TECHNICAL DOCUMENT

The Psychometric Properties of the Organisational Human Factor Benchmark (OHFB): A multi-national validation

Afriforte: Metrics that Matter

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Contents

Introduction

Work stress and its consequences for individual and organisational performance have been, and are, of increasing interest to academics, employers, and management practitioners. To attempt to explain the dynamic processes in employees and organisational work climates various work stress models were proposed and tested which started to light the way e.g. Effort-Reward-Imbalance (ERI) model (Siegrist, 1996; Van Vegchel, de Jonge, Bosma, & Schaufeli, 2005), the Person-Environment Fit Model (French, Kaplan, & Harrison, 1982) and the Demand-Control model (DCM; Karasek, 1979). Additionally, with the advent of the positive psychology paradigm about a decade go the way stakeholders view these dynamics changed, i.e., the emphasis moved from a disease perspective to a fortegenic perspective (Seligman & Csikszentmihalyi, 2000).

The job demands-resources (JD-R) model

The job demands-resources (JD-R) model is, arguably, the pinnacle of work stress models in that it encompasses both the positive and the negative processes at work. In the positive process, also called the motivational process, a balance between job demands and job resources lead to work engagement and extra-role performance (e.g., commitment, citizenship behaviour, and retention). Contrastingly, the negative process, also called the health impairment process, presents that an imbalance between job demands and job resources leads to the erosion of employee energy in the form of exhaustion and cynicism (the core components of burnout). If left unchecked high burnout levels will then lead to both psychological and physical ill health which reduces the employee's ability to function optimally and also affects commitment to the organisation (cf. Bakker & Demerouti, 2007; Bakker, Demerouti, & Euwema, 2005; Bakker, Demerouti, Sanz-Vergel, 2014; Bakker, Demerouti, Taris, Schaufeli, & Schreurs, 2003; Bakker, Hakanen, Demerouti, & Xanthopoulou, 2007; De Beer, Rothmann Jr., & Pienaar, 2012; De Beer, Pienaar, & Rothmann Jr., 2013; Demerouti, Bakker, Nachreiner, & Schaufeli, 2001; Llorens, Bakker, Schaufeli, & Salanova, 2006; Schaufeli & Bakker, 2004; Schaufeli & Taris, 2005).

Therefore, what happens in the work climate (demands & resources), eventually affects the work- related well-being of employees (burnout & engagement), which in turn eventually affects individual and organisational outcomes (e.g., health, turnover, commitment, productivity). The model has proven itself to hold firm: intuitively, theoretically, statistically, and practically.

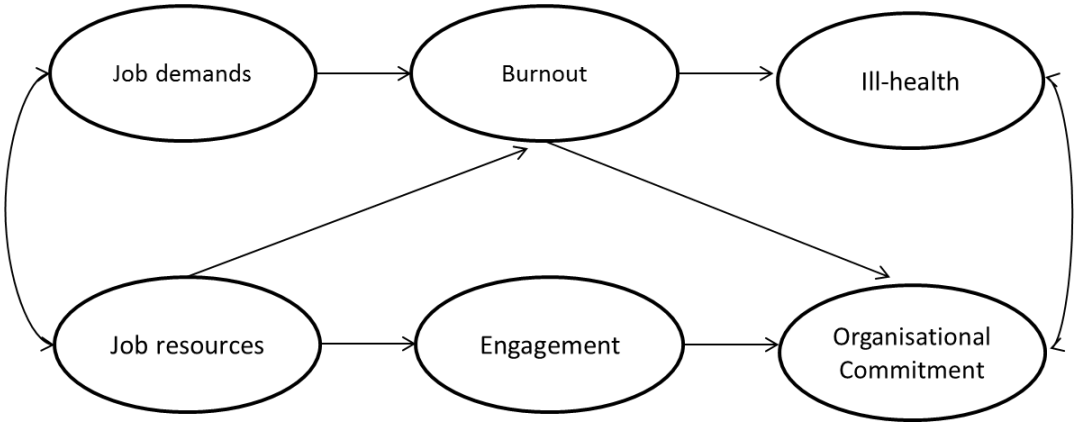

Figure 1. *The job demands-resources model.*

The Organisational Human Factor Benchmark (OHFB)

The Organisational Human Factor Benchmark (OHFB) is - the culmination of at least 15 years of research by the [1]WorkWell Research Unit of the North-West University - grounded in the foundation of the JD-R model (Afriforte, 2013). Its main purpose is to enable organisations and applicable accredited users to identify dynamics in the organisational climate; thereby diagnosing potential areas for intervention purposes. However, it also indicates where things are going well (areas to learn from).

In other words, the OHFB can identify the current state(s) of: i) The work climate, ii) employee well- being, and iii) individual and organisational outcomes related to the former. In being able to identify all these variables with the survey the statistical relationships can be estimated between them, making the JD-R model a predictive model, and giving the OHFB system varying predictive capabilities according to analysis insight. Although the instrument has been validated in many other contexts, the goal of this study is to validate the psychometric properties of the OHFB in a multi-national context.

Method

Constructs measured by the OHFB

Organisational climate

Job demands

"chronic job demands (indicated below) and a lack of sufficient job resources to buffer these demands have been found to lead to burnout and eventual ill health (Bakker, Demerouti, & Sanz-Vergel, 2014; Bakker & Demerouti, 2007; Demerouti et al., 2001; Schaufeli & Bakker, 2005; Schaufeli & Salanova, 2007).

- Pace and amount of work (Amount of work, and the time pressure associated) [3 items]
- Emotional load (Emotionally upsetting situations at work) [3 items]
- Quantitative (mental) load [3 items]

Job resources

""those physical, psychological, social, or organisational aspects of the work context that (1) can reduce the health impairment effect of job demands, (2) are functional in achieving work goals, and (3) stimulate personal growth, development and learning" (Schaufeli & Bakker, 2004, p. 296).

- Career paths (also an indicator of job insecurity) [3 items]
- Colleague support [3 items]
- Communication [3 items]
- Growth opportunities [3 items]
- Job information (Performance management) [4 items]
- Management style [3 items]
- Participation in decision-making [3 items]
- Physical resources [3 items]
- Remuneration [3 items]
- Role clarity [3 items]
- Supervisor support [3 items]

[1] The initial experimental assessment instrument for research purposes was called the SAEHWS

Work-related well-being

Burnout

Schaufeli and Enzmann (1998, p. 36) define burnout as "a persistent, negative, work-related state of mind in 'normal individuals' that is primarily characterized by exhaustion, which is accompanied by distress, a sense of reduced effectiveness, decreased motivation, and the development of dysfunctional attitudes and behaviours at work". Burnout thus reflects a process of deteriorating energetic resources.

- Core components measured:
  - Exhaustion [5 items]
  - Mental distance (Cynicism) [4 items]

Work engagement

Work engagement is defined as a "positive, work-related state of mind in employees characterised by vigour, dedication, and absorption" (Schaufeli, Salanova, Gonzalez-Roma, & Bakker, 2002, p. 74). The core components of engagement are considered as: Vigour and dedication (Schaufeli & Bakker, 2004). But absorption, which is more related to the concept of 'flow' (Csikszentmihalyi, 1990), can be seen as resultant of being engaged at work (cf. Langelaan, 2007).

- Core components measured:
  - Vitality (Vigor) [5 items]
  - Work devotion (Dedication) [5 items]

Employee outcomes

Negative outcomes: Ill health

Unchecked burnout eventually deteriorates into psychological and physical ill health – which could eventually lead to mortality.

- Psychological ill health [7 items]
  - E.g. anxiety, depressive symptoms, loss of sense of humour
- Physical ill health [6 items]
  - E.g. diabetes, high blood pressure, irritable bowel syndrome

Desired outcomes: Retention, commitment, corporate citizenship behaviour (CCB)

A balance in job demands and resources leads to extra-role performance and other desired organisational outcomes.

- Reduced turnover intention (Retention) [4 items]
- Corporate citizenship behaviour (Willingness to walk the extra mile) [7 items]

Other variables

Other useful variables

The OHFB also considers additional variables in analysis to be able to make more accurate predictions – and isolate risk cases/areas more confidently.

- Person-job fit [4 items]
- Productivity and Absenteeism [2 items]
- Resilience levels [6 items]
- Health and Lifestyle (e.g. smoking, drinking, exercise) [5 items]

Characteristics of the Sample

The data was collected from 7027 employees between August 2011 and December 2013 from multiple multi-national companies in several industries including mining, manufacturing, oil, retail, medical, hospitality, telecommunications, and other industries. Table 1 provides a breakdown of continents sampled from. Table 2 gives an overview of occupation category according to the Standard Occupation Classification of 2010 (SOC2010). In terms of demographics, females were slightly more represented (55.2%) and 35.4% of the employees were between the ages of 30 and 39.

Table 1

CONTINENT	#	%
US & Canada	1497	21.3%
Asia	989	14.1%
Australia	608	8.7%
Europe	893	12.7%
Middle-East	326	4.6%
United Kingdom	622	8.9%
Africa	2092	29.8%
GRAND TOTAL	**7027**	**100.00%**

Table 2

OCCUPATION CATEGORY	#	%
Administrative and Secretarial Occupations	908	12.9%
Associate Professional and Technical Occupations	658	9.4%
Caring, Leisure and Other Service Occupations	916	13.0%
Elementary Occupations	994	14.1%
Managers, Directors and Senior Officials	724	10.3%
Process, Plant and Machine Operatives	744	10.6%
Professional Occupations	950	13.5%
Sales and Customer Service Occupations	488	6.9%
Skilled Trades Occupations	645	9.2%
TOTAL	**7027**	**100.00%**

Table 3

GENDER	#	%
FEMALE	3878	55.2%
MALE	3149	44.8%
TOTAL	**7027**	**100.00%**

Table 4

AGE	#	%
< 20	5	0.07%
30-39	2486	35.4%
40-49	1853	26.4%
50-59	1242	17.7%
60 AND OLDER	142	2.0%
TOTAL	**7027**	**100.00%**

Statistical analyses

In order to demonstrate the psychometric properties of the OHFB confirmatory factor analyses (CFA) will be conducted with Mplus 7.11 (Muthen & Muthen, 2013). Mplus is currently the most advanced and accurate structural equation modeling package available; it has the ability to analyse categorical indicators and also continuous indicator, simultaneously, with Bayesian estimation methods. Bayesian estimation will be applied because of its effectiveness in solving models with many parameters, as is typically the case with the OHFB given the large number of constructs and items involved.

First, alpha and omega reliability coefficients will be calculated for all variables. Both alpha and omega coefficients were calculated as indicators of the reliability of constructs; the popular alpha coefficient has been shown to be problematic, i.e. it is a poor estimate of internal consistency and in some cases a gross overestimate (cf. Raykov, 2012; Revelle & Zinbarg, 2009; Sijtsma, 2009). Subsequently, a measurement model will be specified and reported with CFA methods. In accordance with common scientific best-practices the measurement model will be tested with all items and constructs in a single model. The results of the CFA will provide the reader with loadings of each item on the estimated latent variable (including the communality) that it is expected to measure. The Bayesian estimator will be implemented with 8 chains and 100 000 iterations to ensure proper chain mixing. This will be confirmed by checking the parameter trace plots.

Finally, the correlation matrix will be presented in order to show how the different variables from the model are associated with each other. The practical effect sizes for correlation coefficients will be considered as follows: r > 0.29 = medium effect; r > .49 a large effect.

Results

Table 5 presents the alpha and omega reliability coefficients for the latent variables.

Table 5 - Reliability

Variable	Alpha (α)	Omega (ω)
Emotional load	0.726	0.765
Pace and amount of work	0.712	0.754
Quantitative load	0.710	0.752
Burnout	0.875	0.926
Engagement	0.898	0.941
Colleague Relationships	0.854	0.895
Equipment	0.866	0.914
Role clarity	0.813	0.848
Participation	0.786	0.813
Communication	0.820	0.874
Supervisory support	0.887	0.920
Job information	0.875	0.911
Growth opportunities	0.745	0.780
Turnover intention	0.843	0.870
CCB	0.854	0.903
Resilience	0.843	0.887
Psychological ill-health	0.874	0.915
Physical ill-health	0.821	0.864
Career possibilities	0.892	0.932
Remuneration	0.874	0.927

All of the alpha and omega reliability coefficients were acceptable according to the acceptable guideline in the social sciences of α and ω > 0.70 (Sijtsma, 2009).

The CFA measurement model was specified, and the following results (Table 2) were evident:

Table 6 - Results of the CFA with SEM methods

	STD LOADING (λ)	S.D.	p-Value	2.5% Lower	2.5% Upper	Communality (R^2)
ENGAGEMENT						
VI1	0.767	0.006	0.000	0.755	0.779	0.588
VI2	0.884	0.003	0.000	0.877	0.891	0.781
VI3	0.824	0.005	0.000	0.815	0.833	0.679
VI4	0.600	0.009	0.000	0.582	0.616	0.360
VI5	0.693	0.008	0.000	0.676	0.708	0.480
WD1	0.886	0.003	0.000	0.879	0.892	0.785
WD2	0.871	0.004	0.000	0.863	0.878	0.759
WD3	0.855	0.004	0.000	0.847	0.863	0.731
WD4	0.842	0.005	0.000	0.833	0.851	0.709
WD5	0.502	0.010	0.000	0.482	0.521	0.252
BURNOUT						
EX1	0.740	0.007	0.000	0.727	0.752	0.548
EX2	0.739	0.006	0.000	0.726	0.751	0.546
EX3	0.711	0.007	0.000	0.698	0.725	0.506
EX4	0.642	0.008	0.000	0.626	0.658	0.412
EX5	0.747	0.006	0.000	0.734	0.759	0.558
MD1	0.815	0.005	0.000	0.804	0.825	0.664
MD2	0.845	0.004	0.000	0.836	0.854	0.714
MD3	0.704	0.007	0.000	0.690	0.718	0.496
MD4	0.602	0.009	0.000	0.584	0.619	0.362
PACE						
PACE1	0.691	0.009	0.000	0.674	0.708	0.477
PACE2	0.767	0.008	0.000	0.752	0.782	0.588
PACE3	0.688	0.009	0.000	0.670	0.705	0.473
QLOAD						
QLOAD1	0.774	0.009	0.000	0.757	0.791	0.599
QLOAD2	0.657	0.011	0.000	0.635	0.678	0.432
QLOAD3	0.695	0.010	0.000	0.676	0.714	0.483
ELOAD						
ELOAD1	0.663	0.009	0.000	0.645	0.681	0.440
ELOAD2	0.615	0.010	0.000	0.595	0.635	0.378
ELOAD3	0.845	0.008	0.000	0.828	0.860	0.714

GROWTH						
GROWTH1	0.882	0.006	0.000	0.870	0.893	0.778
GROWTH2	0.695	0.009	0.000	0.678	0.711	0.483
GROWTH3	0.654	0.009	0.000	0.636	0.672	0.428
JOB INFORMATION						
JOB INFO 1	0.824	0.006	0.000	0.813	0.835	0.679
JOB INFO 2	0.868	0.005	0.000	0.859	0.877	0.753
JOB INFO 3	0.847	0.005	0.000	0.836	0.856	0.717
JOB INFO 4	0.766	0.007	0.000	0.753	0.779	0.587
SUPERVISORY SUP						
RELSUPER1	0.814	0.006	0.000	0.802	0.826	0.663
RELSUPER2	0.886	0.005	0.000	0.875	0.895	0.785
RELSUPER3	0.903	0.004	0.000	0.895	0.912	0.815
COMMUNICATION						
COMM1	0.814	0.007	0.000	0.801	0.826	0.663
COMM2	0.869	0.005	0.000	0.859	0.880	0.755
COMM3	0.801	0.007	0.000	0.788	0.813	0.642
PARTICIPATION						
PARTIC1	0.862	0.006	0.000	0.850	0.872	0.743
PARTIC2	0.792	0.007	0.000	0.778	0.806	0.627
PARTIC3	0.602	0.010	0.000	0.582	0.622	0.362
RCLAR						
ROLECLAR1	0.681	0.009	0.000	0.664	0.699	0.464
ROLECLAR2	0.690	0.010	0.000	0.670	0.710	0.476
ROLECLAR3	0.798	0.007	0.000	0.784	0.811	0.637
EQUIP						
EQUIP1	0.772	0.008	0.000	0.757	0.787	0.596
EQUIP2 (r)	-0.934	0.005	0.000	-0.943	-0.925	0.872
EQUIP3 (r)	-0.916	0.005	0.000	-0.925	-0.906	0.839
RELCOLL						
RELCOLL1	0.916	0.006	0.000	0.905	0.927	0.839
RELCOLL2	0.922	0.005	0.000	0.912	0.933	0.850
RELCOLL3	0.690	0.010	0.000	0.670	0.709	0.476

REMUN						
REMUN1	0.875	0.005	0.000	0.866	0.884	0.766
REMUN2	0.887	0.004	0.000	0.878	0.895	0.787
REMUN3	0.935	0.004	0.000	0.927	0.942	0.874
CAREER						
CAREERP1	0.872	0.005	0.000	0.863	0.881	0.760
CAREERP2	0.909	0.004	0.000	0.902	0.916	0.826
CAREERP3	0.928	0.003	0.000	0.921	0.935	0.861
PHYSILL						
PHYSILL1	0.747	0.008	0.000	0.732	0.762	0.558
PHYSILL2	0.584	0.010	0.000	0.563	0.604	0.341
PHYSILL3	0.676	0.009	0.000	0.659	0.693	0.457
PHYSILL4	0.715	0.008	0.000	0.699	0.730	0.511
PHYSILL5	0.779	0.007	0.000	0.765	0.792	0.607
PHYSILL6	0.729	0.009	0.000	0.711	0.745	0.531
PSYCHILL						
PSYCHILL1	0.842	0.005	0.000	0.832	0.853	0.709
PSYCHILL2	0.677	0.009	0.000	0.659	0.694	0.458
PSYCHILL3	0.778	0.007	0.000	0.764	0.791	0.605
PSYCHILL4	0.810	0.006	0.000	0.798	0.822	0.656
PSYCHILL5	0.771	0.007	0.000	0.757	0.785	0.594
PSYCHILL6	0.790	0.007	0.000	0.777	0.803	0.624
PSYCHILL7	0.712	0.008	0.000	0.695	0.728	0.507
RESILIENCE						
RESIL1	0.556	0.010	0.000	0.537	0.576	0.309
RESIL2	0.705	0.008	0.000	0.690	0.720	0.497
RESIL3	0.811	0.006	0.000	0.800	0.822	0.658
RESIL4	0.798	0.006	0.000	0.786	0.809	0.637
RESIL5	0.822	0.006	0.000	0.811	0.832	0.676
RESIL6	0.781	0.006	0.000	0.768	0.793	0.610
CCB						
CCB1	0.870	0.006	0.000	0.859	0.881	0.757
CCB2	0.679	0.009	0.000	0.661	0.696	0.461
CCB3	0.735	0.008	0.000	0.718	0.751	0.540
CCB4	0.616	0.009	0.000	0.598	0.634	0.379
CCB5	0.612	0.009	0.000	0.593	0.630	0.375
CCB6	0.858	0.005	0.000	0.848	0.868	0.736

CCB7	0.694	0.008	0.000	0.678	0.709	0.482
TURNOVER						
TURN1	0.825	0.004	0.000	0.816	0.834	0.681
TURN2	0.880	0.004	0.000	0.873	0.887	0.774
TURN3	0.786	0.005	0.000	0.776	0.796	0.618
TURN4	0.704	0.007	0.000	0.691	0.717	0.496

Notes: (R) = Reversed item; Statistical significance (p) < 0.001; 2.5% Upper & Lower = 95% Credibility Intervals

Resulting standardised factor loadings for all latent variables were all acceptable according to the guideline of $\lambda > 0.500$; moreover, the vast majority of factor loadings were large ($\lambda > 0.700$; Kline, 2011). Small S.D.'s were evident for all loadings which is an indication of accurate estimation. Additionally, 95% Credibility Intervals are also calculated for each estimate which provides additional support the significance, size and direction of the loading. Concerning the communalities (R^2) values for all the items all of the items were above 0.300 except for WD5 which was relatively close. No clear guidance on communalities is given in the literature and a rule of thumb of 0.300 is applied by the research unit. We therefore find all item communalities acceptable, and the system investigates of all items (e.g. WD5) in all projects to ascertain if it was a useful item in that sample.

Concerning the correlations between variables (Table 6 below) it is clear that the direction of all the relationships is as expected from the literature on JD-R theory, for example:

- The job resources are all positively related.
- The job resources are all positively related.
- Job demands and job resources are negatively correlated.
- Job demands are positively correlated with burnout.
- Job resources are negatively correlated with burnout.
- Job resources are positively correlated with work engagement.
- Burnout and engagement are highly negatively correlated.
- Burnout is highly correlated with ill health (both physical and psychological).
- Burnout is negatively correlated with corporate citizenship behaviour.
- Work engagement is highly negatively correlated with turnover intention.
- Work engagement is highly correlated with corporate citizenship behaviour.
- Turnover intention and corporate citizenship behaviour are highly negatively related.
- Resilience is negatively correlated with burnout.
- Resilience is positively correlated with work engagement.

Table 7 - Correlation Matrix for the Latent Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Engagement	1																		
2. Burnout	-0.837	1																	
3. Pace and amount of work	-0.070	0.395	1																
4. Quantitative load	0.122	0.200	0.946	1															
5. Emotional load	-0.361	0.611	0.701	0.582	1														
6. Growth opportunities	0.611	-0.56	-0.071	0.043	-0.266	1													
7. Job Information	0.556	-0.526	-0.162	-0.020	-0.347	0.615	1												
8. Supervisory relationships	0.479	-0.503	-0.212	-0.057	-0.433	0.554	0.775	1											
9. Communication	0.559	-0.53	-0.152	-0.002	-0.366	0.657	0.791	0.649	1										
10. Participation	0.608	-0.574	-0.16	0.005	-0.398	0.698	0.814	0.857	0.861	1									
11. Role Clarity	0.614	-0.560	-0.133	0.027	-0.361	0.540	0.964	0.765	0.776	0.806	1								
12. Equipment	0.254	-0.372	-0.285	-0.169	-0.427	0.297	0.330	0.320	0.385	0.330	0.322	1							
13. Colleague Relationships	0.401	-0.394	-0.176	-0.058	-0.339	0.404	0.456	0.469	0.492	0.535	0.487	0.276	1						
14. Remuneration	0.237	-0.292	-0.172	-0.107	-0.245	0.444	0.307	0.317	0.339	0.366	0.212	0.265	0.18	1					
15. Career paths	0.535	-0.531	-0.118	-0.042	-0.307	0.844	0.503	0.478	0.556	0.568	0.425	0.253	0.315	0.503	1				
16. Physical Ill-Health	-0.447	0.646	0.364	0.255	0.576	-0.303	-0.313	-0.317	-0.314	-0.385	-0.325	-0.320	-0.285	-0.295	-0.314	1			
17. Psychological Ill-Health	-0.624	0.798	0.385	0.238	0.642	-0.373	-0.412	-0.415	-0.41	-0.469	-0.446	-0.345	-0.377	-0.25	-0.384	0.875	1		
18. Resilience	0.520	-0.549	-0.121	0.012	-0.381	0.394	0.391	0.36	0.395	0.436	0.412	0.298	0.288	0.321	0.349	-0.508	-0.599	1	
19. CCB	0.613	-0.486	-0.008	0.13	-0.172	0.493	0.408	0.368	0.481	0.498	0.445	0.221	0.312	0.352	0.447	-0.22	-0.331	0.413	1
20. Turnover intention	-0.663	0.608	0.103	-0.022	0.354	-0.616	-0.509	-0.493	-0.558	-0.592	-0.525	-0.296	-0.357	-0.434	-0.594	0.333	0.452	-0.455	-0.869

Summary and Conclusion

The aim of this technical appendix was to demonstrate the psychometric properties of the OHFB. Results of latent variable modelling with structural equation modelling methods revealed that:

- The reliability indicators alpha / omegas were acceptable (> 0.70)
- All factor loadings loaded acceptably on all the latent variables.
- All factor loadings were statistically significant at the $p < 0.001$ level.
- The standard errors of were quite small, indicating very accurate estimation of the loadings.
- The correlations between variables are in the directions as is theorized in the literature.

Therefore, the OHFB's measurement properties are acceptable according to the most stringent standards of statistical modelling today.

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