Original Research Article

The research on innovative work behavior of iron and steel companies in Hebei

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Abstract: This research is about the design used to investigate the relationship between innovative work behavior of iron and steel companies that is linked to individual's personality traits (extraversion, agreeableness, conscientiousness, neuroticism, openness to experience), perception of HRM practices and the mediation of innovative climate and innovative work behavior of iron and steel companies. Meanwhile, it also discusses research design, population, sample size and unit of analysis, sampling technique, as well as data collection procedure and data analysis strategy.
Keywords: individual's personality traits; perception of HRM practices; innovative climate; innovative work behavior

1. Population, sample size and unit of analysis

This study aims to explore innovative work behavior of Tangshan iron and steel companies from individual's personality (extraversion, agreeableness, conscientiousness, neuroticism, openness to experience), perception of HRM practices perspective, then the targeted population is the employees working among these companies. The sampling frame for this study is then identified from Tangshan Industrial and Commercial Registration that listed all iron and steel companies. There are currently 36 iron and steel companies in this area, with 600,000 employees working in the iron and steel companies of Tangshan in China.

The sampling guidelines by Krejcie and Morgan (1970) is used by this study because it has taken into account aspects of confidence level and precision estimation in ensuring that the right sample size is chosen in a study. It is a common method to estimate sample size by using Krejcie and Morgan in research (Chuan & Penyelidikan, 2006). Krejcie and Morgan (1970) developed a table to determine the sample size required in a limited population. According to the generalized scientific guidelines by Krejcie and Morgan (1970), the appropriate sample size for this study is 384 employees selected.

The unit of analysis refers to the objects studied in the research, from which data are collected (Kumar, Talib & Ramayah, 2013). The analysis unit can be at the individual level, business unit or organization level, and group level. The analysis unit plays a critical role in the process of solving the problem statement. The analysis unit of this study is at the individual level, representing the employees of different iron and steel companies in Tangshan. Due to the nature of innovative work behavior, focusing at the level of individual can help to identify how individual's personality traits (extraversion, agreeableness, conscientiousness, neuroticism, openness to experience), perception of HRM practices form innovative climate by sense-making and social information processing which will in turn contribute to the individual's innovative work behavior.

2. Sampling technique

Sampling is the process of selecting a sufficient number of elements from the population in order to study the sample and understand its characteristics, so that it is possible to generalize these characteristics to the population elements (Kumar et al., 2013). Therefore, the importance of the research goal is to select samples from the true population to achieve the desired purpose. In this study, the multi-stage sampling technique is adopted, that is, smaller and smaller sampling units are used in each stage, which is divided into two or more stages. In other words, for a given target population, sample selection is carried out in stages to make the sampling process more practical. Therefore, this study adopts two-stage sampling design with multi-stage sampling. In the first stage, 1 iron and steel company was sampled from each of the 13 districts or counties in Tangshan identified

from a sampling frame of Tangshan Industrial and Commercial Registration, in the second stage, 100 targeted employees were selected from each of these iron and steel companies to form a sample group. This will result in 1,300 individual respondents from 36 iron and steel companies being included in our sample group.

Lawley (2001) observed that the sampling technique is a process that involves the population need to be explained, the sampling frame needs to be recognized, and the correct sampling method as well as right instructions need to be chosen. Sampling methods are divided into non-probability sampling and probability sampling (Sekaran, 2003). Non-probability sampling does not allow all individuals to have the same probability of being selected, while probability sampling refers to entities with the same likelihood selected in the population. Since it is impossible to obtain a list of all the elements in the population from which the samples were taken, this study adopted a convenience sampling method. The convenience sampling method is appropriate because the information is collected from individual employees in different departments of iron and steel companies, who are conveniently available or accessible for researchers to use. Besides, convenience sampling is also used when researchers want to cover a large number of surveys quickly and cost effectively, but in this case, it has selection bias and generality is limited (Kumar et al., 2013; Sekaran & Bougie, 2010). This study includes 36 iron and steel companies distributed in 13 districts with 600000 employees. In order to avoid the shortage of convenient sampling and minimize the deviation, this study chooses an iron and steel company in each district, and each company surveys 100 employees. 1300 respondents are chosen in this study. Moreover, these are all iron and steel companies, the homogeneity of each unit is very obvious, convenience sampling method is suitable.

3. Data collection procedure

According to Minbaeva (2008), self-reported measurements are used in most studies of organizational behavior, and are especially useful when the constructs they measure are essentially perceptual such as attitude, perception, etc. They can provide insight into how people perceive and feel about their work-related behaviors. Howard (1994) believes that the most appropriate method to study human behavior is the perceptual and self-reported measurement method, and it may even be better than other methods when used in reasonable design. Moreover, this study translates the English version of the measurement instruments into Chinese, and invited relevant experts in human resource management to demonstrate and check. Eventually, a bilingual version of measurement instruments was built.

This study uses convenience sampling technique to choose the sample. At the pre-data collection stage, initially contacts are made with HR managers to seek their participation in this study. It is also to explain the purpose of this study and to obtain consent to allow their employees to respond to the items of the questionnaire. After the HR manager has indicated his willingness to participate in the survey, a softcopy questionnaire package consists of a letter stating the purpose of the study, the importance of their participation, the confidentiality of the data, and explaining to them that the research is only for academic research and that the set of questionnaires survey forms will be sent to them together. At the data collection stage, each respondent is required to respond to each of the 70 items contained in the questionnaire, in which the instructions are clearly listed to guide the respondent to complete the survey. Respondents will have one week to complete the questionnaire and send it to the designated email address after completion. At the post-data collection stage, the data will be cleaning and handling. When the data is not normal such as all the answers are the same or according to Hair, Hult, Ringle and Sarstedt (2014), if the missing value is more than 15%, they suggested that the response should be removed. The data is then loaded into IBM SPSS version 25, and the dataset is converted into an Excel CVS file to generate the original input for the SmartPLS 2 application. By extracting Excel CVS file into SmartPLS 2 software, the collected data inputs related to all potential variables used in this study are now ready for validation in measurements and structural models, and the resulting outputs are then analyzed using the variance-based PLS-SEM method. SmartPLS 2.0 M 3 software (Ringle, Wende & Will, 2004) is used to perform all PLS-SEM analyses. The software package standardizes the raw data and latent variable scores of the metrics. Thus, the PLS-SEM algorithm calculates the normalized coefficients between-1 and + 1 for each relationship in the measurement model and the structural model (Hair et al., 2014). When analyzing data by PLS-SEM, the measurement model is evaluated first, then the structural model is evaluated. To report the results of the PLS path model, this study followed the PLS-SEM guidelines developed by Chin (2010) and Hair et al. (2014).

4. Data analysis strategy

In order to analyze the data collected from the questionnaire survey, the "Statistical Package for Social Sciences" (SPSS) and the "Partial Least Squares Structural Equation Modeling" (PLS-SEM) are used. SPSS statistical software is one of the most widely used statistical analysis software in social science. A review of Hair, Sarstedt, Pieper and Ringle (2012) shows that PLS-SEM has become an increasingly widely used multivariate analysis technology in management research.

4.1. Preliminary analysis

All the collected quantitative data sets related to the variables are first entered into the SPSS spreadsheet to generate the respondents' demographic profile, along with a descriptive statistical report, including the mean and standard deviation, to provide an overview of the characteristics of the test variables. Then a preliminary analysis is carried out, and before further PLS-SEM analysis, the normality of the data distribution, multicollinearity problems and potential common method variance bias are examined. Firstly, the normality test method is used to observe the matching degree between the distribution data and the normal distribution data (Hair & al, 2005). Before assuming that the observed data come from the normal distribution population, this study uses statistical tests such as Kolmogorov-Smirnov and Shapiro-Wilk normality test to examine the normal distribution of the data. Secondly, the research is continuing to explore the phenomenon of multicollinearity between independent variables, that is, the high correlation between two or more independent variables, which will affect the coefficient of independent variables in multiple regression models (Kumar et al., 2013). Two indicators of tolerance and variance inflation factor (VIF) were used for evaluation of collinearity diagnosis, where VIF was 1 / tolerance. Finally, in order to test the possibility of common method variance bias caused by the use of a single questionnaire to obtain a single information source, the present study conducted a Hamann's single-factor test, in which all measurements were performed using exploratory factor analysis (EFA). This test is essential to examine whether a single potential factor accounts for the majority (i.e. more than 50%) of the total variance explained and whether the variables studied are factorizable.

4.2. PLS-SEM analysis

In this study, PLS-SEM is chosen as a multivariate data analysis technique, because it is considered as a variance-based method to SEM, thus emphasizing the prediction of empirical results and comparing with the theory. As a result, PLS-SEM method is more suitable for testing and predicting the relationship between variables on the basis of prior theoretical knowledge. Thus, it is very important to use the score of latent variables to predict the correlation and explore the potential relationship between latent variables in theoretical models. PLS-SEM has become a particularly useful multivariate statistical analysis method, and its application is becoming more and more popular in strategic management research. In addition, the theoretical model of the conceptual relationship between personality traits (extraversion, agreeableness, conscientiousness, neuroticism, openness to experience), perception of HRM practices and innovative work behavior of iron and steel companies and the mediating role of innovative climate is still not well developed, and the conceptual framework cannot be supported in the case of limited empirical evidence. Therefore, it is further proved that the variance-based PLS-SEM technique is a more appropriate method in this study. Furthermore, PLS-SEM works well under the conditions of small sample size, complex model, large number of latent variables, large number of indicators and non-normal distribution of data (Chin, 2010; Chin & Newsted, 1999). Finally, When PLS-SEM is applied, researchers benefit from efficient parameter estimation, which indicates that the statistical ability of the method is better than that of CB-SEM (Hair et al., 2014). This means that PLS-SEM is more likely to present a specific relationship between significant and actually significant groups. PLS-SEM is also less restrictive (or flexible) because it does not assume the multivariate normal distribution of data. In fact, PLS-SEM is a nonparametric method, which can be used to analyze data when the normal hypothesis is violated. It can also easily deal with reflective and formative measurement models without identification problems.

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References

[1] Chin, W. W., Newsted, P. R. (1999). Structural equation modeling analysis with small samples using partial least squares. Statistical strategies for small sample research, 1(1), 307-341.

[2] Chuan, C. L., Penyelidikan, J. (2006). Sample size estimation using Krejcie and Morgan and Cohen statistical power analysis: A comparison. Jurnal Penyelidikan IPBL, 7(1), 78-86.

[3] Daft RL (2007). Understanding the theory and design of organization.China: Thomson South Western.

[4] Fornell, C., Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. Journal of marketing research, 18(1), 39-50.

[5] Hair, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2014). A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM).

[6] Hair, J. F., Sarstedt, M., Pieper, T. M., et al. (2012). The use of partial least squares structural equation modeling in strategic management research: a review of past practices and recommendations for future applications. Long range planning, 45(5-6), 320-340.

[7] Howard, G. (1994). Why do people say nasty things about self-reports? Journal of Organizational Behavior, 15 (5), 399-404.

[8] Krejcie, R. V., Morgan, D. W. (1970). Determining sample size for research activities. Educational and Psychological Measurement, 30, 607-610.

[9] Kumar, M., Talib, S. A., Ramayah, T. (2013). Business research methods. Oxford Fajar/Oxford University Press.

[10] Lawley, M. (2001) Research methods for managers. Faculty of Business Course Work, University of Sunshine Coast.

[11] Minbaeva, D. B. (2008). HRM practices affecting extrinsic and intrinsic motivation of knowledge receivers and their effect on intra-MNC knowledge transfer. International Business Review, 17(6), 703-713.

[12] Ringle, C., Wende, S., Will, A. (2004). SmartPLS Software Version 2.0. M3.

[13] Sekaran, U. (2003). Research method for business: A skill building approach, 4th edition. Jon Wiley & Sons.