Confirmatory Factor Analysis of Absorptive Capacity and Competitiveness of Small and Medium-Sized Enterprise of Thailand's Gems and Jewelry Industry

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Abstract

The objective of this research was to synthesize and analyze the confirmatory factors of absorptive capacity and competitiveness of small and medium-sized enterprises (SMEs) of Thailand's gems and jewelry industry according to the hypothesis model and empirical data. The sample of this research was 270 SME executives or entrepreneurs. Multi-Stage-Sampling was used to select the sample. Data were analyzed with Confirmatory Factor Analysis. The results of this study indicated that 1) there were 10 causal factors of absorptive capacity in three aspects, were ordered based on highest to lowest factor loading as follows: environmental turbulence, external source, and social integration mechanism. The factor loading values of three factors were 0.65, 0.54 and 0.43, respectively. The model was consistent with empirical data. 2) There were 8 causal factors of competitiveness in three aspects, were ordered based on highest to lowest factor loading as follows: potential capacity, realize capacity, and competitiveness. The factor loading values of three factors were 0.86, 0.71, and 0.40, respectively. The model was consistent with empirical data (χ^2- test = 16.20, df = 13, p-value = 0.24, CFI = 1.00, GFI = 0.99, AGFI = 0.96, RMSEA = 0.030, SRMR = 0.021) Which is a model that is suitable for use in the context of SME's that use primary technology in Thailand.

Keywords: Confirmatory Factor Analysis, Absorptive Capacity, Competitiveness, Small and Medium-Sized Enterprise, Thailand's Gems and Jewelry Industry

Introduction

In the 21st century, the panorama of new look competition has been transitioned to the information and technology era. It enables communication to be possible globally, quickly, at any times and anywhere. Moreover, it increases social and economic complex as well as self-adjustment and adapt of direction to be in harmony with changes that challenge new face of environmental competition. Emphasis placed on the importance of the knowledge base is regarded as a source of competitive advantage (Grant, 1996; Jansen et al., 2005; Huarng, 2010). Those who have a competitive advantage over competitors must be able to respond on time, quickly, and flexible manners as well as their abilities to manage efficiently with coordination and core competence that lead to organizational dynamic capabilities (Teece et al., 1997; Di Stefano et al., 2014). Absorptive capacity (ABC) is one of dynamic capabilities (Zahra and George, 2002; Easterby-Smith and Prieto, 2008; Barreto, 2010; Patterson and Ambrosini, 2015; Roberts, 2015) that is acceptable as an organizational capability in creating its value from knowledge to achieve competitive advantage (Zahra and George, 2002)

An organization cannot sustainably survive in an industrial world if it depends only on resources within its organization and every organization needs to have absorptive capacity and create its value from new knowledge, new idea, new methods and technologies (Kamal and Flanagan, 2012). These capabilities link to see absorptive capacity (ABC) related to searching external knowledge, transferring knowledge and improving operational performance (Nagati and Rebolledo, 2012). Determining to search for knowledge from outside that triggers competitive advantage has been last longer than three decades.

The previous studies conducted by academics and researchers found that there were varieties of model towards causal factors (antecedents) and the obtained outcomes of absorptive capacity (ABC) in each level of organizations. A group of the previous studies used conceptual framework and theory of Cohen and Levinthal (1989; 1990) with the explanation of important characteristics. Those are multidimensional concepts concerned with 3 basic characteristics that are associated with new knowledge, such as acceptance of the value of knowledge, knowledge absorption, and the utilization of knowledge in commercial fields and as a tool for making decisions to return on the investment in research and development of organizations.

Zahra and George (2002) reviewed and reconceptualization of absorptive capacity which different from the concept of Cohen and Levinthal (1989; 1990). That is the definition of absorptive capacity (ABC); dynamic capability deeply rooted in routines and process of organizations. (It is classified into 4 dimensions under 2 elements; the potential of the dimension of acquisition capability and assimilation capability; the realized of the dimension of transformation capability and the dimension of exploitation capability, including contingent factors and new outcomes related to development of organizational competitive advantage. It is classified into 4 dimensions under 2 elements; the potential of absorptive capacity, such as the dimension of acquisition capability and assimilation capability; the realized of absorptive capacity, such as the dimension of transformation capability and the dimension of exploitation capability, including contingent factors and new outcomes related to the development of organizational competitive advantage that need to nourish prior knowledge that leads to the intensity of the experience curve in organizations and important causal factors to learning, such as the dependence of external knowledge.

Comparable to Van Den Bosch et al. (2003), the conceptual framework of Zahra and George (2002) did not specify organizational mechanisms as causal factors (antecedent) of absorptive capacity (ABC) but offered activation trigger, social integration mechanisms, and appropriate regimes to be situational factors working with causal factors. It is believed that a gap reduction between the potential of absorptive capacity (PCAB) and the realized of absorptive capacity (RCAB) to increase competitive advantage should add efficiency in these causal factors.

A lot of previous research studies conducted on absorptive capacity (ABC) by using variables to measure the direct influence of the structure focusing on investment in research and development or firm's R&D intensity (Cohen and Levinthal, 1989; 1990; Mowery et al., 1996; de Jong and Freel, 2010; Albort-Morant et al., 2018) However, these measures cannot clearly describe the conceptual framework since the measurement in the context of advanced technology industry (Lane and Lubatkin, 1998; Lichtenthaler, 2009; Flatten et al., 2011; Armstrong and Lengnick-Hall, 2013; Sciascia et al., 2014) is not enough for the measurement in the context of primary and intermediate technology industry (Santamaría et al., 2009; Sciascia et al., 2014) though causal factors in each organization are differently broad and complicated, influence in each dimension of absorptive capacity and the obtained outcomes are different. Therefore, much importance should be given to a study in the context of small organizations without research and development (Jansen et al., 2005; Lane et al., 2006; Moilanen et al., 2014; van Doorn et al., 2017)

Therefore, the researcher is interested in studying confirmatory factor analysis (CFA) of absorptive capacity and competitive advantage of small and medium-sized enterprises which enabling to know appropriate factors and indicator for Thailand's gems and jewelry industry. Considering the importance of role in these situations, this study to validate the consistency between the causal model of absorptive capacity and competitiveness of

small and medium-sized enterprises (SMEs) of Thailand's Gems and Jewelry Industry and empirical data under the confirmatory factor analysis (CFA).

Methods and Materials

This research was a survey research.The questionnaires were distributed to 270 entrepreneurs or executives of small and medium-sized enterprises (SMEs) of Thailand's Gems and Jewelry Industry. The data were analyzed by using Confirmatory Factor Analysis. The empirical research was conducted in Thailand's gem and Jewelry small and medium-sized industrial firms registered in the department of industrial works about 627 firms. Using multi-stage random sampling to determine the size of small and medium-sized enterprises in accordance with the regional employment criteria. There are 360 sample sizes allocated, therefore, the sample group of 360. Questionnaires has 270 responses in response to the questionnaire sent by mail to the business owner, an executive or Information management may not cooperate as expected. Data were analyzed by using Confirmatory Factor Analysis. Examined the consistency of the model with empirical data by the Maximum Likelihood method to evaluate the measurement model with the Confirmatory Factor Analysis (CFA) first order and second order as a model that uses observable variables to measure latent variables and determine the effectiveness of the measurement model for both validity and reliability of variables.

Results

The total number of respondents was 270 people. Most businesses operate in Bangkok, 55.56%, followed by the central region, 33.70%, the rest are distributed in other regions, including North, East, West and North East, respectively. Examined the consistency of the model of Absorptive Capacity and Competitiveness of Small and Medium-Sized Enterprise of Thailand's Gems and Jewelry Industry with empirical data by the maximum likelihood method to evaluate the measurement model with the confirmatory factor analysis (CFA) for both validity and reliability of construct, the results were as follows:

First Order Confirmatory Factor Analysis

To determine the composition of external latent variables that can be measured by observed variables and analyze the model consistency by considering Construct Reliability (ρ_c) Average Variance Extracted (ρ_v). The analytic results could be divided into two parts as follows:

1. The results of first order confirmatory factor analysis showed that the causal factors of absorptive capacity as shown in Figure 1 consisted of three factors including external source (EXT) and environmental turbulence (TURBO) and social integration mechanism (CULT). The consistency of the model with empirical data was at a very good level as shown in test statistics as follows: χ^2- test = 30.19, df = 27, p = 0.31, χ^2/df = 30.19/ 27 = 1.118, RMSEA = 0.021, SRMR = 0.028, CFI = 1.00, GFI = 0.98, and AGFI = 0.96.

When the capacity of observed variables to measure latent variables in the model with factor loadings (b) were considered, all values were positive from 0.25 to 0.86 and different from zero with a statistical significance level of .01, as shown in Table 1. When standardized factor loadings (B) were analyzed to determine observed variables that could measure latent variables of the causal factors influencing absorptive capacity, the results were as follows:

In terms of external source (EXT), observed factors with the highest factor loadings were business and customer network (NET) and government and independent organizations (GOP) with a standardized factor loading of 0.75. Covariance value between the two factors and external source (EXT) were 56% and 57%, respectively.

In terms of environmental turbulence (TURBO), an observed factor with the highest factor loading was market turbulence (MART) with a standardized factor loading of 0.81. Covariance value with environmental turbulence (TURBO) was 55%. Technology turbulence (TECT) was an observed factor with a standardized factor loading of 0.74. Covariance value with environmental turbulence (TURBO) was 66%.

In terms of social integration mechanism (CULT), an observed factor with the highest factor loading was risk-oriented culture (RISK) with a standardized factor loading of 0.95. Covariance value with social integration mechanism (CULT) was 90%. Open communication (OPEN) was an observed factor with a standardized factor loading of 0.80. Covariance value with social integration mechanism (CULT) was 64%. Reward-oriented culture (REW) was an observed factor with a standardized factor loading of 0.79. Covariance value with social integration mechanism (CULT) was 62%. Cross-functional team (TEAM) was an observed factor with a standardized factor loading of 0.77. Covariance value with social integration mechanism (CULT) was 60%. Task-oriented culture (TASK) was an observed factor with a standardized factor loading of 0.66. Covariance value with social integration mechanism (CULT) was 43%. Cooperation-oriented culture (COOP) was an observed factor with a standardized factor loading of 0.65. Covariance value with social integration mechanism (CULT) was 43%.

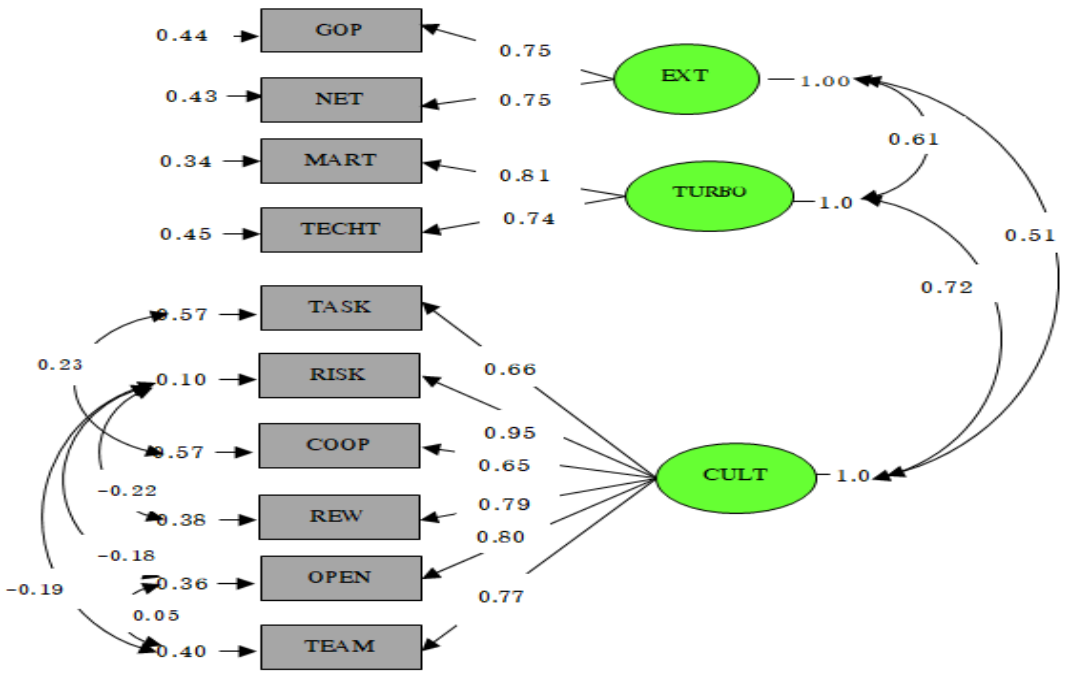

Figure1 First Order Confirmatory Factor Analysis of the Causal Factors of Absorptive Capacity

Table 1 Factor Loadings and Construct Reliability and Factor Scores Regressions

Component Variables	Factor Loadings					Factor Scores Regressions
	b	B	SE	t	R^2	
External Source (EXT)						
Government and Independent Organization (GOP)	0.82	0.75	0.07	11.01*	0.56	0.37
Business and Customer Network (NET)	0.69	0.75	0.06	11.10*	0.57	0.46
Environment Turbulence (TURBO)						
Market Turbulence (MART)	0.69	0.81	0.05	14.13*	0.66	0.50
Technology Turbulence (TECT)	0.25	0.74	0.02	12.76*	0.55	0.85
Social Integration Mechanism (CULT)						
Task Oriented Culture (TASK)	0.56	0.66	0.05	11.93*	0.43	0.06
Risk Oriented Culture (RISK)	0.86	0.95	0.05	16.95*	0.90	0.77
Cooperative Oriented Culture (COOP)	0.57	0.65	0.05	11.88*	0.43	0.06
Reward Oriented Culture (REW)	0.75	0.79	0.05	14.44*	0.62	0.29
Open Communication (OPEN)	0.75	0.80	0.05	14.48*	0.64	0.20
Cross Functional Team (TEAM)	0.68	0.77	0.05	13.66*	0.60	0.22

To determine Construct Reliability (ρ_c) of latent variables and Average Variance Extracted (ρ_v), it was found that external source (EXT), environmental turbulence (TURBO), and social integration mechanism (CULT) factors had high construct reliability values and most of factors could explain the variance of the variables in the factor as shown in table 2.

Table 2 Construct Reliability (ρ_c) of Latent Variables and Average Variance Extracted (ρ_v)

Latent Variables	Construct Reliability (ρ_c)	Average Variance Extracted (ρ_v)
EXT	0.7212	0.5639
TURBO	0.7525	0.6389
CULT	0.8997	0.6032

2. The results of first order confirmatory factor analysis showed that the causal factors of competitiveness as shown in Figure 2 consisted of three factors, including potential capacity (PCAB), realized capacity (RCAB), and competitiveness (COMPE). The consistency of the model with empirical data was at a very good level as shown in test statistics as follows: χ^2-test = 16.20, df = 13, p = 0.24, χ^2/df = 16.20/13 = 1.246, RMSEA = 0.030, SRMR = 0.021, CFI = 1.00, GFI = 0.99, and AGFI = 0.96.

When the capacity of observed variables to measure latent variables in the model with factor loadings (b) were considered, all values were positive from 0.61 to 0.90 and different from zero with a statistical significance level of .01, as shown in Table 3.

When standardized factor loadings (B) were analyzed to determine observed variables that could measure latent variables of the causal factors influencing absorptive capacity, the results were as follows:

In terms of potential capacity (PCAB), an observed factor with the highest factor loading was assimilation capability (ASCA) with a standardized factor loading of 0.83. Covariance value with potential capacity (PCAB) was 69%. Acquisition capability (ACAB) was an observed factor with a standardized factor loading of 0.76. Covariance value with potential capacity (PCAB) was 58%.

In terms of realized capacity (RCAB), an observed factor with the highest factor loading was transformation capability (TRAN) with a standardized factor loading of 0.93. Covariance value with realized capacity (RCAB) was 86%. Exploitation capability (EXPLO) was an observed factor with a standardized factor loading of 0.77. Covariance value with realized capacity (RCAB) was 60 %.

In terms of competitiveness (COMPE), an observed factor with the highest factor loading was product (PRODUCT) with a standardized factor loading of 0.96. Covariance value with competitiveness (COMPE). was 92%. Customer (CUSTO) was an observed factor with a standardized factor loading of 0.73. Covariance value with competitiveness (COMPE) was 54 %. Market (MARK) was an observed factor with a standardized factor loading of 0.72. Covariance value with competitiveness (COMPE) was 54 %. Profit (PROFIT) was an observed factor with a standardized factor loading of 0.72. Covariance value with competitiveness (COMPE) was 52 %.

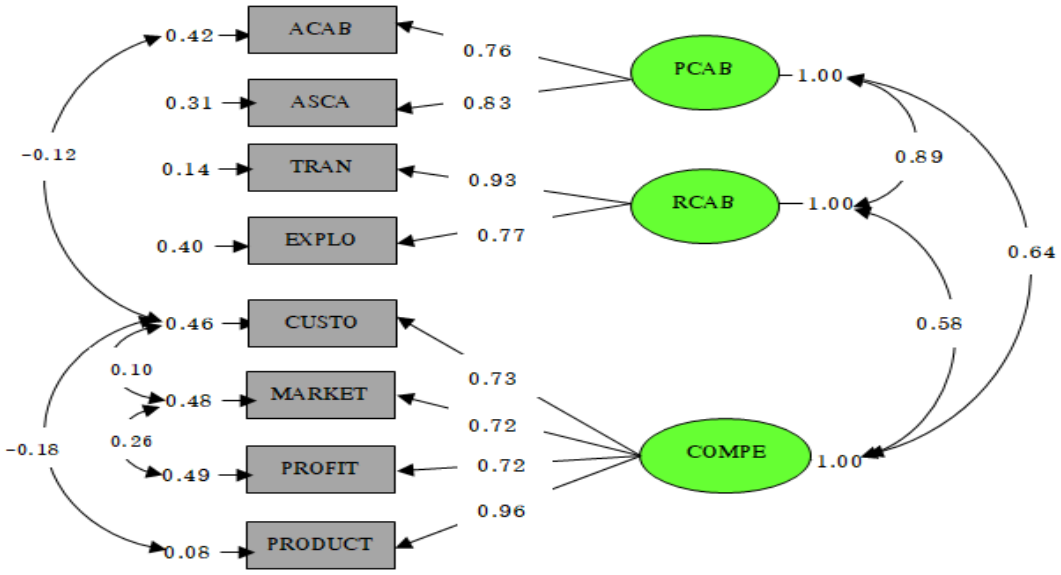

Figure 2 First Order Confirmatory Factor Analysis of the Causal Factors of Competitiveness

Table 3 Factor Loadings and Construct Reliability and Factor Scores Regressions

Component Variables	Factor Loadings					Factor Scores Regressions
	b	B	SE	t	R^2	
Potential Capacity (PCAB)						
Acquisition Capability (ACAB)	0.87	0.76	0.06	13.82*	0.58	0.23
Assimilation Capability (ASCA)	0.72	0.83	0.05	15.43*	0.69	0.38
Realized Capacity (RCAB)						
Transformation Capacity (TRAN)	0.79	0.93	0.04	18.35*	0.86	0.75
Exploitation Capacity (EXPLO)	0.64	0.77	0.04	14.30*	0.60	0.22
Competitiveness (COMPE)						
Customer (CUSTO)	0.61	0.73	0.06	11.01*	0.54	0.43
Market (MARKET)	0.73	0.72	0.06	12.40*	0.52	0.11
Profit (PROFIT)	0.78	0.72	0.06	12.39*	0.51	0.05
Product (PRODUCT)	0.90	0.96	0.05	16.84*	0.92	0.84

To determine Construct Reliability (ρ_c) of latent variables and Average Variance Extracted (ρ_v), it was found that potential capacity (PCAB), realized capacity (RCAB), and competitiveness (COMPE) factors had high construct reliability values and most of factors could explain the variance of the variables in the factor as shown in table 4

Table 4 Construct Reliability (ρ_c) of Latent Variables and Average Variance Extracted (ρ_v)

Latent Variables	Construct Reliability (ρ_c)	Average Variance Extracted (ρ_v)
PCAB	0.7759	0.6344
RCAB	0.8426	0.7297
COMPE	0.8665	0.6226

Second Order Confirmatory Factor Analysis

To validate construct reliability of the model and compare factor loadings of each factor with empirical data, the results were as follows:

1. The results of second order confirmatory factor analysis to validate construct reliability of causal factors of absorptive capacity indicated that the model was consistent with empirical data with acceptable consistency indices as shown in test statistics as follows: χ^2-test = 30.19, df = 27, p-value = 0.31, CFI = 1.00, GFI = 0.98, AGFI = 0.96, RMSEA = 0.021, and SRMR = 0.028, as shown in figure 3.

There were 10 causal factors of absorptive capacity in three aspects, which were ordered based on highest to lowest factor loading as follows: environmental turbulence (TURBO), external source (EXT), and social integration mechanism (CULT) with standardized factor loadings of 0.65, 0.54, and 0.43, respectively.

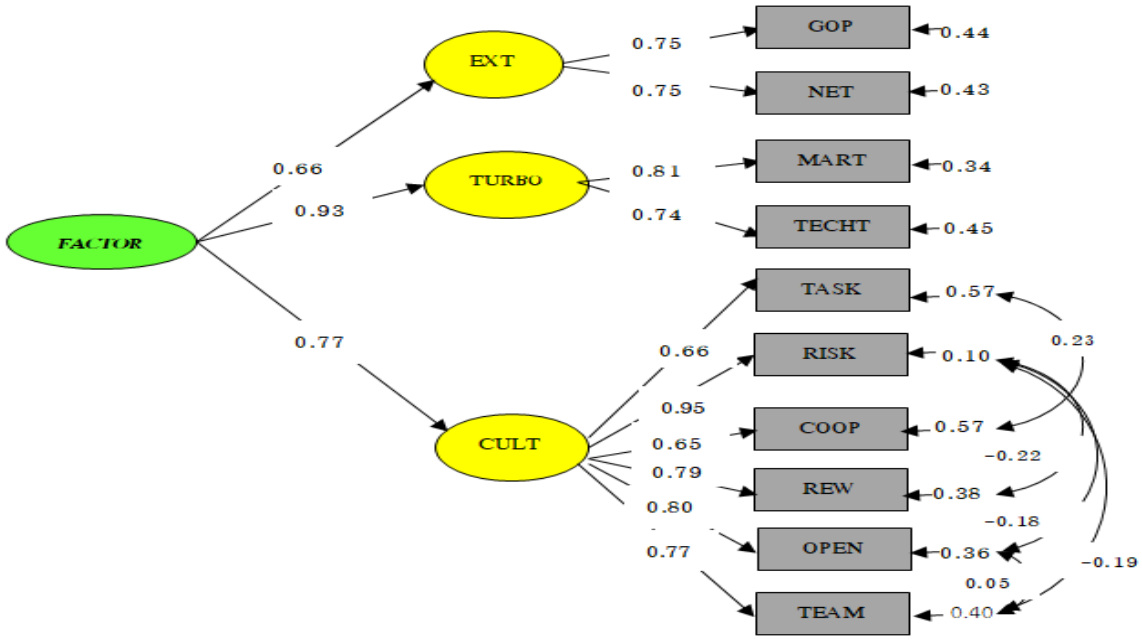

Figure 3 Second Order Confirmatory Factor Analysis of the Causal Factors of Absorptive Capacity Indicated

2. The results of second order confirmatory factor analysis to validate construct reliability of causal factors of competitiveness indicated that the model was consistent with empirical data with acceptable consistency indices as shown in test statistics as follows: χ^2- test = 16.20, df = 13, p-value = 0.24, CFI = 1.00, GFI = 0.99, AGFI = 0.96, RMSEA = 0.030, and SRMR = 0.021, as shown in figure 4.

There were 8 causal factors of competitiveness in three aspects, which were ordered based on highest to lowest factor loading as follows: potential capacity (PCAB), realized capacity (RCAB), and competitiveness (COMPE) with standardized factor loadings of 0.86, 0.71, and 0.40 respectively.

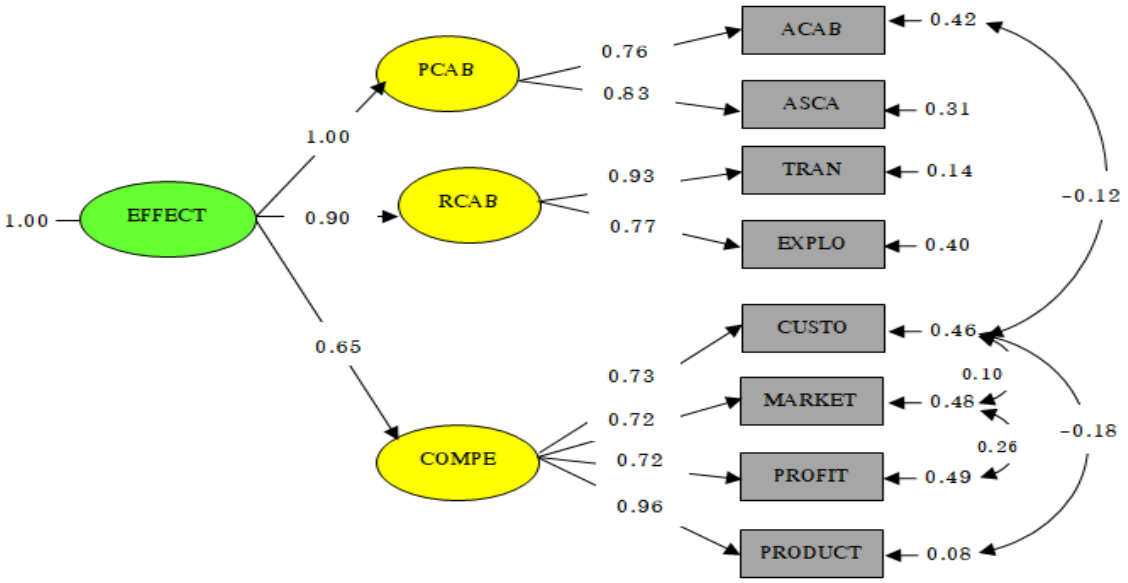

Figure 4 Second Order Confirmatory Factor Analysis of the Casual Factors of Competiveness Indicated

Discussion

The results of analyzing first order confirmatory factor analysis showed that the causal factors of absorptive capacity consisted of three factors, including 1. external source (EXT) measured by two sub-factors: 1) business and customer network (NET) and 2) government and independent organization (GOP), 2. environment turbulence (TURBO) measured by two sub-factors: 1) technology turbulence (TECH), and 2) market turbulence (MART), and 3. social integration mechanism (CULT) measured by six sub-factors: 1) risk-oriented culture (RISK), 2) open communication (OPEN), 3) reward-oriented culture (REW), 4) cross-functional team (TEAM), 5) task-oriented culture (TASK), and 6) cooperative-oriented culture (COOP).

The results of analyzing first order confirmatory factor analysis showed that the causal factors of competitiveness consisted of three factors, including 1.potential capacity (PCAB) measured by two sub-factors: 1) acquisition capability (ACAB), and 2) assimilation capability (ASCA), 2. Realized capacity (RCAB) measured by two

sub-factors: 1) transformation capability (TRAN), and 2) exploitation capability (EXPLO), 3. Competitiveness (COMPE) measured by four sub-factors: 1) product (PRODUCT), 2) customer (CUSTO), 3) market (MARK), and 4) profit (PROFIT).

The results of second order confirmatory factor analysis to validate construct reliability of causal factors of absorptive capacity indicated that the model was consistent with empirical data with acceptable consistency indices as shown in test statistics as follows: chi-square (χ^2) = 30.19, probability (p) = 0.31, df = 27, adjusted goodness of fit index (AGFI)=0.96, root mean square error of approximation (RMSEA) = 0.021, standardized root mean square residual (SRMR)=0.028, comparative fit index (CFI) = 1.00, and goodness-of-fit index(GFI) = 0.98. These indices implied that the model of absorptive capacity consisted of environmental turbulence (TURBO), external source (EXT), and social integration mechanism (CULT) (Zahra and George, 2002; Jansen et al., 2005; Lane et al., 2006; Todorova and Durisin, 2007; Kostopoulos et al., 2011; Guo and Wang, 2014; Moilanen et al., 2014; Zhai et al., 2018) and the model was consistent with empirical data and the validity of the model was acceptable to be used to measure causal factors of absorptive capacity of small and medium-sized enterprises (SMEs) in Thailand's gems and jewelry industry.

The results of second order confirmatory factor analysis to validate construct reliability of causal factors of competitiveness indicated that the model was consistent with empirical data with acceptable consistency indices as shown in test statistics as follows: chi-square (χ^2) = 16.20, probability (p) = 0.24, df = 13, adjusted goodness of fit index (AGFI) = 0.96, root mean square error of approximation (RMSEA) = 0.030, standardized root mean square residual (SRMR)=0.021, comparative fit index (CFI) = 1.00, and goodness-of-fit index (GFI) = 0.99. These indices implied that the model of competitiveness consisted of potential capacity, realized capacity, and competitiveness (Jaworski and Kohli, 1993; Zahra and George, 2002; Jansen et al., 2005; Lane et al., 2006; Todorova and Durisin, 2007; Lichtenthaler, 2009; Rammer et al., 2009; Volberda et al., 2010; Engelen et al., 2014; Guo and Wang, 2014; Moilanen et al., 2014) and the model was consistent with empirical data and the validity of the model was acceptable to be used to measure causal factors of competitiveness of small and medium-sized enterprises (SMEs) in Thailand's gems and jewelry industry.

Conclusion and Suggestions

The results indicated that the causal model of factors affecting of absorptive capacity consisted of three factors including external source (EXT), environmental turbulence (TURBO), and social integration mechanism (CULT). The causal model of factors affecting of competitiveness consisted of three factors, including potential capacity (PCAB), realized capacity (RCAB), and competitiveness (COMPE). These six factors had high factor loadings so that they should be considered when applying them in the context of small and medium-sized enterprises (SMEs) in Thailand's gems and jewelry industry. The model of measuring absorptive capacity and competitiveness of Thailand's gems and jewelry industry should be improved by extending the scope of study to the context of exporters in order to generalize the results to the broader scope of population and industry, especially international level.

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