A. (2012), "Personality and organizational commitment- the mediating role of job satisfaction during socialization", Career Development International, Vol. 17 No. 3, pp. 255-275.

Suliman, A. and Al Kathairi, M. (2013), "Organizational justice, commitment and performance in developing countries: the case of the UAE", Employee Relations, Vol. 35 No. 1, pp. 98-115.

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