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ASSESSING VALIDITY OF SOURCES OF INNOVATION, INNOVATION AND FIRM PERFORMANCE FOR VARIANCE-BASED STRUCTURAL EQUATION MODELLING

Wai Lan Mah[1], Noor Azman Ali[2] and Dahlia Zawawi[3]

[1,2.3]University Putra Malaysia, Selangor, Malaysia
Email: [1]m_wailan@yahoo.com, [2]nazman@upm.edu.my, [3]dahlia@upm.edu.my

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Abstract: *In recent years, PLS-SEM is preferred by many researchers from different fields due to the three main distinctive justifications which are related to non-normal data, small sample size and formatively measured constructs. There are two stages in PLS-SEM analysis which include the assessment of measurement model and structural model. The former is conducted to evaluate the validity and reliability of the variables while the latter is performed to examine the causal relationships between variables. The main focus of this paper is to reveal the stages assessing validity of some sources of innovation, innovation and firm performance, started with explanatory factor analysis (EFA) and followed by confirmatory analysis (CFA). A total of six common used validity tools in PLS-SEM will be presented: outer loadings, average variance extracted (AVE), composite reliability, Fornell-Larker criterion, cross-loadings and Heterotrait-Monotrait Ratio (HTMT).*

Keywords*: Validity, PLS-SEM, Innovation*

Introduction

In recent years, variance-based structural equation modelling (PLS-SEM) is preferred by many researchers from different fields due to the three main distinctive justifications which are related to non-normal data, small sample size and formatively measured constructs (Hair, Sarstedt, Hopkins & Kuppelwieser, 2014). In many social science studies, researches fail to meet the normal distribution assumption for covariance-based structuring equation modelling (CB-SEM). Therefore, PLS-SEM is suggested as the PLS algorithm will transform non-normal data based on central limit theorem. In terms of sample size, the requirement of sample size for PLS is much smaller as compared with CB-SEM, even for the case of highly complex model. There are two stages in PLS-SEM analysis which consists of assessment of measurement model and structural

model. The former is conducted to evaluate the validity and reliability of the variables while the latter is performed to examine the causal relationships between variables.

The main focus of this paper is the evaluation of the measurement model. The measurement model of this study consists of three internal sources (R&D strategy, strategic leadership, learning orientation), three external sources (customer relationship, supplier relationship and government support), innovation and firm performance. The measurement model is the precondition for a structural model that examines the relationship between the sources of innovation, innovation and firm performance. The measurement model is assessed to identify a set of constructs that is best explained by its underlying indicators, at the same time to confirm what a researcher wishes to measure is accurate.

At the beginning stage, factor analysis is carried out in order to identify the proper structure of a set of variables measured by some correlated indicators, at the same time it is also a process for data reduction (Hair, Anderson, Tatham & Black, 1998). The exploratory factor analysis (EFA) is first performed in order to identify the indicators best measures the underlying constructs, followed by confirmatory factor analysis (CFA) that assesses the validity of the constructs through convergent validity and discriminant validity (Bagozzi, Yi & Phillips, 1991). A total of six common used validity tests in PLS-SEM will be presented. Those tests include outer loadings, average variance extracted (AVE), composite reliability, Fornell-Larker criterion, cross-loadings and Heterotrait-Monotrait Ratio (HTMT).

Sources of Innovation

Based on Sternberg and Arndt (2001), to avoid firms overestimating a firm's internal strength to implement innovativeness, relative important of both internal and external sources of innovation should be accessed. Pangarkar (2012) suggests that a firm success with regard to innovation is attributed by the integration of knowledge from external partners (universities, customers and suppliers) and internal sources (employees from different divisions, sections, parts, etc.).

When a research department studies a phenomenon in depth, the department is likely to discover new things and then generating knowledge and making inventions (Barrell et al., 1992). Castellacci (2008) reveals that R&D spill over is important for knowledge creation and it contributes to innovation in both product and process. Other than that, invest in R&D leads to greater product quality, better manufacturing processes and cost reduction (David, 2011). Important R&D relevant activities which include acquisition of information, basic research, pilot testing of products and product manufacturing help strengthening the innovation capabilities of SMEs (Jung & Andrew, 2014). According to Gao and Hafsi (2015), the few ways that encourage SMEs to increase their R&D spending include business owners' perceived importance of R&D-related activities, better-educated owners, owners who have technology-related working experience and social connections.

Strategic leadership is defined as the process of forming a vision for the future, communicating it to subordinates, stimulating and motivating followers, and engaging in strategy-supportive exchanges with peers and subordinates (Elenkov, Judge & Wright, 2005). Carneiro (2008) postulates that a strategic leader must actively look for knowledge, then turn the knowledge and creativity to value especially when there is a need for improvement, development as well as

better performance. Carneiro also reveals that a strategic leader must possess three important characteristic: (1) the strategic leader must be self-motivated, (2) he/she can define clearly what is expected, and (3) the leader posses integrative skill that enable he/she to motivate others at the same time seek and accept challenges that contributes to the generation of new ideas.

Learning and innovation are always associated. Learning orientation which is referred to the creation and the use of knowledge enables firms to understand the environment well and thus it influences the implementation of new ideas, products and processes (Calantone, Cavusgil, S. & Zhao, 2002). Salim and Sulaiman (2011) suggest that managers should promote a learning climate in the organization for knowledge creation and sharing. This is because learning creates desire to adopt new ideas and helps firms to seek ways to achieve competitiveness through various innovation processes. In a recent study, Real, Roldan and Leal (2014) define organizational learning as a dynamic process to generate knowledge creation in the organizations via its individuals. Creativity of individuals through new idea generation and implementation enable enhancement of innovative products (Gumusluoglu & Ilsev, 2009). Based on creativity-innovation cycle developed by Lee, Kim and Jun (2007), the connections between employees' creative ideas generation, ideas sharing, ideas implementation and learning from market response allow company to execute breakthrough innovations.

Customer focus and product innovation are associated (Ar & Baki, 2011). The sharing of knowledge of customers helps firms to develop and commercialize new products (Duarte & Sarkar, 2011). The formation of buyer-seller relationship also enables greater firm's competitiveness advantage by developing new products/services and processes that fulfil customer preferences (Panayides, 2006). As suggested by Mosey (2005), to search for new technologies to support product innovation, firm can look for partnerships with other organizations and the partnership should not be limited only to suppliers or competitors but also with customers. Due to the various advantages brought by customers' feedback, firms should maintain and manage the customer-relation well in order to best meet customers' expectation in this changing market environment. Besides, small firms that have limitations in R&D budget also can seek for partnership with international clients in order to acquire resources and support needed that promote innovation (Lin, Chen & Chiu, 2010)

According to Ceci and Lubatti (2012), the combination of personal relationship and professional relationship prone to stimulate innovation activities which include product, process, organizational and IT related innovations. They refer personal relationship to the presence of trust, shared value and mutual objectives in networks. While the professional relationship is pertaining to relationships occur among members in the industry, clients, suppliers and competitors. The important role of supplier as a source of innovation has increased due to the need of outsourcing and shorter innovation cycles, therefore the potential suppliers who can bring benefits to the firm must be carefully evaluated (Winter & Lasch, 2016). The author stress that the suppliers who can produce better products, achieve lower production cost, reduce manufacturing time and increase speed of delivery, are believed to be able to affect the performance of their purchasing company.

The public support instruments are important when the internal competencies and networking of small firms are limited (Varis & Littenun, 2010). The local and regional government innovation related needs of small and medium firms in terms of technology, finance, training and some other

organizational issues (Cobbenhagen, 2000). In a recent study, Radas, Anic, Tafro and Wagner (2015) prove that both subsidies and tax incentives granted by government strengthen the R&D orientation of a firm as well as the firm's innovation output, as a result, the percentage of sales from innovation also increases. Feder and Savastano (2006) suggest that training provided by the public sector enable firms expose to external sources of knowledge, thus, spread innovations information and advice to the people in a community. It helps to stimulate innovation process which is related to the implementation of new approaches, procedures and practices in management,

Research Methodology

In this study, data is collected using self-administered questionnaire. To ensure the content validity, the pre-pilot study and pilot study were performed. In the pre-pilot study, a total of four managers and a senior executive were participated to review the questionnaire to ensure adequacy, readability, clarity and completeness of the questions. Then, minor amendment was made in order to make sure the instruments are easy to understand and relevant to the study. Then, a pilot test that involved 22 SMEs was conducted. The Cronbach's alpha values calculated reveal high level of internal consistency except process innovation; however, its reliability is still at acceptable level. Both SMEs from manufacturing and service sectors were selected and the questionnaires were distributed using email followed by phone follow-ups. A total of 125 useful collected were analysed using different tests to ensure its validity and reliability.

Explanatory factor analysis (EFA) was first used to extract the important items and number of factors that best represent the data. The reason to perform EFA is to identify a smaller set of factor structures for the constructs that is best explained by its underlying items (Thien, Razak & Ramayah, 2014). It is conducted using IBM SPSS 16.0 software. The significant of the test is determined using Bartlett test for the presence of nonzero correlations between the measured variables. On the other hand, measure of sampling adequacy (MSA) which should be greater than 0.5 is examined to make sure the reduced set of variables meets the minimum requirements for factor analysis (Hair et al., 1998). When Kaiser–Meyer–Olkin which is greater than 0.5 is significant based on Bartlett's test of Sphericity, the data is appropriate for factor analysis (Thien, Razak & Ramayah, 2014).

Next confirmatory factor analysis (CFA) was carried out to assess the validity of the constructs through convergent validity and discriminant validity (Bagozzi, Yi & Phillips, 1991). SmartPLS 3 software was used for validity, reliability testing. Validity is primarily to confirm what we wish to measure is accurate. The convergent validity is determined by (1) outer loadings for reflective model or weights for formative model, (2) average variance extracted, and (3) the reliability of the constructs to evaluate whether it produces consistent results using composite reliability. The discriminant validity is commonly examined by cross-loading or Fornell-Larcker criterian. There are some important cutoff values suggested by Hair et al. (2014) for different measures of validity and reliability evaluation:

- the common rule of thumb value for outer loadings is 0.7 and higher as the squared outer loading will contribute to about 50% variance of the items explained by a construct; the outer loadings fall between 0.4 and 0.7 can still be retained only when the removal of the indicators affect content validity or it should be deleted if the removal of the items

contribute to higher composite reliability; the outer loadings below 0.4 should not be retained in the scale,

- the optimal value for average variance extracted (AVE) is at least 0.5 as the lower value indicates more errors in the items rather than the variance of the items explained by the construct,
- the composite reliability values should be at least 0.6, ideally 0.7, to show high level of reliability.

For discriminant validity, Hair et al. (2014) specify that the outer loading of a construct should be greater than all of its loadings on other constructs for cross loadings checking. At the same time, they also propose Fornell—Larcker criterian as another method to assess discriminant validity. It involves the comparison between the square root of the AVE values and the latent variables' correlations, where the square root of all AVE values should be higher than the correlations. According to Henseler, Ringle and Sarstedt (2015), failure to satisfy discriminant validity may contribute to biased estimation of structural parameters and thus lead to inappropriate decision made on the hypothesized relationship between constructs. Therefore, the authors suggest another approach to assess discriminant validity especially for the case of variance-based SEM, the Heterotrait-Monotrait Ratio (HTMT), which is much more reliable in detecting the lack of discriminant validity as compared with cross loadings and Fornell-Larcker criterian. To determine whether there is a problem with lack of discriminant validity, the HTMT values should be smaller than 0.85 or 0.9, at the same time; their confidence interval must not contain value 1 to meet the alternative hypothesis of H1: HTMT < 1 (Henseler, Ringle & Sarstedt, 2015). When these two conditions are met, it means the two constructs are empirical distinct; discriminant validity satisfied.

Results

The explanatory factor analysis of this study is showed in Table 1. A total of 10 constructs were extracted with Bartlett test significant at 0.000 level and MSA 0.835 which is greater than 0.5. This indicates that the set of variables identified meets the fundamental requirements of factor analysis. Based on EFA, only 52 indicators were retained, 8 others were omitted due to low loadings or low correlations. There was 1 item (PdI5) deleted from product innovation which was "in comparison with our competitors, our company has a higher success rate in new products/services launch". Two items (PcI6 and PcI7) were discarded from process innovation which include "we describe ourselves as a firm focusing on process innovation" and "our processes are often perceived as very new by customers". Market innovation has the highest number of removed items. The three items (MI14, MI15 and MI16) deleted were "in comparison with our competitors, our company has invested more in different locations", "in comparison with our competitors, our products' most recent marketing program is revolutionary/innovative in the market", and "in new product/service introductions, our company is often at the cutting edge of technology". Lastly, SL23, "our top management encourages innovation activities", was removed from strategic leadership, and LO33, "our company encourages employees to take risk", was omitted from learning orientation.

Table 1: Exploratory Factor Analysis

Indicators	1	2	3	4	5	6	7	8	9	10
FP53	1.001									
FP54	0.994									
FP51	0.842									
FP56	0.726									
FP49	0.715									
FP59	0.695									
FP52	0.666									
FP48	0.595									
FP60	0.587									
FP57	0.517									
FP58	0.510									
FP55	0.507									
FP50	0.445									
LO32		0.971								
LO27		0.877								
LO29		0.827								
LO28		0.772								
LO31		0.765								
LO27		0.638								
Rnd18			0.899							
Rnd17			0.878							
Rnd19			0.870							
Rnd20			0.817							
GS43				0.910						
GS47				0.900						
GS44				0.899						
GS45				0.897						
GS46				0.894						
CR36					0.943					
CR34					0.805					
CR37					0.793					
CR35					0.633					
CR38					0.419					
SR39						0.869				
SR42						0.820				
SR40						0.768				
SR41						0.664				
ProdI3							0.846			
ProdI1							0.721			
ProdI2							0.613			
ProdI4							0.520			
SL21								0.720		

SL26	0.656		
SL24	0.633		
SL25	0.615		
SL22	0.610		
Mark12		0.805	
Mark13		0.757	
Mark11		0.695	
ProcI8			0.705
ProcI10			0.629
ProcI9			0.519

Note: N=125. Varimax rotation Factor loadings higher than 0.4 shown. Kaiser–Meyer–Olkin measure of sampling adequacy = 0.835 with Bartlett test significant at 0.000 level. The KMO measures the sampling adequacy, which should be greater than 0.5 for a satisfactory factor analysis to proceed (Hair et al., 1998).

Based on the indicators determined by EFA, a model in Figure 1 was developed for validation and reliability checking using SmartPLS 3. In the model, only 8 indicators were selected to measure firm performance rather than 13 as showed in EFA. The main reason is because of the selected indicators are theoretically more meaningful to measure firm performance (FP) from different dimensions which include 3 financial indicators (based on profit and revenue) and 5 non-financial indicators (customer value performance, internal business process performance, innovation performance and employee performance). On the other hand, the product (Prod) innovation, process innovation (Proc) and market innovation (Mark) are combined to become a construct to measure innovation (Inno) as a whole.

Table 2 shows most loadings were greater than 0.7, except Prod3 (0.679), Prod 4 (0.687), Proc 9 (0.687) and Proc10 (0.644). However, the 4 indicators were still retained as they are important measurement items for innovation and their loadings were in the acceptable range. The AVE and CR of all constructs were above 0.5. It is concluded that convergent validity and reliability of the constructs are achieved.

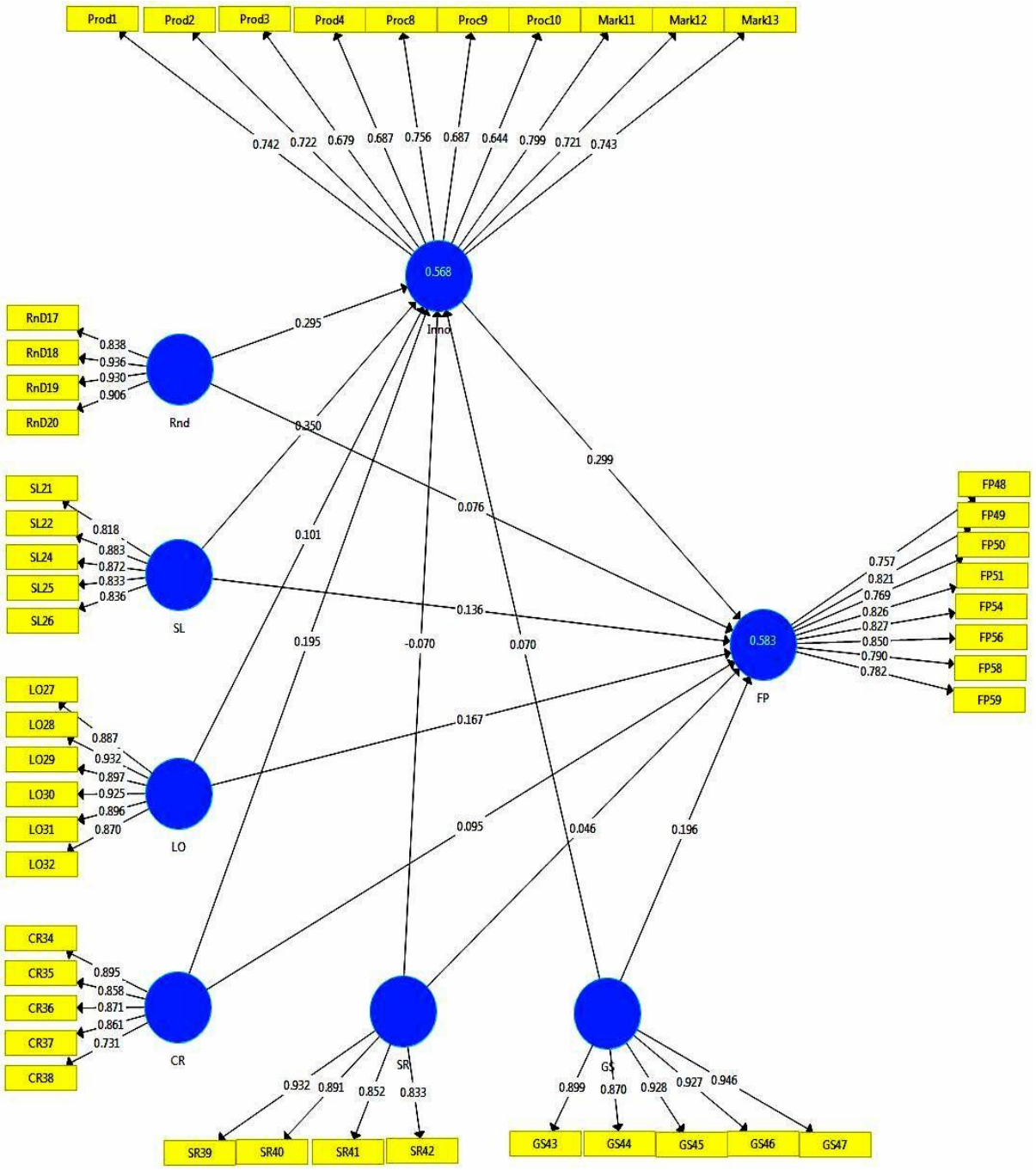

Figure 1: Confirmatory factor analysis.

The results of discriminant validity are depicted in Table 3, 4 and 5. Table 3 illustrates the outer loadings of the constructs which were greater than all of its cross loadings. Table 4 shows Fornell-Larcker criterion with each of the construct's square root AVE (diagonal figures in bold) higher than its correlation with other constructs in the model. In Table 5, all the values fulfil $HTMT_{0.9}$ at the same time the confidence interval of each construct did not straddle a value of 1. Based on the results of the three approaches, it is concluded that discriminant validity is ascertained.

Table 2: Results Summary for Measurement Model

Latent Variable	Indicators	Loadings	Composite Reliability	AVE	Discriminant Validity
R&D	Rnd17	0.838	0.947	0.816	Achieved
Strategy	Rnd18	0.936			
	Rnd19	0.930			
	Rnd20	0.906			
Strategic	SL21	0.818	0.928	0.721	Achieved
Leadership	SL22	0.883			
	SL24	0.872			
	SL25	0.833			
	SL26	0.836			
Learning	LO27	0.887	0.963	0.813	Achieved
Orientation	LO28	0.932			
	LO29	0.897			
	LO30	0.925			
	LO31	0.896			
	LO32	0.870			
Customer	CR34	0.895	0.926	0.714	Achieved
Relationship	CR35	0.858			
	CR36	0.871			
	CR37	0.861			
	CR38	0.731			
Supplier	SR39	0.932	0.931	0.770	Achieved
Relationship	SR40	0.891			
	SR41	0.852			
	SR42	0.833			
Government	GS43	0.899	0.962	0.836	Achieved
Support	GS44	0.870			
	GS45	0.928			
	GS46	0.927			
	GS47	0.946			
Innovation	ProdI1	0.742	0.914	0.517	Achieved
	ProdI2	0.722			
	ProdI3	0.679			
	ProdI4	0.687			

	ProcI8	0.756			
	ProcI9	0.687			
	ProcI10	0.644			
	Mark11	0.799			
	Mark12	0.721			
	Mark13	0.743			
Firm	FP48	0.757	0.936	0.645	Achieved
Performance	FP49	0.821			
	FP50	0.769			
	FP51	0.826			
	FP54	0.827			
	FP56	0.850			
	FP58	0.790			
	FP59	0.782			

Table 3: Cross Loadings

	CR	FP	GS	LO	Inno	Rnd	SL	SR
CR34	**0.895**	0.521	0.291	0.517	0.450	0.219	0.460	0.554
CR35	**0.858**	0.489	0.341	0.555	0.545	0.390	0.495	0.525
CR36	**0.871**	0.412	0.244	0.499	0.373	0.302	0.442	0.507
CR37	**0.861**	0.423	0.230	0.481	0.445	0.352	0.403	0.521
CR38	**0.731**	0.415	0.208	0.481	0.347	0.132	0.445	0.537
FP48	0.449	**0.757**	0.349	0.469	0.543	0.532	0.417	0.454
FP49	0.475	**0.821**	0.281	0.504	0.589	0.436	0.572	0.331
FP50	0.425	**0.769**	0.421	0.467	0.444	0.375	0.420	0.488
FP51	0.367	**0.826**	0.466	0.382	0.475	0.366	0.489	0.340
FP54	0.438	**0.827**	0.425	0.455	0.491	0.311	0.495	0.375
FP56	0.395	**0.850**	0.371	0.466	0.610	0.470	0.568	0.338
FP58	0.435	**0.790**	0.248	0.557	0.634	0.409	0.578	0.335
FP59	0.481	**0.782**	0.283	0.574	0.453	0.365	0.508	0.418
GS43	0.258	0.403	**0.899**	0.226	0.326	0.284	0.298	0.307
GS44	0.262	0.315	**0.870**	0.160	0.215	0.195	0.198	0.234
GS45	0.301	0.421	**0.928**	0.236	0.275	0.285	0.255	0.332
GS46	0.266	0.438	**0.927**	0.231	0.302	0.279	0.273	0.379
GS47	0.355	0.415	**0.946**	0.230	0.327	0.330	0.270	0.361
LO27	0.522	0.627	0.221	**0.887**	0.568	0.451	0.739	0.488

LO28	0.561	0.558	0.178	**0.932**	0.531	0.393	0.715	0.515
LO29	0.592	0.560	0.214	**0.897**	0.542	0.395	0.619	0.559
LO30	0.523	0.488	0.235	**0.925**	0.474	0.387	0.650	0.491
LO31	0.532	0.495	0.194	**0.896**	0.522	0.364	0.662	0.500
LO32	0.520	0.519	0.256	**0.870**	0.502	0.392	0.570	0.445
Mark11	0.442	0.560	0.310	0.485	**0.799**	0.438	0.528	0.320
Mark12	0.380	0.475	0.264	0.421	**0.721**	0.405	0.461	0.290
Mark13	0.357	0.453	0.292	0.458	**0.743**	0.400	0.538	0.273
Proc10	0.415	0.425	0.240	0.529	**0.644**	0.287	0.492	0.271
Proc8	0.444	0.540	0.235	0.429	**0.756**	0.380	0.444	0.363
Proc9	0.350	0.475	0.179	0.327	**0.687**	0.465	0.536	0.276
Prod1	0.317	0.449	0.252	0.380	**0.742**	0.460	0.459	0.252
Prod2	0.370	0.435	0.157	0.461	**0.722**	0.373	0.483	0.333
Prod3	0.308	0.443	0.156	0.324	**0.679**	0.486	0.434	0.289
Prod4	0.340	0.497	0.205	0.380	**0.687**	0.598	0.484	0.184
RnD17	0.232	0.456	0.335	0.341	0.450	**0.838**	0.421	0.309
RnD18	0.371	0.435	0.265	0.458	0.579	**0.936**	0.555	0.296
RnD19	0.316	0.491	0.237	0.376	0.567	**0.930**	0.477	0.251
RnD20	0.290	0.463	0.273	0.419	0.562	**0.906**	0.551	0.248
SL21	0.381	0.484	0.161	0.545	0.550	0.537	**0.818**	0.303
SL22	0.406	0.582	0.281	0.649	0.670	0.516	**0.883**	0.411
SL24	0.487	0.508	0.300	0.691	0.609	0.457	**0.872**	0.479
SL25	0.535	0.537	0.245	0.621	0.473	0.401	**0.833**	0.418
SL26	0.463	0.569	0.219	0.606	0.551	0.447	**0.836**	0.492
SR39	0.566	0.446	0.326	0.449	0.368	0.296	0.436	**0.932**
SR40	0.540	0.439	0.359	0.534	0.345	0.273	0.449	**0.891**
SR41	0.571	0.426	0.313	0.571	0.353	0.235	0.531	**0.852**
SR42	0.515	0.357	0.251	0.387	0.322	0.263	0.314	**0.833**

Table 4: Fornell-Larcker Criterion

	CR	FP	GS	Inno	LO	Rnd	SL	SR
CR	**0.845**							
FP	0.539	**0.803**						
GS	0.317	0.440	**0.914**					
Inno	0.519	0.664	0.320	**0.719**				
LO	0.602	0.604	0.240	0.583	**0.902**			
Rnd	0.336	0.510	0.304	0.600	0.443	**0.903**		
SL	0.532	0.633	0.286	0.677	0.734	0.556	**0.849**	
SR	0.625	0.477	0.358	0.396	0.555	0.304	0.497	**0.878**

Conclusion

This study reveals the two stages assessing validity of sources of innovation, innovation and firm performance for variance-based structural equation modelling. Based on the EFA results, only 52 indicators out of the 60 were retained, 8 others were omitted due to low loadings or low correlations. The CFA results confirmed that all variables are valid and reliable for further structural equation modelling analysis. The results of outer loadings, AVE and CR ascertained that convergent validity and reliability of the constructs are both achieved. On the other hand, the results of cross loadings, Formell-Larcker criterian and HTMT ratio produced consistent results for this study and it satisfied the discriminant validity which can avoid biased estimation of structural parameters and inappropriate decision made on the hypothesized relationship between constructs.

Table 5: HTMT Ratio

	CR	FP	GS	Inno	LO	Rnd	SL
FP	0.589 $CI_{.90}$ (0.446, 0.709)						
GS	0.336 $CI_{.90}$ (0.159, 0.508)	0.469 $CI_{.90}$ (0.295, 0.619)					
Inno	0.570 $CI_{.90}$ (0.428, 0.698)	0.725 $CI_{.90}$ (0.558, 0.867)	0.341 $CI_{.90}$ (0.183, 0.507)				
LO	0.648 $CI_{.90}$ (0.455, 0.797)	0.639 $CI_{.90}$ (0.483, 0.751)	0.249 $CI_{.90}$ (0.099, 0.414)	0.629 $CI_{.90}$ (0.459, 0.773)			
RnD	0.361 $CI_{.90}$ (0.195, 0.539)	0.552 $CI_{.90}$ (0.374, 0.713)	0.323 $CI_{.90}$ (0.144, 0.501)	0.655 $CI_{.90}$ (0.516, 0.788)	0.468 $CI_{.90}$ (0.277, 0.633)		
SL	0.594 $CI_{.90}$ (0.375, 0.756)	0.690 $CI_{.90}$ (0.544, 0.814)	0.303 $CI_{.90}$ (0.139, 0.478)	0.748 $CI_{.90}$ (0.612, 0860)	0.787 $CI_{.90}$ (0.662, 0.879)	0.607 $CI_{.90}$ (0.438, 0.749)	
SR	0.697 $CI_{.90}$ (0.554, 0.825)	0.525 $CI_{.90}$ (0.305, 0.688)	0.379 $CI_{.90}$ (0.191, 0.561)	0.442 $CI_{.90}$ (0.251, 0.630)	0.596 $CI_{.90}$ (0.433, 0.742)	0.336 $CI_{.90}$ (0.130, 0.562)	0.546 $CI_{.90}$ (0.374, 0.698)

References

Ar, I. M. & Baki, B. (2011). Andecedents and performance impacts of product versus process innovation: empirical evidence from SMEs located in Turkish science and technology parks. *European Journal of Innovation Management*, *14*(2), 172-206. doi: 10.1108/14601061111124885

Bagozzi, R. P., Yi, Y. & Phillips, L. W. (1991). Assessing construct validity in organizational research. *Administrative Science Quarterly*, *36*(3), 421-458. Retrieved from https://www.researchgate.net/profile/Youjae_Yi/publication/234021313_Assessing_Construct_Validity_in_Organization_Research/links/00b4952e499bcb1826000000/Assessin Construct-Validity-in-Organization-Research.pdf

Barrell, A., Herriot, W. & Mitchell, R. (1992). *How to profit from innovation*. England: Director Books.

Calantone, R. J., Cavusgil, S. T. & Zhao, Y. (2002). Learning orientation, firm innovation capability, and firm performance. *Industrial Marketing Management*, *31*(6), 515– 524. doi:10.1016/S0019-8501(01)00203-6

Carneiro, A. (2008). When leadership means more innovation and development. *Business Strategies Series*, *9*(4), 176-184. doi: 10.1108/17515630810891843

Ceci, F. & Lubatti, D. (2012). Personal relationships and innovation diffusion in SME networks: A content analysis approach. *Research Policy*, *41*(3), 565-579. doi: 10.1016/j.respol.2011.10.003

Cobbenhagen, J. (2000). *Successful innovation: Towards a new theory for the management of small and medium-sized enterprises*. Cheltenham: Edward Elgar.

David, F. R. (2011). *Strategic management: Concepts and cases* (13th ed.). New Jersey: Prentice Hall.

Duarte, V. & Sarkar, S. (2011). Separating the wheat from the chaf – a taxonomy of open innovation. *European Journal of Innovation Management*, *14*(4), 435-459. doi: 10.1108/14601061111174907

Elenkov, D. S., Judge, W. & Wright, P. (2005). Strategic leadership and executive innovation influence: An international multi-cluster comparative study. *Strategic Management Journal, 26,* 665-682. doi: 10.1002/smj.469

Feder, G. & Savastano, S. (2006). The role of opinion leaders in the diffusion of new knowledge: The case of integrated pest management (Working Paper No. 3916). Retrieved from IDEAS website: http://wwwwds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2006/05/05/000016406 2006 505155436/Rendered/PDF/wps3916.pdf

Gao, Y., & Hafsi, T. (2015). R & D spending among Chinese SMEs: The role of business owners' characteristics. Management Decision, 53(8), 1714-1735. doi: 10.1108/MD-04 2014 0208

Gumusluoglu, L. & Ilsev, A. (2009). Transformational leadership, creativity and organizational innovation. *Journal of Business Research*, *62*(4), 461-473. doi: 10.1016/j.jbusres.2007.07.032

Hair, J. F., Anderson, R. E., Tatham, R. L. & Black, W. C. (1998). *Multivariate data analysis*, (5th edi). New Jersey: Prentice Hall.

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2014). *A primer on partial least squares structural equation modeling (PLS-SEM)*. Thousand Oaks: Sage.

Henseler, J., Ringle, C. M. & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academic Marketing Science, 43,* 115-135. doi: 10.1007/s11747-014-0403-8

Jung, K. & Andrew, S. (2014). Building R&D collaboration between university-research institutes and small medium-sized enterprises. *International Journal of Social Economics*, *41*(12), 1174-1193. doi: 10.1108/IJSE-07-2013-0171

Lee, K., Rho, S. Kim, S. & Jun, G. J. (2007). Creativity-innovation cycle for organizational exploration and exploitations: Lessons from Neowiz – a Korea internet company. *Long Range Planning*, *40*(4), 505-523. doi: 10.1016/j.lrp.2007.06.009

Lin, R., Chen, C. & Chiu, K. K. (2010). Customer relationship management and innovation capability: An empirical study. *Industrial Management & Data Systems Information, 110*(1), 111-133. doi: 10.1108/02635571011008434

Mosey, S. (2005). Understanding new-to-market product development in SMEs. International *Journal of Operations and Production Management, 25*(2), 114-130. doi: 10.1108/01443570510576994

Panayides, P. (2006). Enhancing innovation capability through relationship management and implications for performance. *European Journal of Innovation Management*, *9*(4), 466-483. doi: 10.1108/14601060610707876

Pangarkar, N. (2012). *High performance companies: Successful strategies from the world's top achievers*. Singapore: John Wiley & Sons.

Radas, S., Anic, I. D., Tafro, A. & anger, V. (2015). The effects of public support schemes on small and medium enterprises. *Technovation, 38*, 15-30. doi: 10.1016/j.technovation.2014.08.002

Real, J. C., Roldan, J. L. & Leal, A. (2014). From entrepreneurial orientation and learning orientation to business performance: Analysing the mediating role of organizational learning and the moderating effects of organizational size. *British Journal of Management*, *25*, 186-208.doi: 10.1111/j.1467-8551.2012. 00848.x

Salim, I. M. & Sulaiman, M. (2011). Organizational learning, innovation and performance: A study of Malaysian small and medium sized enterprises. *International Journal of Business and Management*, *6*(12), 118-125. doi: 10.5539/ijbm. v6n12p118

Sternberg, R. & Arndt, O. (2001). The firm or the region: What determines the innovation behavior or European firms? *Economic Geography*, *77*(4), 364-382. doi: 10.1111/j.1944 8287.2001.tb00170.x

Thien, L. M., Razak, N. A. & Ramayah, T. (2014). Validating teacher commitment scale using a Malaysian sample. *Sage Open*, *2014*(4), 1-9. doi: 10.1177/2158244014536744

Varis, M. & Littunen, H. (2010). Types of innovation, sources of information and performance in entrepreneurial SMEs. European Journal of Innovation Management, *13*(2), 128-154. doi: 10.1108/14601061011040221

Winter, S. & Lasch, R. (2016). Recommendations for supplier innovation evaluation from literature and practice. *International Journal of Operations & Production Management*, *36*(6), 643-664. doi: 10.1108/IJOPM-07-2014-0341

Appendix

ProdI1	In new product and service introductions, our company is often first-to-market.
ProdI2	We describe ourselves as a firm focusing on product/service innovation.
ProdI3	Our products/services are often perceived as very new by customers.
ProdI4	In comparison with our competitors, our company has introduced more innovative products/services.
ProdI5	In comparison with our competitors, our company has a higher success rate in new products/services launch.
ProcI6	We describe ourselves as a firm focusing on process innovation.
ProcI7	Our processes are often perceived as very new by customers.
ProcI8	We are constantly improving our business processes.
ProcI9	During the past few years, our company has developed many new management approaches.
ProcI10	When we cannot solve a problem using conventional methods, we introduce new methods.
Mark11	We tap new market to fulfil customer needs.
Mark12	We explore new location to capture more market share.
Mark13	We enter new market to approach potential customers.
Mark14	In comparison with our competitors, our company has invested more in different locations.
Mark15	In comparison with our competitors, our products' most recent marketing program is revolutionary/innovative in the market.
Mark16	In new product/service introductions, our company is often at the cutting edge of technology.
RnD17	We have high fund allocated as R&D expenditure.
RnD18	We have well-planned R&D strategy.
RnD19	Our R&D resources/facilities are appropriate for new product/service, process or market development.
RnD20	We have clarity of project goals and management rules relating to R&D.
SL21	Our top management researches the new technologies, processes and product/service ideas.
SL22	Our top management actively seeks innovative ideas.
SL23	Our top management encourages innovation activities.
SL24	Our top management promotes the advantages of new solutions and ideas enthusiastically.
SL25	Our top management pays serious attention on deviations from what is expected.
SL26	Our top management communicates clear vision for future.
LO27	Our company strives to improve employee capabilities and abilities.
LO28	Our company strives to improve employee skills.
LO29	Our company develops mutual understanding and mutual trust among employees.
LO30	Our ccompany strives to improve employee knowledge.
LO31	Our company encourages cooperation between staff.
LO32	Our company strives to improve employees' way of thinking changes.
LO33	Our company encourages employees to take risk.
CR34	We actively and always seek customers input to identify their needs and expectations.

CR35 We involve customers in our new product/service design.
CR36 We always maintain a close relationship with customers.
CR37 We research that the needs of customers now and in the future.
CR38 We use customers' complaints to improve our product/service quality.

SR39 Our suppliers support us to development of our products, services, or processes.
SR40 Our suppliers provide us some technical support.
SR41 We build long-term good relationships with suppliers.
SR42 Suppliers are involved in the development of new products/services.

GS43 Government provides training for our employees.
GS44 Government holds showcase/talks/exhibition for SMEs to expand networking/market share.
GS45 Government provides financial aids for SMEs.
GS46 Government provides R&D support for SMEs.
GS47 Government allocates incentives/subsidies for SMEs to participate in innovation relevant activities.

FP48 In comparison to our competitors, we have more market share.
FP49 In comparison to our competitors, we have better quality of products/services.
FP50 In comparison to our competitors, we earn higher profit.
FP51 Compare with last few years, our company achieves higher profit.
FP52 Compare with last few years, our company achieves efficiency in operations.
FP53 Compare with last few years, our company achieves sales growth.
FP54 Compare with last few years, our company achieves higher revenue.
FP55 Compare with last few years, our company's public image improves.
FP56 Compare with last few years, our productivity increases.
FP57 Compare with last few years, our employees' satisfaction increases.
FP58 Compare with last few years, our employees knowledge/skill improves.
FP59 Compare with last few years, our production defects/errors in operation decreases.
FP60 Compare with last few years, people satisfaction towards our company increases.