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ENGINEER SPECIFIC JOB DEMAND SCALE DEVELOPMENT

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Abstract: This research study was carried out with the aims to formulate new measuring, which focuses on the measuring of job demands in the context of engineer's job. The content of ESJD scale was validated via expert assessment using the Delphi Method (30 experts). Descriptive statistics, analysis factor with promax rotation, correlation analysis, linear regression analysis and one-way MANOVA test were used in this study to analyse the samples of registered engineers in Malaysia (N=504). The study showed satisfactory reliability and validity results for the new scale. The results of this study are expected to provide information to the management, administrators and organisational leaders in managing risks that affect the level of stress, psychological wellbeing and their impact on the level of professional commitment among engineers as well as the best method of implementing them.

Keywords: Job demand, Occupational stress, Psychological wellbeing, Engineers

INTRODUCTION

Parallel to meeting the needs of national and community development, engineering-related organisations and companies are required to work hand-in-hand in completing the aspirations of the people and nation. However, in the era of globalisation, engineering-related companies have to operate in a highly competitive open market with low profitability expectations, and even have to complete engineering projects on tight deadlines and faced with the constraints of very limited financial budget. Because of this, engineers as the main drivers of engineering-related companies are forced to face high job demands from management and clients, to continue to compete and further survive in business.

This has led to the occupational stress experienced by most engineers, following high job demands. Due to workload, many studies have reported cases of occupational stress experienced by engineers in various economic sectors (Bowen, Edwards, Lingard, & Cattell, 2014; Chen et al., 2011; De Silva, Samannali, & De Silva, 2017). High workload and lack of salary and promotion prospects are among the two major contributory factors of occupational stress experienced by engineers (Yip & Rowlinson, 2009).
OBJECTIVES

We specifically address three goals: first, we identify, list down, develop and propose the occupational needs of specialised item engineers and ESJD measurement models based on comprehensive literary scans and expert opinions through Delphi techniques.

Second, we collect engineer researcher feedback data from various industries and gender background (N = 550). Random multistage sampling is used as a technique for determining samples. Third, we analyse the data. We conduct descriptive analysis to examine the data distribution. We perform reliability checks to determine internal consistency of the measurements. We assess, discriminate and reduce measuring items, based on the suitability of items to measure using principal component analysis techniques.

Next, we test whether the ESJD measurement model is suitable for research data, using a valid factorial analysis method. We hypothesise that the ESJD measurement model has a satisfying level of goodness-of-fit with the research data. Lastly, we examine the relation of ESJD towards the stress with regard to job, and psychological wellbeing among engineers.

LITERATURE REVIEW

Occupational stress experienced by engineers has become the subject of accumulated research (Hall et al., 2015; Ronen & Malach Pines, 2008). Concerns about the health effects of various stress relating to work, shortage of engineers and retrenchment among engineers have been highlighted in the national and global themes (e.g. Etzion, 1988; Keenan & Newton, 1985; Lingard, 2003; Rothmann & Malan, 2006)

One of the most frequently used theories is the job demands-resources theory, first introduced by Demerouti (2001) which is known as the JD-R model, and later improved and matured into the JD-R theory (Bakker & Demerouti, 2007, 2017). As detailed in the latest meta-analysis collection, the JD-R model has been used as part of the thousands of associations, and is used as part of the accurate size of research measurement (Alarcon, 2011; Bakker, Demerouti, & Sanz-Vergel, 2014; Crawford, LePine, & Rich, 2010; Nahrgang, Morgeson, & Hofmann, 2011).

According to Demerouti (2001), 'job demands' as demonstrated by the JD-R model and the determination of this investigation consideration refers to "the job aspects that require continuous physical or mental effort and are associated with certain physiological and psychological effects", for example; emotionally, has to work with customers or clients under high work pressure.

Job demands' in the JD-R model is a unique predictor for health problems such as stress due to work and fatigue. However, psychological measurements for job demands in the JD-R model are highly generic, since there are additional job demands that are specific for certain job contexts. The use of generic job demands can affect prognostic quality (Bakker & Demerouti, 2017). Hence, it is said that the causes of occupational stress, in this case, job demands, need to be identified in the design of specific occupational characteristics based on specific context by the types of employment, as a way to
develop a better understanding of the relationship between job demands and stress (Sparks & Cooper, 1999).

For example, jobs in the healthcare sector such as nurses are recorded as having certain job demands such as emotional demand related to ‘illness and death’, ‘patient needs’ and ‘patient threats and violence’ (Sundin, Hochwälder, & Bildt, 2008). Specific job demands in the context of entrepreneurial jobs have been found, such as emotional demands related to ‘uncertainty and risk’ (Dijkhuizen, Van Veldhoven, Schalk, & Schalk, 2014).

Engineers also have a particular job design for certain responsibilities, for example; applying engineering theory principles to engineering projects; performing detailed engineering calculations to build manufacturing, construction and installation standards; investigating client or public complaints; determining the nature and extent of the problem; recommending recovery measures, etc. (International Labor Office, 2012).

Therefore, this study identified and developed a measurement scale of specific job demands for engineers, and subsequently compared the effects of job demands of ordinary occupations and engineer specific job demands, on the stress and psychological wellbeing associated with the work of an engineer.

**METHODOLOGY**

Literary analysis and interviews were performed to identify the engineer's job demand scope and subsequently to develop draft questionnaires. This was aimed to produce more specific measurements for job demands. Then, content validation process for the proposed measurement items was done through Delphi's repeated consultation process with the experts. Next, items were tested on face validity according to the criteria of the face validity analysis. For the purpose of the ESJD construct validity analysis (factorial analysis) and the subsequent analysis (linear regression analysis), the study collected feedback from respondents involving 504 engineers registered with the Board of Engineers Malaysia in various industry sectors of various engineering disciplines. Respondent's distribution by engineering disciplines is shown in Table 1.

<table>
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<tr>
<th>Engineering Discipline</th>
<th>Frequency</th>
<th>Per cent</th>
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</thead>
<tbody>
<tr>
<td>Civil Engineering</td>
<td>182</td>
<td>36.1</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>78</td>
<td>15.5</td>
</tr>
<tr>
<td>Electronic Engineering</td>
<td>64</td>
<td>12.7</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>94</td>
<td>18.7</td>
</tr>
<tr>
<td>Chemical Engineering</td>
<td>43</td>
<td>8.5</td>
</tr>
<tr>
<td>Others</td>
<td>43</td>
<td>8.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>504</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
Next, the items extracted in factorial analysis were tested for similarities in measuring certain job demands, regardless of the differences in demographics (i.e. type of industry, years of service, gender and engineering discipline). Afterward, the validity of the developed criterion scale was assessed. Based on the research hypothesis, these specific job demands of engineering have positive influence towards work-related stress and negative towards psychological wellbeing, and we estimated that the strength of the relationship far outweighed the relationship between ordinary job demands and psychological wellbeing and work-related stress. Reliability test was then performed.

**FINDINGS**

<table>
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<th>RESULTS OF THE ESJD SCALE DEVELOPMENT ANALYSIS</th>
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<td>ACTIVITY</td>
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<td>Development of scale draft</td>
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<td>Delphi content validity analysis</td>
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<td>Face validity analysis</td>
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<td>Equality analysis</td>
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| Criterion validity analysis                   | - Challenge specific job demands recorded more positive relationship strengths towards occupational stress than ordinary job demands.  
- Challenge specific job demands recorded the strength of a positive relationship towards the psychological wellbeing parallel to job resources. |
| Reliability analysis                          | All six dimensions showed satisfactory internal consistency, Cronbach's alpha ranging from .92 to .94. |
CONCLUSION

The findings of the ESJD scale development analysis suggested that the ESJD scale is a measurement instrument that has a satisfactory level of validity and reliability to measure specific job demands for the context of an engineer's job.

SELECTIVE REFERENCES


