

Chapter 2

ANALYSIS OF QUESTIONNAIRE AND METHODS

The main objective of this research was to find the association between organisational, social and individual factors on occupational stress, WMSDs and work performance in Indian middle-level managers. This chapter presents the data and methods used to achieve the objectives. Based on the objective, a questionnaire was used to collect the data. Initially, the questionnaire was tested to generate reliability and validity to validate the constructs and questionnaire scale. This facilitated the required adjustments and modifications, if any and increased the effectiveness of the constructs.

2.1. QUESTIONNAIRE

The questionnaire used in the study to collect data was divided into five sections organisational factors, socio-economic factors, personal factors, occupational stress and WMSDs, and work performance.

2.1.1. Organisational factors

The section on organisational factors includes scales on variables such as 1) workload, 2) job control, 3) “support at work”, 4) experience in the organisation and 5) experience in the current position. Table 2.1 shows the organisational factors and tools used to measure them.

Table 2.1: Tools used to measure organisational factors

Factors	Tool used	Scale
Workload	NASA TLX	0-100 scale
Job control	Copenhagen Psychosocial	5-point Likert scale
Support at work	Questionnaire	5-point Likert scale
Exp. in organisation	Single question	-----
Exp. in current position	Single question	-----

The workload was measured using NASA Task Load Index (NASA TLX) (Hart and Staveland, 1988). It is a multi-item questionnaire that has been used in various fields since its development. It is a measure of the perceived workload. The perceived workload is a complex construct that means the amount of effort people have to put mentally and physically into their work. NASA TLX uses six dimensions to measure workload: mental demand, physical demand, temporal demand, performance, effort, and frustration. This scale uses a weighting process based on paired comparisons. NASA TLX is administered in two steps.

In the first step, a score on a scale of 0 to 100 is obtained for each dimension. In the next step, participants compare the dimensions from each of the paired combinations to decide which dimension is more related to their workload. So, 15 paired comparisons are used in this step to collect the data on workload. The score for the workload is obtained by multiplying the weight of each scale by the individual dimension scale score and then summing it across the scales (Hitt et al., 1992). This scale gives a score of workload ranging from 0 to 100. A higher score represents a higher workload. NASA TLX is free to use in paper and pencil form and as software (Cao et al., 2009). A paper and pencil version of the scale is used for the present work.

Scales used for job control and “support at work” were taken from the Copenhagen psychosocial questionnaire (Kristensen et al., 2005). It is available to use freely and requires no permission from the developers (Nuebling and Hasselhorn, 2010). The questions were scored on a five-point Likert scale varying from 0 to 4. A higher score for job control and “support at work” represented a higher level of these variables.

2.1.2. Social factors

The section on social factors includes scales on variables support from family and friends, salary and social media usage. Table 2.2 shows the social factors and tools used to measure them.

Table 2.2: Tools used to measure social factors

Factors	Tool used	Scale
Support from family	Copenhagen Psychosocial	5-point Likert scale
Support from friends	Questionnaire	5-point Likert scale
Salary	Single question	-----
Time spent using WhatsApp	Single question	-----
Time spent using Facebook	Single question	-----
Time spent using Instagram	Single question	-----
Time spent using YouTube	Single question	-----

Support from family and friends was also measured using Copenhagen Psychosocial Questionnaire. The questions for these were also scored on a five-point Likert scale varying from 0 to 4. A higher score represented a higher level of these variables.

Salary and time spent using social media WhatsApp, Facebook, Instagram and YouTube were measured using a single item.

2.1.3. Personal factors

The section on personal factors includes questions related to personal information such as age, gender, weight and height (BMI). This section also included questions on substance use, workout habits and phone and laptop usage. Table 2.3 shows the personal factors and tools used to measure them.

Age, gender, and time spent on the phone and laptop were asked as single questions. For BMI, weight and height were asked in the questionnaire. Tea/coffee intake,

tobacco usage, alcohol consumption and workout habits were also asked using a single question on a 5-point Likert scale.

Table 2.3: Tools used to measure personal factors

Factors	Tool used	Scale
Age	Single question	-----
Gender	Single question	-----
Weight	Single question	-----
Height	Single question	-----
Tea/coffee intake	Single question	5-point Likert scale
Tobacco usage	Single question	5-point Likert scale
Alcohol consumption	Single question	5-point Likert scale
Workout habits	Single question	5-point Likert scale
Time spent on the phone	Single question	-----
Time spent on the laptop	Single question	-----

2.1.4. Psychological stress and WMSDs

This section was further divided into subsections as 1) psychological stress and 2) WMSDs. The psychological stress section included questions on behavioural stress, somatic stress and cognitive stress. The section on WMSDs included questions related to pain in the neck, shoulders, elbows, wrists, upper back, lower back, thighs, knees and feet. Table 2.4 shows the psychological factors and tools used to measure them.

Table 2.4: Tools used to measure psychological stress and WMSDs

Factors	Tool used	Scale
Behavioural stress	Copenhagen Psychosocial	5-point Likert scale
Somatic stress	Questionnaire	5-point Likert scale
Cognitive stress		5-point Likert scale
WMSDs	Stanford pain rating scale	10-point Likert scale

Behavioural, somatic and cognitive stress was measured using Copenhagen Psychosocial Questionnaire. The questions for these were also scored on a five-point Likert scale varying from 0 to 4. A higher score represented a higher level of these variables.

WMSDs were measured using a single item on a 10-point pain rating scale. A higher score represented a higher level of pain.

2.1.5. Work performance

This section had questions related to the work performance of the employees. It was a self-reported work performance of the employees that consisted of questions related to the quality, planning, and results of the work as well as setting priorities in the work and competition of work within the given deadlines. The questions were measured on a 5-point Likert scale from 0 to 4. A higher score represented a higher level of work performance.

As a next step, the data was collected using the earlier mentioned questionnaire. The following section describes the sample size and the data collection.

2.2. DATA COLLECTION

The data for the study were collected from Middle-Level Managers (MLMs) of a public Indian telecom organisation during Nov 2018 – Apr 2019. 250 MLMs were contacted, and 210 responded. The response rate of the questionnaire was 84%. All the participants, the MLMs, were informed about the scope of the study and were asked to fill out the questionnaire. The responses to the questionnaire were kept anonymous. Respondents voluntarily agreed to participate in the survey. The mean age of the sample was 48.05 years. Of the sample, 91% were male, and 9% were female. All the participants were working as senior executives in the organisation located in different parts of India.

After the collection of the data, the validity and reliability of the questionnaire were checked before data analysis. For this purpose, Exploratory Factor Analysis (EFA) and reliability analysis was done.

2.3. EXPLORATORY FACTOR ANALYSIS

Exploratory Factor Analysis (EFA) was done to check the validity of the questionnaire. The analysis was performed using IBM SPSS, 210.0. EFA is a statistical approach used to determine the correlation among the variables in a questionnaire. This provides a factor structure, i.e., a grouping of variables based on strong correlations and determining whether each observed variable is related significantly to the latent variable. A latent variable is a variable that is not observed directly but measured through observed variables. Most constructs in research where questionnaires are used are latent variables. For example, behavioural stress is not measured directly but using observed variables through the questionnaire. In EFA, a latent variable is called a factor, and the associations between latent and observed variables are called factor loadings. In general, an EFA prepares the variables to be used for cleaner structural equation modelling.

EFA first confirms the adequacy of the data before providing factor loadings. For this purpose, Kaiser-Meyer-Olkin (KMO) test and Bartlett sphericity test are used. KMO test is the measure of sampling adequacy. KMO value between 0.6 and 1 indicates that the sample size is adequate (Cerny & Kaiser, 1977). Bartlett sphericity test is used to determine the significance of the various questions that have been used to measure the latent variables. The test involves the determination of Pearson's correlation coefficients among the questions on a particular latent variable. The null hypothesis takes the correlation matrix not to be an identity matrix. A small Bartlett sphericity test value (less than 0.005), measuring the significance level, indicates that the correlation matrix is not an identity matrix and will indicate a significant correlation between various observed variables. Under this situation, it is suggested that it will be worthwhile to run a meaningful EFA.

So, for all the latent variables in the questionnaire, i.e., job control, “support at work”, “support from family and friends”, behavioural stress, cognitive stress, somatic stress and work performance, EFA was done. The following section shows the results of EFA for all the latent variables.

2.3.1. EFA for Job control

The value of the KMO test was 0.695 for job control, indicating that the sample size was adequate (Cerny & Kaiser, 1977). The value of the Bartlett sphericity test was 0.00, indicating that the observed variables of the latent variable job control had a significant correlation among them to run a meaningful EFA.

Table 2.5 shows the values of factor loadings for job control. JC1, JC2, JC3, JC4, JC5, JC6, and JC7 are the observed variables for job control. JC(i) represent the i^{th} questions asked in the questionnaire for job control, as shown in Appendix A. A factor loading value above 0.45 suggests that the item loads sufficiently on the respective factor, i.e., job control (Comrey and Lee, 1992).

Table 2.5: Factor loadings for job control

Observed variables	Factor loadings
JC1	0.455
JC2	0.469
JC3	0.467
JC4	0.473
JC5	0.649
JC6	0.155
JC7	0.030

It can be seen from Table 2.5 that factors JC6 and JC7 did not load significantly on the factor. After analysing all the observed variables, it was seen that observed variables JC6 and JC7 were related to the control over time dimension of the job control and the remaining five dimensions were related to “control over work”. So, EFA was done again after removing JC6 and JC7. The value of the KMO test was 0.695, and the

value of the Bartlett sphericity test was 0.00. The results of the factor loadings are shown in Figure 2.6.

Table 2.6: Factor loadings for control at work dimension of job control

Observed variables	Factor loading
Job control	
JC1	0.513
JC2	0.586
JC3	0.495
JC4	0.563
JC5	0.460

It can be seen from Table 2.6 that all the remaining observed variables load significantly on the factor.

Observed variables JC6 and JC7 are retained as the independent dimensions of job control as “control over working time” and “control over working hours”. They are used in a later Chapter as job control dimensions along with “control over work”.

2.3.2. EFA Support at work and support from family and friends

The “Support at work” dimension included support from colleagues and supervisors. Observed variables of “support at work” were SW1, SW2 and SW3, i.e., questions related to “support at work”, as shown in Appendix A. “Support from family and friends” had observed variables as SF1, SF2, SF3 and SF4, i.e., questions related to “support from family and friends”, as shown in Appendix A.

The value of the KMO test was 0.642, indicating that the sample size was adequate (Cerny & Kaiser, 1977). The value of the Bartlett sphericity test was 0.00, indicating that the observed variables of the latent variable job control had a significant correlation among them to run a meaningful EFA. Table 2.7 shows the values of factor loadings for “support at work” and “support from family and friends”.

It can be seen from Table 2.7 that all three observed variables of the “support at work” load significant on a single factor, i.e., Factor 1, which is “support at work”. However, the observed variables for “support from family and friends” load on two different factors.

Table 2.7: Factor loadings for support

Observed variables	Factor loadings		
	Factor 1	Factor 2	Factor 3
	Support at work	Support from friends	Support from family
SW1	0.830	0.083	0.014
SW2	0.806	0.128	0.155
SW3	0.565	0.057	0.127
SF1	0.186	0.250	0.530
SF2	0.051	0.101	0.993
SF3	0.127	0.988	0.083
SF4	0.073	0.555	0.203

After analysing observed variables SF1, SF2, SF3 and SF4, it was found that SF1 and SF2 were related to support from family, and the remaining two were related to support from friends. As these also load significantly on different factors (support from family and support from friends), the dimension support from family and friends was divided into two dimensions: support from family and support from friends.

2.3.3. EFA Psychological stress

Psychological stress included behavioural, somatic and cognitive stress. Observed variables of behavioural stress were BS1, BS2, BS3, BS4 and BS5, i.e., questions related to behavioural stress, as shown in Appendix A. Similarly, observed variables for somatic stress were SS1, SS2, SS3, SS4, SS5, SS6 and SS7 (Questions related to somatic stress) and CS1, CS2, CS3 and CS4 (questions related to cognitive stress) for Cognitive stress.

The value of the KMO test was 0.851, indicating that the sample size was adequate (Cerny & Kaiser, 1977). The value of the Bartlett sphericity test was 0.00,

indicating that the observed variables had a significant correlation among them to run a meaningful EFA. Table 2.8 shows the values of factor loadings for behavioural, somatic and cognitive stress.

Table 2.8: Factor loadings for behavioural, somatic and cognitive stress

Observed variables	Factor loadings		
	Factor 1	Factor 2	Factor 3
	Somatic stress	Behavioural stress	Cognitive stress
BS1	0.110	0.801	0.115
BS2	0.059	0.800	0.118
BS3	0.158	0.709	0.048
BS4	0.170	0.686	0.172
BS5	0.086	0.639	0.302
SS1	0.585	0.005	0.279
SS2	0.811	0.149	0.120
SS3	0.762	0.150	0.024
SS4	0.732	0.110	0.071
SS5	0.784	0.141	0.083
SS6	0.648	0.097	0.237
SS7	0.602	0.091	0.090
CS1	0.224	0.221	0.634
CS2	0.097	0.202	0.763
CS3	0.158	0.080	0.759
CS4	0.099	0.126	0.638

It can be seen from Table 2.8 that all observed variables of behavioural stress load on a single factor, i.e., Factor 2, which is behavioural stress. Similarly, all observed variables of somatic and cognitive stress load significantly on Factor 1 (somatic stress) and Factor 3 (cognitive stress), respectively.

2.3.4. EFA Work performance

Observed variables WP1, WP2, WP3, WP4 and WP5, i.e., questions related to work performance as shown in Appendix A, were used to measure the work performance. The value of the KMO test was 0.794, and the value of the Bartlett sphericity test was

0.00, indicating the adequacy of the data and significant correlation among observed variables, respectively. Table 2.9 shows the values of factor loadings for work performance.

Table 2.9: Factor loadings for control at work dimension of job control

Observed variables	Factor loading
	Work performance
WP1	0.618
WP2	0.752
WP3	0.795
WP4	0.725
WP5	0.659

It can be seen from Table 2.9 that all the observed variables of work performance load significantly on a single factor.

After confirming the validity of the questionnaire, a reliability analysis was done to check reliability of the questionnaire. The following section describes the reliability analysis of the questionnaire.

2.4. RELIABILITY ANALYSIS

In statistical analysis, reliability refers to the extent to which a scale or questionnaire produces consistent results if the measurements are repeated a number of times. Cronbach's alpha is the most common measure of reliability. In the case of multiple Likert questions in a survey/questionnaire, Cronbach's α is used to measure the reliability. Nunnally (1978) suggested a value of Cronbach's α greater than 0.70 for the questionnaire to be reliable.

To check the reliability of the questionnaire value of Cronbach's α was calculated for job control, support, psychological stress and work performance. Table 2.10 shows the values of Cronbach's α for all the latent variables.

Table 2.10: Values of Cronbach's α

Variables	Cronbach's α
Job control	0.735
Support at work	0.772
Support from family	0.735
Support from friends	0.727
Behavioural stress	0.834
Somatic stress	0.858
Cognitive stress	0.859
Work performance	0.837

It can be seen that the value of Cronbach's α was greater than 0.70 for the variables. It suggested that the questionnaire was reliable.

After confirming the validity and the reliability of the questionnaire, the data obtained using the questionnaire was further used to study the objectives defined in Chapter 1. For this purpose, several methods were used. The following section describes the methods used in the study.

2.5. METHODS

Different statistical methods have been used in research to study the relationship between job demand, control and psychological stress, and other outcome variables. A few studies have used ANOVA to check the differences in various outcome variables among different job categories as defined by Karasek (1979) (O'Donnell et al., 2015; Häusser et al., 2011; Brunborg, 2018; Useche et al., 2018; Dutheil et al., 2020). Canjuga et al. (2010) and Ariza-Montes et al. (2018) have also used Binary Logistics Regression (BLR) in predicting neck and back pain and well-being, respectively. Other methods such as linear regression and the Pearson-correlation test have also been used in the research studies (Dollard et al., 1998; De Jonge et al., 1996; Ota et al., 2005).

However, most of the studies have used multiple linear regression analysis to analyse the effect of demand, control and support on various outcome variables (De Jonge et al., 1999; van der Doef et al., 2000; Grönlund, 2007; Söderberg et al., 2012; Leitão et al., 2018). Multiple linear regression is a more specific form of linear regression with more than one variable to predict an outcome. However, if the variables included in the study are latent variables, then this method is not preferred. In such cases, Structural Equation Modelling (SEM) is used. SEM has been used widely in research to study the relationship between various factors, especially in the studies based on JDC and JDCS model (Wright, 2008; Bowen et al., 2014; Lin et al., 2015; Jensen et al., 2021). SEM is a variation of multiple linear regression. SEM is a multivariate statistical analysis method that is generally used to analyse structural relationships. This method is a combination of factor analysis and multiple regression analysis to analyse the structural relationship. In this method, the variables included can be observed or latent. This method is preferred because it estimates the multiple and interrelated dependence in a single analysis.

The main objective of the research work was to check the validity of the JDC and JDCS method and to study the effect of organisational, personal and social factors, psychological stress and WMSDs on the work performance and well-being of the employees. So, ANOVA, BLR and SEM were used to study the different objectives. The validity of the JDC and JDCS model was checked using one-way and three-way ANOVA. The effect of job control dimensions on psychological stress was analysed using BLR. The direct and indirect effect of organisational, personal and social factors, psychological stress and WMSDs on work performance was analysed using Structural Equation Modelling (SEM). The following sub-section briefly describes these methods with a literature survey.

2.5.1. ANOVA

Analysis of Variance (ANOVA) is a statistical method that is used to determine if the means of two or more groups are significantly different from each other. It was developed by Ronald Fisher (1918). ANOVA checks the impact of one or more independent variables on a dependent variable by comparing the means of different samples. Depending on the number of dependent variables, ANOVA is classified as 1) one-way ANOVA, 2) two-way ANOVA, and 3) n-way ANOVA. However, generally one-way, two-way and three-way ANOVA is used in most cases. If n-ANOVA is used with a value of n more than 3, the complexity becomes too high to interpret the results.

The one-way ANOVA is used to determine whether there are any statistically significant differences between the means of two or more independent groups. For example, one-way ANOVA can be used to understand whether there is a significant difference in the scores of examinations amongst students in different sections of the class. In this example, different sections are independent groups. This method has been used in various studies to check the validity of the direct hypothesis of the JDC and JDCS model. In this case, this is the preferred method as the direct hypothesis of the JDC and JDCS model is that there is a significant difference in the occupational stress of employees of different job categories. However, the buffer hypothesis of the JDC and JDCS model is that there is an interaction effect of demand, control and support on occupational stress. So, for the buffer hypothesis using three-way ANOVA is preferred. The three-way ANOVA is used to check if there is an interaction effect between three independent variables on a continuous dependent variable (i.e. if a three-way interaction exists). It can also be used to analyse the direct effect of independent variables on a dependent variable. For example, the effect of extra classes on marks. However, if there is a case of two different sections of the same class concerned, then the effect of extra classes on exam scores can be different (i.e., depending on the section), as well as if the

student is male or female. Indeed, there is a chance that the effect of the extra classes on exam scores will depend on both section and gender. So, there is a need to determine if a three-way interaction effect exists between extra classes, sections and gender (i.e., the three independent variables) in explaining exam scores. Table 2.11 shows the summary of the literature on ANOVA used in checking the validity of the JDC and JDCS models in different studies.

Table 2.11: Summary of literature on ANOVA for JDC and JDCS model

Author (year)	Study design	Outcome
Landsbergis (1998)	Cross-sectional	Job strain Burnout
De Rijk et al. (1998)	Cross-sectional	Job strain
Salanova et al. (2002)	Cross-sectional	Self-efficacy
Brunborg (2008)	Cross-sectional	Stress
Chiu et al. (2009)	Cross-sectional	Turnover intention
Häusser et al. (2011)	Cross-sectional	subjective well-being salivary cortisol
Häusser et al. (2013)	Cross-sectional	Performance
O'Donnell et al. (2015)	Cross-sectional	Heart rate variability (HRV) salivary alpha-amylase (sAA)
Mauno et al. (2016)	Longitudinal	Exhaustion Work-family enrichment
Useche et al. (2018)	Cross-sectional	Stress Traffic safety outcomes
Gómez et al. (2018)	Cross-sectional	Stress Traffic safety outcomes
Gameiro et al. (2020)	Cross-sectional	Burnout

It can be seen from Table 2.11 that ANOVA has been used to check whether there is a difference in the various outcome variables among the job categories. Also, it has been used in the literature to identify the interaction effect of the demand, control and support. In the present work, the objective is to check the validity of the JDC and JDCS method, i.e., 1) to determine if there is a difference in psychological stress and job

satisfaction among the four job categories defined by Karasek (1979) and 2) to determine the interaction effect of demand control and support. So, for this purpose, one-way and three-way ANOVA was used.

2.5.2. Binary Logistics Regression

Binary Logistics Regression (BLR) is an extension of linear regression. It is used when the dependent variable is dichotomous, i.e., yes or no type, e.g., “reported stress Vs no reported stress” or “pass Vs fail”, etc. The independent variables can be dichotomous, ordinal or continuous. BLR is used to understand the relationship between dependent and independent variables and find appropriate statistical conclusions (Singh et al., 2022). It has been used very rarely in the case of the JDC and JDCS model; however, it has been used significantly for predicting outcome variables such as stress and other health-related outcomes (Canjuga et al., 2010; Tsai and Liu, 2012; Alpak et al., 2015; Ariza-Montes et al., 2018; Severn et al., 2012). However, Canjuga et al. (2010) and Ariza-Montes et al. (2018) have used the dimensions of the job demand-control model in predicting neck and back pain and psychological stress, respectively. The second objective of the present work was to analyse the effect of control dimensions in predicting psychological stress. So, for this purpose, BLR was used.

2.5.3. Structural Equation Modelling

Structural equation modelling (SEM) is a powerful multivariate analysis technique that models simultaneous regression equations with latent variables and is widely used in the psychological and social sciences (González et al., 2008). Methods such as linear regression, multivariate regression, path analysis, exploratory factor analysis, and structural regression are special cases of SEM. The following relationships are possible in SEM:

- Observed to observed variables

- Latent to observed variables
- Latent to latent variables

SEM has the ability to uniquely encompass both measurement and structural models. The measurement model is one that relates observed to latent variables, while the structural model relates latent to latent variables. Its applications range from an analysis of simple relationships between observed variables to complex analyses of measurement equivalence for first and higher-order latent variables (Cheung, 2008). It provides a flexible framework to test the validity of theory using empirical models by analysing complex relationships among multiple variables. In SEM, mediating variables can be used in the model to analyse the direct as well as the indirect effect of independent variables. One of the greatest advantages of using SEM is its ability to manage measurement error, which is one of the greatest limitations of most methods. All these advantages to SEM make it very useful in analysing the relationships among various factors.

Most of the studies analysing the effect of organisational or other factors on various outcomes related to the health and performance of the employees are very complex. These studies have both latent and observed variables with relationships among them. In the present work, SEM is used to effectively analyse the relationships between all combinations of observed and latent variables. It has been used significantly in the studies based on the JDC and JDCS models. Table 2.12 summarises the literature on SEM for the studies based on JDC and JDCS models. It can be seen from Table 2.12 that SEM was used in cross-sectional as well as longitudinal studies to analyse various outcomes like burnout, well-being, stress, sleep quality, exhaustion etc.

Objectives three and four of the present work included various latent and observed variables. A high number of variables has led to a very complex situation which can easily be handled by SEM.

Table 2.12: Summary of literature on SEM for JDC and JDCS model

Author (year)	Study design	Outcome
Janssen et al. (2001)	Cross-sectional	Burnout
Heuven and Bakker (2003)	Cross-sectional	Emotional dissonance Burnout
Bakker and Demerouti (2007)	Cross-sectional	Employee well-being
Wong and Lin (2007)	Cross-sectional	Work-to-leisure conflict
Lourel et al. (2008)	Cross-sectional	Burnout
Wright (2008)	Cross-sectional	Stress
De Lange et al. (2009)	Longitudinal	Sleep quality Fatigue
Chen et al. (2009)	Cross-sectional	Job satisfaction
Taris et al. (2010)	Cross-sectional	Professional efficacy Exhaustion
Shih et al. (2011)	Cross-sectional	Turnover intention
Rivera-Torres et al. (2013)	Cross-sectional	Job stress
Lin et al. (2015)	Cross-sectional	Work-to-leisure conflict
Mauno et al. (2016)	Longitudinal	Exhaustion Work-family enrichment
Hosseiniabadi et al. (2018)	Cross-sectional	Job satisfaction

These methods, visualised as ANOVA, BLR and SEM, are used to analyse the data based on the chapter's objective and the independent and dependent variables used.

The next chapter deals with the validity of JDC and JDCS models using ANOVA.