Validation of the Assessment of Performance Competency

Chaiwichit Chianchana[a]*, Sageemas Na Wichian[b]

* Corresponding author: Chaiwichit Chianchana, chaiwichit.c@fte.kmutnb.ac.th

[a]*Assist. Prof. Dr., Faculty of Technical Education,King Mongkut's University of Technology North Bangkok, Thailand,
E-mail: chianchanachch@hotmail.co.th, chaiwichit.c@fte.kmutnb.ac.th Tel: (66) 2555-2000 Ext.3209*
[b]*Assoc. Prof. Dr., College of Industrial Technology, King Mongkut's University of Technology North Bangkok, Thailand,
E-mail: sageemas.n@cit.kmutnb.ac.th; Tel: (66) 2555-2000 Ext.6625*

Abstract

http://dx.doi.org/10.15405/epsbs.2016.05.21

Competency, which has complexity, means that competency assessment has to be done elaborately and in-depth. The importance of assessment is that it has to show the evidence of validity. Is assessment of performance competency by the methods of rash analysis, inter-subtest correlation analysis, and confirmatory factor analysis valid or not. The purpose of research is to examine the validity of assessment of performance competency by the methods of rash analysis, inter-subtest correlation analysis, and confirmatory factor analysis. The sample group consisted of directors and employees. The instruments included three volumes - assessment by director (volume I), self-assessment (volume II), and supervisor assessment (volume III). The data were analyzed by the rash analysis, inter-subtest correlation analysis, and confirmatory factor analysis. Results revealed that the examination by the rash analysis volume I fit almost all of the items, whereas volume II and volume III had all values in the range of statistical acceptance, the inter-subtest correlation analysis in all volumes had a high level of relationship, and the confirmatory factor analysis for all volumes was concordant with the empirical data. The evidence of examination on three methods based on the measurement standard for item response theory and classical test theory can indicate the quality of assessment of performance competence very well.

Keywords: Validity; Performance competency; Rash analysis; Inter-subtest correlation analysis; Confirmatory factor analysis.

1. Introduction

Society is always changing; therefore, a successful organization has to be improved and developed all the time. Organizational success depends on the drive of human resources. The organization which has the ready, potentiality, and competent human resources for performance gets the advantage and has the opportunity to achieve great success. Hence, the human factor is considered crucial factor for the performance in the organization. The success of an organization, thus, depends on employee

performance as the crucial factor. The indicator leading to the success is essential for performance of employees in the organization (Kesler, 1995; Beheshtifar, 2011). An individual will expose any competency and usually depends on various components in terms of knowledge, skills/competency, and other characteristics. These crucial components affect the competency of individuals (behavioral characteristics of performance). Moreover, the competency also has a relationship with the accomplishment (Office of the Civil Service Commission, 2005).

Competency is complicated; hence, the competency assessment should be done elaborately, deeply, and with variation. This is in accordance with the concept of Baartman et al. (2006) who said that the competency assessment is very complex, and that one single assessment method seems not to be sufficient. Moreover, Koeppen et al. (2008) suggested that the competencies are conceptualized as complex ability constructs. For the challenge point of this research about competency assessment, one of the points is about psychological models (Frey & Hartig, 2009). In addition, Vazirani (2010) represented the challenge of using competency models for measuring or appraising certain areas of performance and providing developmental feedback based on these assessments. Thus, it can be seen that competency is complex. It has to be assessed elaborately and with in-depth scrutiny. Only a single method cannot be sufficient, and the interested point to be studied should be in terms of psychological models.

Competency assessment has to be done indirectly; it cannot be measured directly but has to use qualified instruments, and the qualified instruments have to be considered carefully in terms of validity. According to the Educational Testing Service, 'validity is the most important aspect of the quality of an assessment' (2002), and the American Educational Research Association et al. stated that 'validity is the most fundamental consideration in developing and evaluating tests' (1999) According to the definition of validity, from the Standards for Educational and Psychological Testing (as cited in AERA et al., 1999), validity refers to "the degree to which evidence and theory support the interpretations of test scores entailed by proposed uses of tests". The validation process, therefore, involves the accumulation of evidence to support the proposed test score interpretations and uses. The process of accumulating evidence to support the validity of test score interpretations starts prior to the development of an assessment (AERA et al., 1999). This suggests that the evidence of validity on the instruments used to assess is the qualification which had to be considered at the first stage.

Regarding the backgrounds of this research, in terms of competency which had complexity, competency assessment has to be done elaborately and with in-depth scrutiny. The importance of assessment is that it has to show the evidence of validity by correct and accurate evaluation; thus, various methods of assessment are necessary to be used in order to reach correctness and accuracy of competency assessment. This will be the reflection of quality through competency assessment to lead to measurement, assessment, and development of personnel for performance in the organization effectively and successfully with sustainable performance.

2. Purposes of the study

The purpose of this research is to examine the validity of assessment of performance competency by the methods of rash analysis, inter-subtest correlation analysis, and confirmatory factor analysis.

3. Research methods

3.1. Participants

1）The group of employees in the self-assessment is the TISCO company's employees working between 2013 and 2014. Tisco is a financial institute running the business with the highest standard of good supervision. The Company is considered as a large company, consisting of Tisco Financial Group, Tisco Bank, Tisco Securities, and Tisco Asset. The Company has been numerously rewarded for success, which reflects the quality of the organization, such as the reward of Board of The Year 2013, Top Corporate Governance Report Awards 2013, Outstanding Securities Company Awards 2013 – Retail Investors, Outstanding Securities Company Awards 2013 – Institutional Investors, Outstanding Investor Relations Awards 2013, "A" on Hewitt Best Employers in Thailand 2013, and Top Bank in the Secondary Market for Corporate Bonds 2012 (Tisco, 2014). The subjects are from stratified random sampling by having the strata pillar, as well as having the employees as the random unit from the assessed employees for 3,929 persons.

2）The group of assessments by directors were obtained from purposive sampling. They are the direct superiors of the employees.

3）The group of employees in the supervisor assessment consists of 516 TISCO Company's supervisors from stratified random sampling by having the strata pillar.

3.2. Instrumentation

There are three instruments used to measure the five aspects of competency, which are, communication, personnel, logic, business, and leadership. These consist of twenty-four lists in total. The volume I is about the assessment form of performance competency of the directors. The response is in the form of a rubric score, by investigating the quality of instruments in terms of content validity. The consideration of the experts has the value of index of consistency between 0.6 and 1.00. The form is used by the directors who have to assess 48 employees. The item-total correlation value is between .03 and .76. The reliability is carried out by using the formula of Cronbach's alpha coefficient equal to .91 and equal to Spearman-Brown coefficient .56. For the volume II, it is the assessment form of performance competency on Self-Assessment. The investigation of instruments quality in terms of content validity by consideration of the experts has the value of index of consistency between 0.6 and 1.00. The form was tried out by 52 employees. The value of item-total correlation was between -.14 and .44. The reliability was carried out by using the formula of Cronbach's alpha coefficient equal to .54 and equal to Spearman-Brown coefficient .86. The volume III is about the assessment form of performance competency of the supervisors. The investigation of instruments quality in terms of

content validity, by consideration of the experts, has the value of index of consistency between .50 and 1.00. The form is used by the employees who have to assess 52 supervisors. The value of item-total correlation was between .22 and .53. The reliability was carried out by using the formula of Cronbach's alpha coefficient equal to .93 and equal to Spearman-Brown coefficient .83.

3.3. Procedure

For the process of validity examination on instruments of three volumes, each volume is examined by three methods: 1) Rash analysis — this method will examine the fundamental data of the uni-dimensionality or multi-dimensionality by factors analysis considered by Eigen value, then it will be analyzed by multi-dimensional random coefficients multinomial logit model (MRCMLM), which is considered by INFIT mean square or weighted mean square (INFIT MNSQ), 2) Inter-subtest correlation analysis — this can be analyzed by the relationship of five sub-competency scores and total competency scores by using the Pearson correlation coefficient considered by the validity from statistical significance, and 3) Confirmatory factor analysis — this is the confirmation of five competency components considered by the concordance of the model with empirical data from the chi square, goodness of fit index, adjusted goodness of fit index, root mean square residual, and root mean square error of approximation

4. Findings

4.1. Rash analysis

4.1.1. Fundamental data examination

The analysis results of performance competency dimension by factors analysis was found that the ratio between the Eigen value of factor 1 toward the Eigen value of factor 2 of the assessment by directors was equal to 1.315, the self-assessment was equal to .001, and the supervisor assessment was equal to 1.652. The values were less than the criteria, which would be concluded by the unidimensionality. Morizot et al. (2007) proposed to consider the unidimensionality from the ratio between Eigen value of factor1 toward the Eigen value of factor 2. If the value was more than or equal to 3.00, it indicated the unidimensionality. With all evidence mentioned above, it can be concluded that the performance competency assessed by the assessment by directors, self-assessment and supervisor assessment were appropriate for multidimensionality assessment.

4.1.2. Research result of multidimensionality

According to this research, the researchers studied the base model called multidimensional random coefficients multinomial logit model (MRCMLM) (Adams et al.,1997). Because there are five competency assessment methods, with their fundamental characteristics about multi-dimensionality, it fits with the analysis by the multidimensional form of the partial credit model. This is the model that fits to the measurement having multi values response, personality measurement, metacognition and attitudes measurement, and it fit to the measurement using the items of giving multi values scores by

ordered polytomous items (Ostini, & Nering, 2006). The data was analyzed by the ConQuest 2.0 computer program. The analysis results were concordant between the assessment model of performance competency and question items considered by the INFIT mean square or weighted mean square (INFIT MNSQ). These are the values based on the root mean square error (RMSE) concept between the estimated and true item response (DeMars, 2004). The statistical values indicated that the data of each item is concordant with the item response model determined, and does not accept the value between .60 and 1.40, which is the criteria for consideration of value measurement by rating scale (Wright et al., 1994). The analysis result shown in Table 1 found that the assessment by the director had the INFIT MNSQ value between .79 and 1.45. Only a single question item was beyond the acceptance range, which was, COM2. Whereas the self-Assessment had the INFIT MNSQ value between .98 and 1.01, and the supervisor assessment had the INFIT MNSQ value between .88 and 1.09, which its value was in the acceptance range. This evidence shows the validity according to the theoretical construct of the assessment of performance competency.

Table 1. Item statistics and fit statistics.

COMP	Assessment by Director			Self-Assessment			Supervisor Assessment		
	Est	Error	INFIT MNSQ	Est	Error	INFIT MNSQ	Est	Error	INFIT MNSQ
COM1	.211	.014	.82	.006	.014	1.01	-.151	.030	.95
COM2	.016	.013	*1.45*	-1.446	.020	1.00	.057	.040	1.09
COM3	.363	.015	.78	-1.271	.013	.98	-.012	.038	1.02
COM4	.093	.014	.98	-.107	.014	.99	-.493	.032	1.00
PEO1	.499	.014	.95	-.296	.010	1.00	-.031	.035	1.03
PEO2	-.159	.014	1.13	-.045	.009	1.00	-.362	.036	.99
PEO3	.264	.014	1.06	-.059	.011	1.00	-.010	.032	.97
LOG1	.875	.020	.79	-.697	.013	.98	-.006	.041	.98
LOG2	.674	.017	1.06	-.071	.012	1.03	-.322	.034	.88
LOG3	.894	.017	1.12	.015	.012	.99	-.091	.033	1.03
LOG4	1.147	.019	.83	.015	.011	1.00	.118	.036	.96
LOG5	1.176	.019	.84	-.293	.013	1.00	.060	.036	1.00
LOG6	1.027	.018	.83	.001	.017	1.01	.128	.036	.90
LOG7	.607	.017	1.24	-.766	.016	1.00	-.233	.037	1.13
LOG8	.016	.017	1.09	.108	.011	.98	.114	.034	1.04
BUS1	.395	.020	1.14	-.233	.022	1.00	-.131	.038	1.07
BUS2	1.146	.018	1.04	-.939	.012	1.00	.099	.034	.98
BUS3	.756	.020	1.00	.311	.012	1.00	-.094	.037	.89
BUS4	1.314	.018	1.18	-.034	.013	.99	.035	.032	1.08
BUS5	1.496	.021	0.83	-.303	.011	1.01	-.142	.034	.94
LEA1	1.022	.018	1.01	-.165	.014	1.00	-.079	.039	.99
LEA2	1.047	.018	.98	-.241	.011	1.01	-.378	.038	1.01
LEA3	.618	.018	1.03	-.278	.014	1.00	-.232	.037	1.04
LEA4	.645	.019	1.27	-.153	.011	1.00	-.291	.045	1.02

Note: COMP=competency, COM=communication, PEO=people, LOG=logic, BUS=business, LEA=leadership, Est=estimate.

4.2. Inter-subtest correlation analysis

The construct validity is investigated by the inter subtest correlation method between the dimensional or sub-test scores and total-test scores (Kline et al., 1994; Cohen, & Swerdlik, 2005; 2010;

Xi, 2008; Canivez et al., 2009). By using the Pearson correlation coefficient with the volume I, assessment by director had the value between .675 and .940. The competency which had the highest relationship with the total scores was LOG, secondly was BUS, LEA, COM, and PEO, respectively. For the volume II, the self-Assessment had the value between .441 and .650. The competency which had the highest relationship with the total score was LOG, secondly was COM, BUS, LEA, and PEO, respectively. And the volume III, the supervisor assessment, the value was between .519 and .884. The competency which had the highest relationship with the total score was LOG, secondly was BUS, LEA, COM, and PEO, respectively. All values of all volumes had the statistical significance at .01 level, and the relationship was at a high level. This evidence shows the validity according to the theoretical construct of the assessment of performance competency as shown in Table 2.

Table 2**.** Correlation between the sub-test scores and total-test scores.

	M	S	TOTAL	COM	PEO	LOG	BUS	LEA
Assessment by director								
TOTAL	56.947	17.823	-					
COM	10.917	3.819	.795**	-				
PEO	8.463	2.768	.675**	.511**	-			
LOG	17.455	6.560	.940**	.657**	.551**	-		
BUS	10.919	4.079	.891**	.603**	.481**	.825**	-	
LEA	9.192	3.607	.865**	.601**	.480**	.774**	.762**	-
Self-assessment								
TOTAL	82.464	7.491	-					
COM	15.671	2.454	.486**	-				
PEO	10.225	2.856	.405**	.011	-			
LOG	26.464	4.077	.650**	.149**	.050**	-		
BUS	17.270	2.890	.463**	.097**	-.033	.058**	-	
LEA	12.834	2.612	.441**	.102**	.014	.044**	.077**	-
Supervisor assessment								
TOTAL	75.266	15.246	-					
COM	12.521	3.099	.576**	-				
PEO	9.558	2.720	.519**	.350**	-			
LOG	24.562	6.801	.884**	.352**	.327**	-		
BUS	15.616	4.298	.772**	.288**	.216**	.597**	-	
LEA	13.008	3.568	.763**	.309**	.267**	.597**	.539**	-

Note: ** p<.01, M=mean, S=standard deviation, TOTAL=total test score.

4.3. Confirmatory factor analysis

According to the analysis result of the models on assessment of performance competency, five major indicators were found. These consisted of communication, people, logic, business and leadership within the three volumes of the assessment form, When examining the concordance of performance assessment models and empirical data, it was found that the assessment by director volume had the chi square equal to 1.93 (df=2, p=.38), because the chi square was sensitive to the size of sample group. Therefore, it had to mutually consider other statistical values. The goodness of fit index (GFI) was equal to 1.00, the adjusted goodness of fit index (AGFI) was equal to 1.00, the root mean square residual (RMR) was equal to .00, and the root mean square error of approximation (RMSEA) was equal

to .00. The self-assessment had the chi square = 5.65 (df = 2, p = .059), GFI = 1.00, AGFI = 1.00, RMR = .00, RMSEA=.02, and the supervisor assessment had the chi square = 4.30 (df = 4, p = .37), GFI = 1.00, AGFI = .99, RMR = .01, RMSEA=.01. When considering the data according to the assessment criteria of Bollen (1989), Kelloway (1998), and Hair et al. (2010) from the fit index value of the model, the data showed that the assessment model of performance competency was concordant with the empirical data. This evidence shows the validity according to the theoretical construct of assessment of performance competency.

Table 3**.** Fit indices of the assessment model of performance competency.

Instruments	Competency	b	SE	t	R^2
Assessment by director					
	COM	.69*	<-->	<-->	.48
	PEO	.55*	.02	35.26	.31
	LOG	.95*	.02	49.87	.90
	BUS	.87*	.02	50.90	.75
	LEA	.87*	.02	46.58	.76
Chi square = 1.93 (df = 2, p = .38), GFI = 1.00, AGFI = 1.00, RMR = .00, RMSEA=.00					
Self-assessment					
	COM	.62*	<-->	<-->	.39
	PEO	.16*	.06	2.78	.03
	LOG	.23*	.09	2.79	.05
	BUS	.33*	.06	5.41	.11
	LEA	.17*	.07	2.49	.03
Chi square = 5.65 (df = 2, p = .059), GFI = 1.00, AGFI = 1.00, RMR = .00, RMSEA=.02					
Supervisor Assessment					
	COM	.42*	<-->	<-->	.17
	PEO	.37*	.05	7.00	.14
	LOG	.83*	.10	8.71	.69
	BUS	.72*	.09	8.50	.52
	LEA	.73*	.09	8.53	.54
Chi square = 4.30 (df = 4, p = .37), GFI = 1.00, AGFI = .99, RMR = .01, RMSEA=.01					

Note: *p<.05, <-->=constrained parameters, b=factor loading, SE=standard error, t=t-value, R^2=squared multiple correlation for variable.

5. Conclusion

The validity examination result of assessment of performance competency was carried out by using five competencies, which consisted of communication, personnel, logic, business, and leadership. The examination was done by using the rash analysis method, which found that the volume I, assessment by director, had the INFIT MNSQ value between .79 and 1.45 from all twenty-four items. Only a single question item was beyond the acceptance range. For the volume II, self-assessment method, this had the value of INFIT MNSQ between .98 and 1.01, and the volume III, supervisor assessment had the value of INFIT MNSQ method between .88 and 1.09 which had the value in the range of statistical

acceptance. The examination by inter-subtest correlation analysis was found that the volume I had the value between .675 and .940, the volume II had the value between .441 and .650, and the volume III had the value between .519 and .884. The competency which had the highest relationship with the total scores of all volumes was LOG. All values, of all volumes, had the statistical significance at .01 level, and the relationship value was in a high level. For the examination that used the confirmatory factor analysis method, it was found that the assessment model of performance competency of all volumes was concordant with the empirical data. According to the evidence of examination on the three methods based on the measurement standard for item response theory and classical test theory, these can indicate the quality of assessment of performance competence very well.

6. Discussion

Regarding the instruments used for assessment created by the five aspects of competency, which are, communication, personnel, logic, business, and leadership, for three volumes, consisting of the assessment by director (volume I), self-assessment (Volume II), and the supervisor assessment (volume III), the validity of these instruments were examined by three methods, which included the rash analysis, inter-subtest correlation analysis, and confirmatory factor analysis.

The rash analysis results by considering the item fit value based on the concept of root mean square error (RMSE) between estimated and true item response (DeMars, 2004) is the statistics value which indicates whether the item data are concordant with the item response model. The item data, concordant with the model, suggested that item has the response form concordant with the model in a form of cumulative frequency curve (Chianchana, 2009), while only one question item was beyond the statistical acceptance of Wright and others, 1994, which is, assessment by director (Volume I). Whereas the question item of Com2 is "plan of representation by expecting that it can motivate others", this question item is still not concordant with the construct according to the item response theory; however, this is considered as a small abnormality from the response structure, while other volumes showed that every question item was concordant with the theoretical construct.

The result of inter-subtest correlation analysis for all volumes showed that all values had a highly positive relationship. This was the evidence shown between the dimensional or sub-test scores and total-test scores. These highly internal relationships reflect the validity of all series of assessment forms developed under the same theory, considered as the aspect of homogeneity (Kline et al., 1994; Cohen, & Swerdlik, 2005; 2010). All volumes have the logic competence related highly with the total competence score. For the measured logic, it is the concept involved with the reason giving, and reasonable reason criteria. The indicator consists of basic analysis, basic analysis and synthesis, complex situations, and holistic and systematic. For the logic characteristic, Copi (2002) said that logic is about reasoning on every subject — science and medicine, ethics and law, politics and commerce, sports and games, and even the simple affairs of everyday life — which are considered as crucial factors towards the performance.

The result of confirmatory factor analysis for all volumes showed that the assessment model was concordant with the empirical data. The confirmatory factor analysis was then employed so that the

researcher could test the relationship between the model and the empirical data (McIntire and Miller, 2007). This means that all five structures of competency assessment forms were valid by the assessment of structural models through the statistical index including chi-square test statistics, goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI) , root mean squared residual (RMR) , and root mean squared error of approximation (RMSEA). All indexes complied with a consideration of Bollen (1989), Kelloway (1998) and Diamantopoulos and Siguaw (2000), who showed the model congruence with empirical data (Bollen, 1989; Kelloway, 1998; Diamantopoulos, & Siguaw, 2000). Moreover, when the assessment of measurement model, through the consideration from the value of indicator loading, which is the validity evidence (Diamantopoulos, & Siguaw, 2000), it appeared that all loading volumes have statistical significance, which supports the validity of all instruments for competency assessment. The crucial competency, when considering the loading value in the assessment by director (Volume I) and supervisor assessment (volume III), is about the logic. This is in accordance with the examination result of validity, by inter-subtest correlation analysis, whereas the self-assessment (volume II) contradicts the result of inter-subtest correlation analysis. Another crucial competency is communication, which is the personal characteristic which has fluency, persuasion, presentation, and negotiation. These characteristics are crucial, but not more or less than the logic. This is in accordance with the requirement of employers who need the employees who have communication competency   and presentation skills (Woodward et al., 2010). In addition, this is in accordance with Kelley and Bridges' study (2005), which showed that business communication skills and presentation skills are the top two of twenty-three skills that are necessary for a successful career.

7. Recommendation

The instruments for competency assessment of performance have various volumes, and they are conducted under the organizations which can control the examination effectively. For further research, it should apply the technology to help originate the quickness, and saving. Moreover, it should be created to be appropriate to the responders, until it builds the sustainability of the test. The conduction should be done in terms of computer adaptive testing (CAT). Moreover, the nature within organizations to have various groups of employees means that the instruments used for assessment should be evaluated carefully to consider these differences of variance. For further research, the differential item functioning (DIF), and differential test functioning (DTF) should be examined to show the evidence of quality on the tests and questionnaires in terms of fairness through every group of responders.

Acknowledgement

References

Adams, R., Wilson, M., & Wang, W. (1997). The multidimensional random coefficients multinomial logit model. *Applied Psychological Measurement*, *21*, 1-23.

American Educational Research Association., American Psychological Association., & National Council on Measurement in Education. (1999). *Standards for educational and psychological testing*. (2nd ed.). Washington, DC: American Educational Research Association.

Baartman, L.K.J., Bastiaens, T.J., Kirschner, P.A., & Van Der Vleuten, C.P.M. (2006). The wheel of competency assessment: Presenting quality criteria for competency assessment programs. *Studies in Educational Evaluation*. *32*, 153-170.

Beheshtifar, M. (2011). Role of career competencies in organizations. *European Journal of Economics, Finance and Administrative Sciences*, *42*, 6-12.

Bollen, K.A. (1989). Structural equations with latent variables. New York, NY: John Wiley & Sons, Inc.

Canivez, G.L., Konold, T.R., Collins, J.M., & Wilson, G. (2009). Construct validity of the Wechsler abbreviated scale of intelligence and wide range intelligence test: Convergent and structural validity, *School psychology Quarterly*, *24*(4), 252-265.

Chianchana, C. (2009). Multidimensional analysis. *Journal of Education Khon Kaen University*, *32*(4), 13-22.

Cohen, R.J., & Swerdlik, M.E. (2005). *Psychological testing and assessment: An introduction to tests and measurement* (6th ed.). Boston: McGraw-Hill.

Cohen, R. J., & Swerdlik, M. E. (2010). *Psychological testing and assessment: An introduction to tests and measurements* (7th ed.). Boston: McGraw-Hill.

Copi, I.M. (2002). *Introduction to logic* (11th ed.). New Jersey: Pearson Education.

DeMars, C. (2004). Measuring higher education outcomes with a multidimensional rasch model. *Journal of Applied Measurement*, *5*(4), 350-361.

Diamantopoulos, A., & Siguaw, J.A. (2000). *Introducing LISREL: A guide for the uninitiated*. London: SAGE Publication.

Educational Testing Service (ETS). (2002). *ETS standards for quality and fairness*. Princeton, NJ: Author.

Frey, A., & Hartig, J. (2009). Assessment of competencies. *Studies in Educational Evaluation*, *35*, 55-56.

Hair, J.F., Anderson, R.E., Tatham, R.L., & Black, W.C. (2010). *Multivariate Data Analysis: A Global Perspective* (7th ed.). New Jersey: Pearson education.

Kellowey, E. (1998). *Using LISREL for structural equation modeling: A researcher's guide*. Thousand Oaks: SAGE Publications.

Kelly, C.A. & Bridges, C. (2005). Introducing professional and career development skills in the marketing curriculum. *Journal of Marketing Education*, *27*(3), 212-218.

Kesler, G. C. (1995). A model and process for redesigning the HRM role, competencies, and work in a major multi-national corporation. *Human Resource Management*, 34, 229-252.

Kline, R.B., Snyder, J., Gulmette, S., & Castellanos, M. (1994). Evaluation of the construct validity of the kamphaus-reynolds supplementary scoring system for the K-ABC. *Assessment*, *1*(3), 219-226.

Koeppen, K., Hartig, J., Klieme, E., and Leutner, E. (2008). Current issues in research on competency modeling and assessment. *Zeitschrift fur Psychologie/Journal of Psychology*, *216*, 60-72.

McIntire, S.A., & Miller, L.A. (2007). *Foundations of psychological testing: A practical approach* (2nd ed.). Thousand Oaks: Sage Publications.

Morizot, J., Ainsworth, A.T., & Reise, S. (2007). Toward modern psychometrics: Application of item response theory models', In R.W. Robins, R.C. Fraley, & R.F. Krueger. (Eds.), *Handbook of Research Methods in Personality Psychology* (pp. 407-423). New York: Guilford Press.

Office of the Civil Service Commission. (2005). *Competency manual of civil service*. Bangkok: P.A. living.

Ostini, R., & Nering, M.L. (2006). Polytomous item response theory models. Thousand Oaks: Sage Publications.

Tisco. [Online]. *Retrieved from http://www.tisco.co.th/en/aboutus/awards.html* [29 September 2014]

Vazirani, N. (2010). Competencies and competency model-A brief overview of its development and application. *SIES Journal of Management*, *7* (1), 121-131.

Woodward, B., Sendall, P., & Ceccucci. W. (2010). Integrating soft skill competencies through project-based learning across the information systems curriculum. *Information Systems Education Journal*, 8(8). Retrieved from http://isedj.org.

Wright, B. D., Linacre, J.M., Gusafson, J.-E., & Martin-Lof, P. (1994). Reasonable mean-square fit values. Rasch Measurement Transactions, 8(3) . *Retrieved from http://www.rasch.org/rmt/rmt83b.htm*

Xi, X. (2008). Methods of test validation. In E. Shohamy, and N.H. Hornberger. (Eds.), Encyclopaedia of Languate and Education: Vol.7, *Language Testing and Assessment* (pp.177-196), (2nd ed.). New York, NY: Springer.