Modelling an Integrated Human Performance Model of the Train Driver

Jalil Azlis-Sani1, Siti Zawiah Md Dawal2, Norhayati Mohmad Zakwan3

1Faculty of Mechanical and Manufacturing Engineering, Universiti Tun Hussein Onn Malaysia, 86400 Batu Pahat, Johor, Malaysia
2Department of Mechanical Engineering, Faculty of Engineering, University of Malaya, 50603 Kuala Lumpur, Malaysia
3Department of Business Administration, Faculty of Management, Universiti Teknologi Malaysia, UTM Skudai, 81310, Johor, Malaysia

E-mail: azlis@uthm.edu.my

Abstract. The purpose of this paper is to address the development an integrated performance model of train drivers. A human performance measure was developed by integrating several significant factors of the train driver. The evaluation was conducted on train drivers of a major train operating company (TOC) in Malaysia, focusing only on drivers of intercity passenger trains and freight trains. 229 respondents had participated in the quantitative paper-and-pencil survey conducted, and the data obtained was subsequently analysed using SPSS software and was then tested using structural equation modelling (SEM)-PLS approach in the SmartPLS software to determine the relationship among the significant factors of train driver performance. Fourteen factors were hypothesized and tested under the three main domains, namely human domain; activity domain; and lastly, the context domain. The results indicated that fatigue, job related tension (internal conflict) and occupational stress; under human domain were found to be the significant factors which influence the performance of train drivers. For the activity domain, hypothesis testing proved that driving task, was significant factor. In the context domain; three factors were found to be significant. These include safety culture, working environment and working condition. To summarize, the study identified a total of seven significant factors which include occupational stress, job related tension – internal conflict, fatigue, driving task, work environment, safety culture and working condition. However, the results have failed to support the remaining seven factors of job related tension (external conflict), job satisfactions, sleep, job demand, work facilities, and safety issue.

1. Introduction
The performance of train drivers has been studied during the past decade, especially in the United Kingdom after the train accident at Ladbroke Grove on 5th October 1999 [1-3]. These studies have focused on factors such as cognitive, workload, fatigue, sleepiness and analysis of task. There were also studies on accident analysis, new design of cab, safety and operating system [4-9].

However, there are very limited literatures on the performance of train driver as an integrated model which relates the various influencing factors. Past research has focused on assessment of individual
influencing factors, overlooking the relationship possibilities between them. Furthermore, these factors were not categorised systematically, whether based on its common characteristics or on the HFE basic interacting domains of human – machine – environment. Understanding the relationship between the performance of train drivers and factors influencing their performance would enable their integration into the development of a performance model [10]. The availability of the performance model would offer a holistic approach in evaluation of train driver performance to ensure the safety of the train journey as well as the overall system [11]. In addition, the performance evaluation would improve the quality of service, reduce degree of risk and avoid occurrence of accidents. Most studies on train driver performance have been conducted in European countries, especially in the United Kingdom. To date, there has yet to be any study conducted on performance measurement of train drivers in Malaysia.

This study consists of three major domains influencing the performance of the train drivers in Malaysia namely drivers’ activities, context and human domains. These domains cover the generic factors of human performance as proposed by Bailey [12], Baines, Asch [10] and Chang and Yeh [13]. A total of sixty factors were extracted from their studies, although to consider all of the proposed factors in this study, given the constraint of time and resources, is quite impossible. However, the selections of domains and factors for this study by using factor analysis are considered sufficient within the scope of the research work. These three domains (activities, context and human) are considered to be sufficient in representing human performance within the time frame of the research.

The major reference of this study is based on the research by Ryan, Wilson [14] on the development of the Rail Ergonomics Questionnaire (REQUEST) instrument with several adaptations and modifications. This comprehensive instrument was designed especially for railway workers and has been refined and developed over a number of years. Additions to the REQUEST instrument were made based on the studies of Strahan, Watson [15], John [16-18], Johns and Hoaking [19], Gradisar, Lack [20], Austin and Drummond [21] and Dawal, Taha [22].

The present study was conducted on the train drivers of a major train operating company (TOC) in Malaysia. Since all the train drivers were males, there were no data for female respondents. The survey was conducted on intercity passenger and freight train drivers. These types of trains are characterised by their long-haul journeys with a minimum of four hours trips, which may have a significant impact on the safety of the rail network.

2. Methodology

In this study, subjective rating scales would be the main method used to gather responses from the subjects and the environment [23, 24]. Demand and effects of the employees’ wellbeing would be investigated to evaluate their performance [25]. A questionnaire survey would be used to obtain individual responses, which is known to be the best method for collecting perceptions and opinions from the driver with regard to their performance [14].

2.1 Self-administered questionnaire

The survey questionnaire used was developed from the combination of several existing validated measurements of past research; which are worded in English, were carefully translated into Bahasa Malaysia (Malaysian language) and verified by experts to ensure linguistic and contextual accuracy. The translations were necessary since most of the respondents were well-versed only in Bahasa Malaysia. The instrument consisted of 148-items for measuring nine variables.

Structural equation modelling (SEM) technique is used to evaluate the model and to determine the relationships between variables. Since the research is in the exploratory stage in determining the
relationship between variables in measuring the performance of the train driver, the PLS-SEM approach is considered to be the most suitable.

3. Result

3.1 Evaluation of the measurement model

A systematic analysis using a partial least square (PLS) approach is used, which presents the results in two steps [26, 27]. The first step examined the validity and reliability of the survey items in the measurement model, whereas the second step analyses the structural model. The measurement model consists of composite reliability to evaluate internal consistency, and convergent validity by using average variance extracted (AVE). Discriminant validity was assessed using the Fornell-Larcker criterion and cross loadings.

3.1.1 Convergent validity

Convergent validity was assessed through factor loadings, composite reliability and average variance extracted (AVE) [28]. The loading of the items should be greater than 0.5 with composite reliability (CR) values of 0.7 [28]. The average variance extracted (AVE) proposed by Fornell and Larcker (1981) was to measure the variance amount from the indicators relative to measurement error. For convergent validity, the AVE values should be more than 0.5 [27].

Table 1 summarizes the results of the measurement model, showing that the values for loadings and CR for all the domains of human, activity and context are generally greater than the cut-off value for loadings and CR, showing that all the constructs have met the recommended values and are thus reliable and valid. The values highlighted in grey boxes shows the improved values after deletion of unreliable items.

3.1.2 Discriminant Validity

Discriminant validity is another assessment of the constructs (factors) to test the validity of the measurement. Discriminant validity tests whether believed unrelated constructs are indeed unrelated. Thus, the cross-construct correlations should be very low, whereas it should measure strongly the construct it attempts to reflect [27].
| Domain                  | Factors                                      | Items      | Loading | AVE  | CR   |
|------------------------|----------------------------------------------|------------|---------|------|------|
| Fatigue                |                                              | FF01 0.718 |         |      |      |
|                        |                                              | FF02 0.839 |         |      |      |
|                        |                                              | FF03 0.840 |         |      |      |
|                        |                                              | FF04 0.533 |         |      |      |
|                        |                                              | FF06 0.748 |         |      |      |
|                        |                                              | FF07 0.725 |         |      |      |
|                        |                                              | JRT1 0.732 |         |      |      |
|                        |                                              | JRT14 0.813|         |      |      |
|                        |                                              | JRT11 0.696|         |      |      |
|                        |                                              | JRT13 0.514|         |      |      |
|                        |                                              | JRT15 0.570|         |      |      |
|                        |                                              | JRT17 0.644|         |      |      |
|                        |                                              | JRT19 0.677|         |      |      |
|                        |                                              | JRT17 0.695|         |      |      |
|                        |                                              | JRT19 0.526|         |      |      |
| Job related tension    | (external conflict)                          | JRT11 0.696|         |      |      |
|                        | (internal conflict)                          | JRT13 0.514|         |      |      |
|                        | (internal conflict)                          | JRT15 0.570|         |      |      |
|                        | (internal conflict)                          | JRT17 0.644|         |      |      |
|                        | (internal conflict)                          | JRT19 0.677|         |      |      |
|                        | (internal conflict)                          | JRT17 0.695|         |      |      |
|                        | (internal conflict)                          | JRT19 0.526|         |      |      |
| Human                  |                                              | JRT11 0.696|         |      |      |
|                        |                                              | JRT13 0.514|         |      |      |
|                        |                                              | JRT15 0.570|         |      |      |
|                        |                                              | JRT17 0.644|         |      |      |
|                        |                                              | JRT19 0.677|         |      |      |
|                        |                                              | JRT17 0.695|         |      |      |
|                        |                                              | JRT19 0.526|         |      |      |
| Job Satisfaction 1     |                                              | JS1 0.620  |         |      |      |
|                        |                                              | JS2 0.806  |         |      |      |
|                        |                                              | JS3 0.666  |         |      |      |
|                        |                                              | JS4 0.847  |         |      |      |
|                        |                                              | JS5 0.768  |         |      |      |
| Job Satisfaction 2     |                                              | JS6 0.863  |         |      |      |
|                        |                                              | JS7 0.907  |         |      |      |
|                        |                                              | JS8 0.722  |         |      |      |
| Occupational Stress    |                                              | STR1 0.801 |         |      |      |
|                        |                                              | STR19 0.672|         |      |      |
|                        |                                              | STR2 0.796 |         |      |      |
| Sleep                  |                                              | FSL02 0.928|         |      |      |
|                        |                                              | FSL03 0.577|         |      |      |
|                        |                                              | FSL07 0.564|         |      |      |
| Activity               | Driving task                                 | DT1 0.700  |         |      |      |
|                        | Driving task                                 | DT2 0.764  |         |      |      |
|                        | Driving task                                 | DT3 0.768  |         |      |      |
| Job Demand             |                                              | JCH1 0.750 |         |      |      |
|                        |                                              | JCH2 0.835 |         |      |      |
|                        |                                              | JCH5 0.513 |         |      |      |
| Working condition      |                                              | SI06 0.610 |         |      |      |
|                        |                                              | WC6 0.634  |         |      |      |
|                        |                                              | WC7 0.678  |         |      |      |
| Safety Culture         |                                              | SI05 0.810 |         |      |      |
|                        |                                              | SC08 0.793 |         |      |      |
|                        |                                              | SC10 0.695 |         |      |      |
| Safety Issue           |                                              | SI01 0.819 |         |      |      |
|                        |                                              | SI02 0.771 |         |      |      |
|                        |                                              | SI04 0.666 |         |      |      |
|                        |                                              | SI05 0.784 |         |      |      |
| Working Environment 2  |                                              | WE12 0.781 |         |      |      |
|                        |                                              | WE14 0.908 |         |      |      |
|                        |                                              | WE15 0.704 |         |      |      |
| Work Facilities        |                                              | WE12 0.781 |         |      |      |
|                        |                                              | WE14 0.908 |         |      |      |
| Performance            |                                              | WE15 0.704 |         |      |      |
The discriminant validity of this study is presented in Table 2, showing the average variance extracted (AVE) of the factor (construct), indicated in bold, is much greater than the squared correlations for each construct. This indicates adequate discriminant validity is achieved. Since the measurement model demonstrated adequate convergent validity and discriminant validity, this indicated that each factor (construct) was unique and captured phenomena not represented by other factors in the model [29].

Table 2: Discriminant validity of construct

| Working condition | Driving task | Fatigue | JRT 2 external | JRT 1 internal | Job Demand | Job Sat 1 | Job Sat 2 | Occp Stress | Performance | Safety Culture | Safety Issue | Sleep | Work Env2 | Work Facilities |
|-------------------|--------------|---------|----------------|---------------|------------|----------|----------|-------------|-------------|---------------|-------------|--------|-----------|-----------------|
| Working condition | 0.583        |         |                |               |            |          |          |             |             |               |             |        |          |                  |
| Driving task      | 0.025        | 0.579   |                |               |            |          |          |             |             |               |             |        |          |                  |
| Fatigue           | 0.066        | 0.160   | 0.550          |               |            |          |          |             |             |               |             |        |          |                  |
| JRT 2 external    | 0.030        | 0.223   | 0.095          | 0.598         |            |          |          |             |             |               |             |        |          |                  |
| JRT 1 internal    | 0.046        | 0.226   | 0.213          | 0.219         | 0.586      |          |          |             |             |               |             |        |          |                  |
| Job Demand        | 0.014        | 0.002   | 0.000          | 0.000         | 0.006      | 0.597    |          |             |             |               |             |        |          |                  |
| Job Sat 1         | 0.006        | 0.051   | 0.106          | 0.038         | 0.100      | 0.045    | 0.557    |             |             |               |             |        |          |                  |
| Job Sat 2         | 0.002        | 0.000   | 0.004          | 0.002         | 0.000      | 0.007    | 0.696    |             |             |               |             |        |          |                  |
| Occp Stress       | 0.016        | 0.107   | 0.115          | 0.026         | 0.111      | 0.008    | 0.047    | 0.006       | 0.571       |               |             |        |          |                  |
| Performance       | 0.035        | 0.024   | 0.035          | 0.013         | 0.041      | 0.003    | 0.017    | 0.002       | 0.000       | 0.540         |             |        |          |                  |
| Safety culture    | 0.035        | 0.019   | 0.077          | 0.034         | 0.127      | 0.000    | 0.181    | 0.000       | 0.030       | 0.041         | 0.599       |        |          |                  |
| Safety Issue      | 0.041        | 0.001   | 0.031          | 0.001         | 0.000      | 0.040    | 0.002    | 0.000       | 0.007       | 0.005         | 0.001       | 0.584   |          |                  |
| Sleep             | 0.003        | 0.015   | 0.088          | 0.031         | 0.014      | 0.001    | 0.025    | 0.001       | 0.003       | 0.005         | 0.002       | 0.002   | 0.000  | 0.516          |
| Work Env1         | 0.013        | 0.029   | 0.010          | 0.013         | 0.051      | 0.008    | 0.060    | 0.000       | 0.029       | 0.011         | 0.045       | 0.001   | 0.001   | 0.643          |
| Work Facilities   | 0.063        | 0.016   | 0.048          | 0.006         | 0.006      | 0.006    | 0.059    | 0.006       | 0.004       | 0.023         | 0.099       | 0.000   | 0.002   | 0.028          | 0.791    |

*Diagonals (in bold) represent the AVE while the off diagonals represent the squared correlations

3.2 Evaluation of the structural model

Once it has been determined that the factors are reliable and valid, the subsequent process is to analyse the structural model by testing the hypothesis [26, 27]. The assessment of the structural model is used to determine whether the concept which has been selected is empirically confirmed.

Table 3: List of the hypotheses of the modified model

| Domain | Hypothesis                        | Activity | Context | Human |
|--------|-----------------------------------|----------|---------|-------|
| H1     | Occupational stress               | H6       | H8a     | H1    |
| H2a    | Job related tension (internal conflict) | H7       | H8b     | H2a   |
| H2b    | Job related tension (external conflict) |         | H9a     | H2b   |
| H3a    | Job satisfaction (1)              |          |         | H3a   |
| H3b    | Job satisfaction (2)              |          |         | H3b   |
| H4     | Fatigue                           |          |         | H4    |
| H5     | Sleepiness                        |          |         | H5    |

E.g.: (Factor) has a significant effect on the performance of train driver
The modified model consists of three domains with fourteen hypotheses. Table 3 lists the hypotheses of the modified model after factor analysis process. Hypothesis testing was used to examine the path loadings and -value between constructs of the inner model. Furthermore, bootstrapping technique was implemented with t-statistics to test for significance. Table 4 shows the path coefficients’ and the results of hypothesis testing.

From the seven hypotheses drawn for human domain, three factors were found to be not significant. The non-significant factors were job related tension (external conflict) and two factors of job satisfactions. Fatigue was positively related (t= 1.371, p<0.1) with the performance of the train driver. Other factors tested for hypotheses for the human domain were job related tension (internal conflict) (t=1.998, p<0.05) and occupational stress (t=4.448, p<0.01) towards performance of the train driver.

For the activity domain, the driving task was found to have positive relationship to performance as its hypothesis is significant (t = 2.170, p<0.05). Conversely, the job demand was found as a non-significant factor on train driver performance (t = 0.428).

The context domain has five factors, from which only three factors had significant hypothesis. The significant factors having direct positive effects on the performance of train drivers were safety culture (t=2.065, p<0.05), working environment (t=2.417, p<0.01) and working condition (t=1.935, p<0.05). On the other hand, safety issue and working condition were found to be non-significant to the performance of the driver.

### Table 4: Path coefficients’ and hypothesis testing

| Cluster | Hypothesis | Beta | Standard Error | t-value | Decision |
|---------|------------|------|----------------|---------|----------|
| Human   | H1         | Occupational Stress → Performance | 0.328  | 0.074 | 4.448*** | Significant |
|         | H2a        | Job related tension (internal conflict) → Performance | 0.148  | 0.074 | 1.998** | Significant |
|         | H2b        | Job related tension (external conflict) → Performance | -0.043 | 0.073 | 0.587  | Not significant |
|         | H3a        | Job Satisfaction 1 → Performance | -0.042 | 0.071 | 0.584  | Not significant |
|         | H3b        | Job Satisfaction 2 → Performance | -0.045 | 0.064 | 0.648  | Not significant |
|         | H4         | Fatigue → Performance | -0.085 | 0.073 | 1.371* | Significant |
|         | H5         | Sleep → Performance | -0.026 | 0.080 | 0.327  | Not significant |
|         | H6         | Job Demand → Performance | -0.037 | 0.086 | 0.426  | Not significant |
|         | H7         | Driving task → Performance | 0.141  | 0.065 | 2.170**| Significant |
| Activity| H8a        | Working environment → Performance | -0.176 | 0.073 | 2.417***| Significant |
|         | H8b        | Work facilities → Performance | 0.076  | 0.070 | 1.089  | Not significant |
|         | H9a        | Safety culture → Performance | -0.133 | 0.065 | 2.065**| Significant |
|         | H9b        | Safety Issue → Performance | 0.060  | 0.084 | 0.712  | Not significant |
|         | H10        | Working condition → Performance | 0.120  | 0.062 | 1.935**| Significant |

Note: *(10%) p<0.1 = 1.28; **(5%) p<0.05 = 1.645 ; *** (1%) p<0.01=2.33 | One-tailed test

4. The performance Model

Fourteen factors were initially evaluated by hypothesis testing, from which seven factors were identified to be significant. Figure 1 shows the overall graphical representation of the model. From the fourteen hypotheses tested, only seven were accepted which were found to have a strong influence on the performance of the train driver. These hypotheses are: H1 (occupational stress), H2a (job related tension – internal conflict), H4 (fatigue), H7 (driving task), H8a (work environment), H9a (safety culture) and H10 (working condition).
5. Conclusion

Three domains, namely human, activity and context, were proposed to categorise the fourteen factors. The relationships between factors were evaluated iteratively using SEM-PLS. The measurement model was also evaluated through composite reliability, prioritizing the indicators according to their individual reliability. This evaluation technique validated that all items with high loading were measuring a particular factor but were loaded lower on other factors. The convergent validity was also measured and confirmed that the items used were valid, reliable, and correlated positively to measure the same construct (factor). Discriminant validity was performed to assess the validity of the measurements, to ensure that constructs were not measuring other constructs or overlapping constructs. It is expected that the cross-construct correlations should be very low but would measure strongly the construct it attempts to reflect. It was found that all factors have average variance extracted (AVE) values greater than 0.5, indicating that each factor was unique and captured phenomena not represented by other factors in the model.

From the originally proposed structural model having fourteen hypotheses, only seven hypotheses were found to be significant. These are job-related tension (internal conflict), fatigue, occupational stress, driving task, work environment, working condition and safety culture. The results highlighted that the three domains i.e. human, context and activity with their seven factors are important in developing an integrated train driver performance model for Malaysia.

Acknowledgment

The authors are supported by the University of Malaya Postgraduate Grants and Fundamental Research Grant Scheme (FRGS) Vot 1542, Office of Research, Innovation, Commercialization and Consultation (ORICC) Universiti Tun Hussein Onn Malaysia. The authors would also like to thank Keretapi Tanah Melayu Berhad on the contribution and participation for this study.

References

[1] Wilson, J.R. and B.J. Norris 2005 Special issue on rail human factors Applied Ergonomics 36(6) 647-648

[2] Stanton, N.A. and G.H. Walker 2011 Exploring the psychological factors involved in the
Ladbroke Grove rail accident *Accident Analysis & Prevention* **43**(3) 1117-1127

[3] Sutherland, C. and L. Groombridge 2001 The Paddington rail crash: identification of the deceased following mass disaster *Science & Justice* **41**(3) 179-184

[4] Darwent, D., N. Lamond, and D. Dawson 2008 The sleep and performance of train drivers during an extended freight-haul operation *Applied Ergonomics* **39**(5) 614-622

[5] Dorrian, J., et al. 2006 The effects of fatigue on train handling during speed restrictions *Transportation Research Part F: Traffic Psychology and Behaviour* **9**(4) 243-257

[6] Dorrian, J., et al. 2007 Simulated train driving: Fatigue, self-awareness and cognitive disengagement *Applied Ergonomics* **38**(2) 155-166

[7] Edkins, G.D. and C.M. Pollock 1997 The influence of sustained attention on Railway accidents *Accident Analysis & Prevention* **29**(4) 533-539

[8] Farrington-Darby, T., J.R. Wilson, and B.J. Norris 2005 Investigating Train Driver Behaviour: The Use of Lineside Information When Regulating Speed *Rail Human Factors: Supporting the Integrated Railway*, ed. J.R. Wilson, et al. (Ashgate) 60 - 69

[9] Jay, S.M., et al. 2008 Driver fatigue during extended rail operations *Applied Ergonomics* **39**(5) 623-629

[10] Baines, T.S., et al. 2005 Towards a theoretical framework for human performance modelling within manufacturing systems design *Simulation Modelling Practice and Theory* **13**(6) 486-504

[11] Williamson, A., et al. 2011 The link between fatigue and safety *Accident Analysis & Prevention* **43**(2) 498-515

[12] Bailey, R.W. 1996 Human performance engineering : designing high quality, professional user interfaces for computer products, applications, and systems. 3rd ed. (New Jersey: Prentice Hall)

[13] Chang, Y.H. and C.H. Yeh 2010 Human performance interfaces in air traffic control *Applied Ergonomics* **41**(1) 123-129

[14] Ryan, B., et al. 2009 Developing a Rail Ergonomics Questionnaire (REQUEST) *Applied Ergonomics* **40**(2) 216-229

[15] Strahan, C., B. Watson, and A. Lennon 2008 Can organisational safety climate and occupational stress predict work-related driver fatigue? *Transportation Research Part F: Traffic Psychology and Behaviour* **11**(6) 418-426

[16] Johns, M.W. 1991 A New Method for Measuring Daytime Sleepiness: The Epworth Sleepiness Scale *Sleep* **14**(6) 540-545

[17] Johns, M.W. 1992 Reliability and Factor Analysis of the Epworth Sleepiness Scale *Sleep* **15**(4) 376-381

[18] Johns, M.W. 1993 Daytime Sleepiness, Snoring and Obstructive Sleep Apnea: The Epworth Sleepiness Scale *Chest* **103** 30-36

[19] Johns, M.W. and B. Hoaking 1997 Excessive Daytime Sleepiness: Daytime Sleepiness and Sleep Habits of Australian Workers *Sleep* **20**(10) 844-849

[20] Gradisar, M., et al. 2007 The Flinders Fatigue Scale: Preliminary Psychometric Properties and Clinical Sensitivity of a New Scale for Measuring Daytime Fatigue associated with Insomnia *Journal of clinical sleep medicine: official publication of the American Academy of Sleep Medicine* **3**(7) 722-728

[21] Austin, A. and P.D. Drummond 1986 Work problems associated with suburban train driving *Applied Ergonomics* **17**(2) 111-116

[22] Dawal, S.Z., Z. Taha, and Z. Ismail 2009 Effect of job organization on job satisfaction among shop floor employees in automotive industries in Malaysia *International Journal of Industrial Ergonomics* **39**(1) 1-6
[23] Annett, J. 2002 Subjective rating scales: science or art? *Ergonomics* **45** 966-987
[24] Wilson, J.R. and C.E. Nigel, eds. 1995 Evaluation of Human Work. 2nd ed. Taylor & Francis
[25] Wilson, J.R. 1995 Chapter 1 : A Framework and a Context for Ergonomics Methodology, in *Evaluation of Human Work*, W. John R and E.N. Corlett, Editors (Taylor and Francis)
[26] Anderson, J.C. and D.W. Gerbing 1991 Predicting the Performance of Measures in a Confirmatory Factor Analysis With a Pretest Assessment of Their Substantive Validities *Journal of Applied Psychology* **Vol. 76(No. 5)** 732 - 740
[27] Chin, W.W. 2010 How to Write Up and Report PLS Analyses: Handbook of Partial Least Squares, V. Esposito Vinzi, et al., Editors. (Springer Berlin Heidelberg) 655-690.
[28] Hair, J.F., et al. 2010 Multivariate Data Analysis. 7th ed. (Prentice Hall)
[29] Hair, J.F., et al. 2014 A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM) (SAGE Publications, Inc.) 328.