

SIMULATION MODEL FOR COMMERCIAL INNOVATION MANAGEMENT GUIDELINE IN INDUSTRIAL BUSINESS FOR THAILAND COMPETITIVENESS IN GLOBAL MARKET

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ABSTRACT

Aim: *This research investigates the characteristics of industrial business enterprises and develops commercial innovation management guideline in industrial business for Thailand competitiveness in global market.*

Methodology: *The model has been simulated from the findings of both qualitative and quantitative of 500 questionnaires distributed to managers/administrators of the industrial business enterprises in Thailand that won the global or nation innovation rewards. The data were analysed by descriptive analysis categorized into light and heavy industries, and by SEM to conduct the model in compatible with the empirical data.*

Finding: *The results reveal that: 1) the simulation model for commercial innovation management guideline in industrial business for Thailand competitiveness in global market consists of 5 factors i.e. learning organization, research & development process, resource management, marketing potential, and information technology. The managers/administrators gave very high importance on commercial innovation management guideline in industrial business at 3.92 on heavy industry and 3.73 on light industry respectively. The analysis of the importance on each aspect shows high importance in most factors; except on the research & development process of light industry which is at moderate level. 2) The development of SEM shows that the model fits with the empirical data at the 0.107 Chi-square probability levels, relative Chi-square at 1.293, goodness of fit index at 0.983 and root mean square error of approximation at 0.024. 3) The hypothesis result shows the following influencing factors: learning organization has direct influence on research and development process at the statistically significant level of 0.001, research and development process has direct influence on information technology at the statistically significant level of 0.001 and the research and development process has direct influence on marketing potential at the statistically significant level of 0.001.*

Conclusion: *The guideline in industrial business for Thailand competitiveness in global market comprises five main factors which are very important on commercial innovation in industrial business of both heavy and light industries. The factors are ranked according to their important levels referred Likert's scale as follows: learning organization, marketing potential, resource management, information technology, research and development process respectively. Both heavy and light industries give the most important factor on learning organization and marketing potential in order to be a guideline in industrial business for Thailand competitiveness in global market. The evaluation of structural equation modelling of the simulation model in commercial innovation showed passing the criteria of the model fitting with the empirical data. It was found that Chi-Square Probability Level equalled 0.107, Relative Chi-square was 1.293, Goodness of fit Index was 0.983 and Root Mean Square Error of approximation was 0.024.*

Keywords: Commercial Innovation Management, Simulation Model, Innovation Management.

INTRODUCTION

Nowadays, the advance in technology enhances consumers to easily access product and service information. This creates high business competition among the producers to cope with the consumer needs. The business sector has to regularly present new products as more alternatives for the customers. Thus, industrial business needs of innovation on products, production processes, and services have significantly increased in order to add more values to the products and services (Wutthirong, 2012). Innovation is one of the most crucial elements to grow a business. Porter (1990) also stressed that innovation can drive long-term product growth and bring about competitive advantage in the future. The higher capability in innovation results in higher capital income of the country based on the Gross Domestic Product per Capita (GDP per capita) in Global Competiveness Report published by World Economic Forum (WEF), a widely recognized and world-renowned entity in accessing countries' capability and competitiveness. According to the claim in Thailand Science & Technology Indicator 2012 represented the positive relation between innovation and GDP per capita of countries and had positively related to economic development level. (National Science Technology and Innovation Policy office, 2012; cited World Economic Forum). WEF classified the economy income threshold for establish as three main stages of development and two transition stages of development depend on GDP per capita of country as shown in Table 1.

	Stage of Development				
	Stage 1 Factor-driven	Transition from Stage 1 to 2	Stage 2 Efficiency-driven	Transition from Stage 2 to 3	Stage 3 Innovation-driven
GDP per Capita (USD)	< 2,000	2,000-2,999	3,000-8,999	9,000-17,000	> 17,000
ASEAN Countries	Laos Cambodia	Vietnam Brunei Philippines	Thailand Indonesia	Malaysia	Singapore Japan Korea

Table 1 represent the first stage, the economy is factor-driven and countries compete based on their factor endowments, primarily unskilled labour, natural resources and exports more than 70% of primary products. The efficiency-driven stage of development, when they must begin to develop more efficient production processes and increase product quality. Finally, as countries move into the innovation-driven stage, they are able to sustain higher wages and the associated standard of living only if their businesses are able to compete with new and unique products. It is clear that innovation-driven countries such as Singapore, Japan, or South Korea each provide higher a GDP per capita (over 17,000 US dollars) than factor-driven countries (<2,000 US dollars) and efficiency-driven ones (3,000-8,900 US dollars) such as Thailand. If estimate the period to approach from 3-4% recently annual growth rate, it would take over 20 years for Thailand to become a developed and innovation-driven country with a GDP of over 9,000 US dollars. This is a crucial challenge task to drive the country's economy forward in a shorter period. Moreover, considering innovation index ranked by World Intellectual Property Organization (WIPO), Cornell University, and Institute European d' Administration des Affaires (INSEAD) in 2018, Thailand was ranked 44th from 126 countries with the Innovation Output

Sub-Index, the index of creativity and products and services, falling from 42nd to 45th from years (2009-2018) (Cornell University, INSEAD, and the World Intellectual Property Organization, 2015); National Science Technology and Innovation Information-Centre of National Science Technology and Innovation, 2019). In addition, the business efficiency index also has continuously fallen from 18th to 24-25th in 5 years based on the business survey by IMD Institute from 2013 to 2018 (National Science Technology and Innovation Information-Centre of National Science Technology and Innovation, 2019; International Institute for Management Development-IMD, 2016). With the overall decreased in indices of the country business, the business sector providing 27-35% of the GDP portion of Thailand economy in 2008-2013 (Office of the National Economic and Social Development Council, 2019; Economy of Thailand, 2019) plays an important role in driving the country economy by changing the driven force from production efficiency to innovation.

Development of innovation is a multidimensional, costly and risky process, because the object of innovations is the intellectual product. The commercialization process of innovations has a significant complexity (Komkov et al., 2005). The question of what success in innovation is one of enormous complexity. Some examples of commonly seen success concepts in innovation are commercialization, market introduction, integration into a product or service, formation of a company based on the innovation, value-creation (More, 2011). People often mention innovation as only in research and development (R&D) activity occurring at universities, national laboratories and corporations. The Organization for Economic Cooperation and Development properly defines innovation more broadly as “*the implementation of a new or significantly improved product, process, and a new marketing method*” (Atkinson, 2013). The author reviewed the literatures finding the factors can build-up the product innovation in industrial business organization as followed.

Learning Organization

Drucker's (2002) proposal mention to the several successes leading business organizations had based from personnel innovative creating. The concept of innovation development in organization for building the learning organization as organization platform to support the creativity and employee able to select new ideas or adjust behavior to develop the new system, process, products and services (Wootirong, 2014) The relationship between open-mindedness and innovation potential has been confirmed by many industry studies such as electronic industry in Thailand (Usaahawanitchakit, 2011) and open-mindedness influences the effectiveness of innovative products. The training provides employees new knowledge rapidly and increase innovation capability. Employees with greater expertise and knowledge will create more technological innovations (Mumford, 2000).

Resource Management

More (2011) defined the innovation is the process of change that creates and grows wealth. For determining that wealth is net cash flow, the real positive net cash flow over time was the one important measure for success innovation. The firm finance is absolutely crucial resource for innovation investment that also creates uncertainty. Investments in innovation in R&D, training, capital equipment, or marketing expenses for new products and processes tend to feature substantial asymmetric information, and the complexity of innovation projects (Hall, 2010; Madrid-Guijarro et al., 2016). In general, most researchers distinguish two main approaches to

the definition of the category of “*innovation potential*” First, resource-based approach treats the concept as a set of resources that are used in certain socio-economic forms to produce innovative products that meet public needs and innovation performance as combinations of resource and efficiency aspects (Vasin & Gamidullaeva, 2015). Firms use their resource base to sustain and improve competitiveness, resource sustainability; new factor consists of items intended for the original predominant resources and competitive intent factors. Theoretically, this new factor made sense because the items point toward building a forward-focused, sophisticated resource base as a platform for innovation and growth (Verreynne et al., 2016). The competitive index ranking in term of World Innovation Leader by World Innovation institute was estimated by several national institutions such as World Economic Forum, International Institute for Management Development-IMD (2016), World Intellectual Property Organization-WIPO, international news agency, and international magazine (i.e., Bloomberg magazine and Forbes magazine). These institutions investigated in the infrastructure, research and development budget, the industrial value added, high technology and engineering companies, science and engineering personnel, number of researchers in the country, number of patents which certainly were parts of organization resources. Intellectual capital is becoming one of the key resources, the use of which is a source of innovation is created by people. Therefore it is necessary to develop human capital, make it a source of productivity and competitiveness, which implies the existence of a certain system of economic relations. In the case of a low value of intellectual potential the company in general should not be engaged in innovation (Vasin & Gamidullaeva, 2015). For the sustainability in innovation creation and has a competitiveness, the organizational resources such as infrastructure, technology, budget, cash flow, personnel competency should be managed in a systematic.

Research and Development Process

Innovation potential is represented as accumulated a certain amount of information on the results of scientific and technical works, inventions, design development of new equipment and products (Vasin & Gamidullaeva, 2015). Wang (2014) claimed to research and development is critical in promoting innovation and firm development. A firm can improve its innovation either by its internal research and development (R&D) efforts or by forming external collaborative R&D alliances (Huang & Yu, 2011). Innovation process starts from the idea creation, product development planning, basic research, applied research, product development including business analysis, design and engineering to develop a prototype of innovation, test marketing and commercialization (Suthiporn, 2012; Praima, 2010). Therefore, in research and development of product innovation in the laboratory to prototype involving the research and development process and product design (Lee, 2012). The firm’s strategies capabilities, knowledge resources, fundamental research, application R&D, and manufacturing capabilities have significant influence on the new product development performance and product competitiveness of Chinese manufacturing enterprises. R&D strategy can point out the right direction for improving enterprise’s competitiveness advantage (Liu & Jiang, 2016). Filippetti (2011) found that design and R&D are complementary sources of innovation. R&D activity is regarded as the major internal source of knowledge, as well as a fundamental driver of firms’ competitiveness. Three major findings: First, an R&D department can increase its influence within the organization by fostering its degree of innovativeness and its customer connection. Second, influential R&D departments positively impact organizational performance through organizational innovativeness, particularly in cost-leadership organizations; this finding

emphasizes the relevance of influence and power structures to research on organizational issues in this research stream. Third, the findings show some reciprocal relationships: While some influence tactics increase the influence of the R&D department.

Marketing Potential

Market orientation had a significant impact on innovation orientation (Zhang et al., 2015). Marketing function especially focuses on it and tries to lead innovation process and activities for value creation to satisfy customers and other stakeholders (Ersun & Karabulut, 2013). Changes to customer relationship were most significant with syndication and co-creation, the emphasis on involving the consumer of the service in design resulted in the need for enhanced communication and interaction; thus strengthening and deepening the customer relationship (Feller et al., 2011). Another key figure in the procedure is to evaluate the marketing potential that is crucial importance in determining the innovative capacity, as it determines the capacity of the enterprise on the orientation of development on a particular consumer and the realization of innovation (Vasin & Gamidullaeva, 2015).

Information Technology

Information and methodological potential is a factor that cannot be ignored when creating a strategy of innovative development as an effective information environment contributes to the rapid adoption of quality management decisions (Vasin & Gamidullaeva, 2015). The digital as a tangible and intangible resource to promote innovation, products and services and the information technology tools useful increases efficiency and effectiveness in product development. Information technology investment supports innovation to be effective, data gathering knowledge transfer (Nambisan, 2013). Information strategy and trust now emerge as the quintessential direct causal factors of the new product development process. In order to promote successful outcomes in the innovation process, all organizations need to take three cores into account simultaneously-administration, innovation core, and information core (Ettlie et al., 2017). Information technology capabilities are more relevant to firm value, which represents growth opportunities, intangible assets, and innovation (Ong & Chen, 2013). Information technology management system is a technical resource that the company necessary to manage and develop for innovation achieving that is the source of competitive advantage (Zawislak et al., 2012).

On the basis of extensive literature review, innovations for execution of industrial competitiveness and related research summarized in followed topics.

Charttirot (2014) studied to explore research and development (R&D) and evaluation process, develop R&D commercialization capacity indicator, develop test the effectiveness of the decision support system. The research result revealed that the R&D commercialization process consists of four stages: Search, Select, Development and Commercialization. The two measurement models of commercialization capability of pre R&D and post R&D development developed for making a decision. They represented excellent accuracy of measurement of model at 96.88%. The components of measurement composed of technology, marketing, resource, and beneficial impact in pre R&D and technology, finance, intellectual property resource and beneficial impact. It noted that had less mention in personnel knowledge built-up for long term competitiveness and had small sample groups for statistical analysis. However, these indicators were the good guideline for scope of latent and variables in my research.

Jureewan (2014) revealed the six factors of innovative leadership of entrepreneurs in processed food business and develop a manual to enhance innovative leadership of entrepreneurs. (1) Outlining vision and strategies towards innovation (2) establishing atmosphere and culture toward learning (3) creating network and knowledge management (4) setting teamwork structure (5) providing supports and incentives for innovative goals and (6) developing innovative thinking skills that included in the context in this research variables especially in learning organization latent. The manual to enhance innovative leadership of entrepreneurs in processed food business divided into five modules (1) innovation and innovation development process (2) creating a network of innovation and learning organization (3) strategic management for innovative leadership (4) team building, motivation and communication and (5) development of innovative thinking skills. The findings with regard to the six factors of innovative leadership of entrepreneurs in processed food business and a manual to enhance innovative leadership of entrepreneurs in processed food business reached a general consensus as approved by the experts and obtained the effectiveness index at high level of satisfaction of the training. Although Jureewan (2014) mentioned in leadership orientation for innovativeness, most contents involved with the innovative strategy, paying attention in employee learning and knowledge and team building to drive the production creation and enhance technology and innovation for commercialization of entrepreneurs.

Pitiwong (2015) studied to develop the model to be used for the management of the special or outstanding local district goods in Thailand, called One Tambol One Product (OTOP) business in order to enhance the sustainable competitiveness efficiency of OTOP industrial business. OTOP industrial business takes a significant role of Thailand economy. There have been so many kinds of problems regarding the management of OTOP business such as low quality of goods, not prominent. The model developed to apply for OTOP business can be sustainably successful, consisted of four dimensions; the core competencies of business, competitiveness efficiency, difficulty of replication and effective organization management. The OTOP entrepreneurs need to develop their core competencies of industrial business to be knowledgeable, skilful and able to transfer correct understanding to practitioners who are interested to run an OTOP business, to understand how to deal with business management. The uniqueness of the OTOP products must have differentness as well as various uniqueness so as to raise more competitiveness efficiency, to keep developing their products to avoid being replicated, to emphasize on product services, set up a transparent system of organizational management and built up a good teamwork. The four dimensions corresponding with of internal factors including personnel skill development for emphasizing the core competencies of business and organization management, strategy and marketing perspective for competitiveness which as fully viewpoints. In my opinion, the additional in networking or supply chain aspect make more completely.

Jarunee & Weranuch (2017) studied the application of the Stage Gate model to the ISO/IEC 17025 metrological laboratories. In particular, the model was applied to the metrological research process and evaluation system which is a kind of new service development. The best practice approach in the Stage Gate model used to guide the metrological research process and evaluation system. The model may nevertheless need further alterations on the screening and development process for proper use in different laboratories. The behaviors can support to success of research project as 1) conduct the KPI for innovation encouragement 2) conduct the marketing strategy effectively 3) Open opportunities training of new knowledge to personnel 4) Manage and collect to the organizational knowledge with systematic and accessible 5) Attention to customer feedback 6) evaluation to prioritize planning and budgeting. This stage gate model had famous tool for innovation management process. However, it was focus in R&D, commercialization and resource

management viewpoint with step of assessment and the assessment that certainly necessary to carry on for investigating the step target achievement. The behavior can provide failure through neglect of assessment, planning in measurement and in budgeting.

With the reasons above, the researcher has an interest in conducting simulation model for commercial innovation management guideline in industrial business for Thailand competitiveness in global market. The study focuses on causal factors influencing successfully operating industrial business. It is expected that the findings of this study will yield guidelines in 5 important factors, 1) Learning organization 2) research and development process 3) resource management 4) Marketing potential and 5) information technology in order to create more competitiveness in global market and enhance the potential and strength of Thailand industrial business.

OBJECTIVES

To develop simulation model for commercial innovation management guideline in industrial business for Thailand competitiveness in global market.

HYPOTHESIS

This research has 6 hypotheses:

H₁ Factor on resource management has direct influence on learning organization factor.

Resource management refers to training and development including efficiency evaluation, behavioral evaluation, and work basis of which are the cost of knowledge. Fernández-Mesa et al. (2013) and Verreyne et al. (2016) studied and developed knowledge index in organization focusing on resource sustainability consisting of outstanding resources and striving for competition. Striving for success during change and striving for being marketing leader are the indices for level of knowledge.

H₂ Factor on resource management has direct influence on information technology factor.

IT ability directly relates to organization value in managing both tangible asset and innovation (Ong & Chen, 2013). Research by Pan et al. (2014) states that apart from good management framework and shareholder commitment, knowledge and experiences in IT are one in 3 characteristics enhancing capability and resources of the organization.

H₃ Learning organization factor has direct influence on research and development process factor.

It has been known that the investment on R&D is important which should gradually implement during uncertainty environment (Hooshangi et al., 2013). The best way for R&D is the specific knowledge together with suitable job operation method (Gulbrandsen & Kyvik, 2010). Knowledge is important for the development of R&D innovation as well (Olsson et al., 2010).

H₄ Resource management factor has direct influence on marketing potential factor.

Resource management refers to resources, resource advantage, competency, capability, as well as dynamic capability influencing marketing strategies (Madhavaram et al., 2014). The research by Grigoriou et al. (2016) mentioned about resource based theory (RBT) of marketing

resources as brand, distribution, and customer sustainable relationship. Companies employ resources for marketing development and brand innovation marketing. The RBT application in marketing can exist in case of certain resource identification, e.g. marketing activity elevating or creating and product uniqueness potential. In addition, resources can support competitiveness and the relationship between the stakeholders and business partner by creating value added together beneficial in the form of business to business, for example in the new market such as China and India. Moreover, the forecast of customer needs is never ending. It is necessary to revise the use of organization resources to explain various needs of the customers in order to strengthen the organization potential on customer relations (Malhotra et al., 2013).

H₅ Research and development process factor has direct influence on information technology factor.

Wang et al. (2017) studied Chinese business sector showing positive effect of research and development process on business sector and research funding by the government also the IT relationship and the company capability. In addition, R&D investment and IT cost can create the company strength during dynamic environment. That is to say R&D investment creates value added in business from IT relationship and positive reinforcement of R&D and IT. However, Ettlie et al. (2017) stated that the relationship between IT and R&D in new product development is on organizational technique resource particularly on human resource to create social capital process.

H₆ Research and development process factor has direct influence on marketing potential factor.

Kim & Gu (2015) stated that the products with small difference but in high competition market costs higher expenses in R&D especially in a country with small market. Günbegi et al. (2017) found that companies with good innovation adjustment get positive effect on the cooperation between R&D and marketing and success on new product launching. The company has to increase marketing opportunity by fulfilling the customer needs through developing new products and improving the existing ones.

METHODOLOGY

This study has been designed as an inductive research with mixed methodology.

1. Qualitative Research using In-depth Interview technique with 9 experts including 3 experts in innovation business organization managers, 3 experts in innovation government department and 3 independent scholars in innovation academic with structured interview form as opened-end questions followed the concept of five latents which reviewed from theory and literature. The questionnaire designed from the expert's guideline opinions as the variable lists in each latent. The five latents comprised of 1) Learning Organization 2) Research and Development Process 3) Resource Management 4) Market Potential and 5) Information Technology. These variables were evaluated the index of the corresponding with objective or content using Item Objective Congruence; IOC analysis that showed 0.60-1.00 value (accepted at >0.5). Finally we obtained the suitable 104 variables in 5 latents for try-out questionnaire that evaluated the reliability from Cronbach's Alpha statistic showed at 0.992 (accepted at >0.8) and discrimination both check-list and rating-scale question items (accepted at >0.3) using Standard Deviation (S.D.) analysis obtained 0.596-2.250 and Corrected Item-Total Correlation analysis obtained 0.495-0.901 respectively.
2. The quantitative research used questionnaire surveys with managers/administrators of industrial business enterprises in Thailand that won the global or nation innovation rewards from 2007-2017, conduct a period of seven months to collect the data from 1,214 surveys. The 500 samples (Comrey & Lee, 2002) for statistical analysis consist of 250 data by responding to heavy industries and 250 data from light

industries. The research tools for quantitative survey questionnaires were. Data analysis was conducted through descriptive statistics by SPSS referred 5 Likert's scales (Tanin, 2014). Multivariate Statistical Analysis employed Structural Equations Model (SEM) by AMOS with evaluating the Data-model Fit in 4 levels including (1) Chi-square Probability Level over 0.05 (2) Relative Chi-square less than 2 (3) Goodness of fit Index over 0.90 and (4) Root Mean Square Error of Approximation less than 0.08.

3. The model of commercial innovation management guideline in industrial business approved by 7 experts using focus group analysis techniques in qualitative research.

RESULTS

The results of this research in relation to the factors affecting commercial innovation management of industrial business for Thailand competitiveness could be further discussed as follows:

Factors of simulation model for commercial innovation management guideline in industrial business	Heavy industry			Light industry		
	\bar{X}	S.D	Significant level	\bar{X}	S.D	Significant level
Overall	3.92	0.41	High	3.73	0.60	High
1. Learning Organization	4.03	0.47	High	3.92	0.56	High
2. Research and Development process (RD)	3.72	0.44	High	3.49	0.64	Medium
3. Resource Management (RM)	3.92	0.44	High	3.71	0.65	High
4. Marketing Potential (MP)	4.04	0.56	High	3.83	0.77	High
5. Information Technology (IT)	3.90	0.42	High	3.70	0.62	High

1. The administrators of both light and heavy industries gave the importance on commercial innovation management in industrial business for Thailand competitiveness in global market by reporting 5 factors shown in Table 2. Table 2 presents factors in simulation model for commercial innovation management guideline in industrial business showing high importance of both heavy and light industries at 3.92 and 3.73 respectively. When considering in each aspect for heavy industry, the importance is on every factor with the highest on marketing potential at 4.04 followed by learning organization at 4.03; then, resource management at 3.92, IT at 3.90, and research and development process at 3.72 respectively. For light industry, the administrators gave high importance on 4 factors, learning organization at 3.92, followed by marketing potential at 3.83, then, marketing potential at 3.83, resource management at 3.71, and IT at 3.70. The factor on research and development process was ranked medium importance at 3.49 which is different from that of heavy industry.
2. The comparison of important level of commercial innovation management guideline in industrial business for Thailand competitiveness in global market between heavy and light industry using independent t-test statistic in SPSS statistical program showed the statistically significant difference between mean of factors important level of heavy and light industry.
3. The evaluation of structural equation modelling of the simulation model in commercial innovation showed that the Chi-square probability level was at 0.000; relative Chi-square at 6.471, goodness of fit index at 0.440, and root mean square error of approximation at 0.0105 which still could not pass the criteria of the SEM.

Thus, the researcher revised the simulation model by considering modification indices suggested by Arbuckle (2011). After the revision of the simulation model, it was found that Chi-Square Probability Level equalled 0.107, Relative Chi-square was 1.293, Goodness of fit Index was 0.983, and Root Mean Square Error of Approximation was 0.024 passing the criteria of the model fitting with the empirical data as shown in Figure 1.

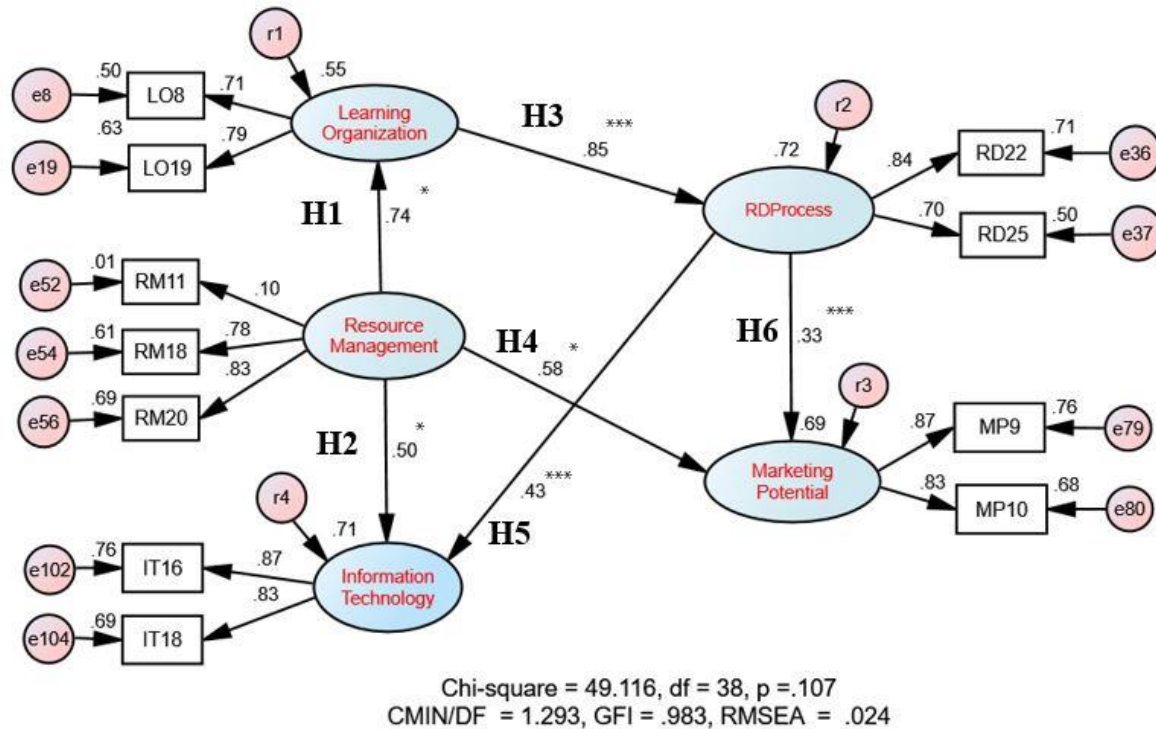


FIGURE 1
SIMULATION MODEL FOR COMMERCIAL INNOVATION MANAGEMENT
GUIDELINE IN INDUSTRIAL BUSINESS IN STANDARDIZED ESTIMATE MODE

From Figure 1, the analysis result of structural equation model of commercial innovation management guideline in industrial business found the important statistic value were factor loading in standardized estimate mode at hypothesis path analysis. The hypothesis 1 (H1) clarify the influencing factors: resource management has direct influence on learning organization at the statistically significant level of 0.05 at factor loading 0.74. The hypothesis 2 (H2), resource management has direct influence on information technology at the statistically significant level of 0.05 at factor loading 0.50. The hypothesis 3 (H3), learning organization has direct influence on research and development process at the statistically significant level of 0.001 at factor loading 0.85. The hypothesis 4 (H4), resource management has direct influence on marketing potential at the statistically significant level of 0.05 at factor loading 0.58. The hypothesis 5 (H5), the research and development process has direct influence on information technology at the statistically significant level of 0.001 at factor loading 0.43. The hypothesis 6 (H6), the research and development process has direct influence on marketing potential at the statistically significant level of 0.001 at factor loading 0.33. Statistical analysis of structural equation model for commercial innovation management guideline in industrial business in standardized estimate mode is shown in Figure 1 and summarized in Table 3.

Table 3 represented the estimate regression weight between factors of simulation model, squared multiple correlations (R^2) identify the statistical relation between variables and P-value as a statistical criteria for evaluating the significant level between variables. The results of latent variable analysis on observational variables can be explained as follows:

The factor loading of learning organization consists of the following sub-factors: learn personals' behavior in organization to conclude and propose the desirable innovation behaviors

(LO19) of 0.79; share, exchange knowledge and viewpoint model between personals in the organization by evaluating habit and culture to improve working cooperation (LO8) of 0.71.

The factor loading of research and development process consists of clear business model of innovation products (RD22) of 0.84 and applies the research and development indicators such as publication, intellectual properties, product prototype, and commercial usages (RD25) at 0.70.

The factor loading of marketing potential factor includes market survey of innovative products to evaluate marketing risk before the innovation operation (MP9) of 0.87 and evaluate the competitiveness of organizational product innovation to specify innovation direction (MP10) at 0.83.

The factor loading of resource management factor consists of evaluating the readiness and potential of R&D resource in the organization and alliances ensuring the innovation cooperation (RM20) at 0.83, arrangement of the evaluation to achieve the time and target management (RM18) at 0.78, and efficient machinery use in innovation (RM11) at 0.10.

The factor loading of information technology includes provide decision making guideline from data analysis (IT16) at 0.87 and providing facility and processing system for time saving and research efficiency (IT18) at 0.83.

Variable	Estimate Regression Weight	Square Multiple Correlation (R ²)	P-value
Resource Management			
Learning Organization	0.74	0.55	0.037*
Information Technology	0.50	0.72	0.041*
Marketing Potential	0.58	0.69	0.039*
Learning Organization			
Research & Develop Process	0.85	0.72	***
Research & Develop Process			
Information Technology	0.43	0.71	***
Marketing Potential	0.33	0.69	***
Learning Organization			
LO8	0.71	0.50	
LO19	0.79	0.63	***
Research & Develop Process			
RD22	0.84	0.71	
RD25	0.70	0.50	***
Resource Management			
RM11	0.10	0.01	
RM18	0.78	0.61	0.036*
RM20	0.83	0.69	0.036*
Marketing Potential			
MP9	0.87	0.76	
MP10	0.83	0.69	***
Information Technology			
IT16	0.87	0.76	
IT18	0.83	0.68	***

Note: *** Significant level at 0.001; * Significant level at 0.05

DISCUSSION

From the result of the difference important level of five factors on commercial innovation management in industrial business for Thailand competitiveness in global market between the heavy and light industry sectors at 0.05 significant level, in heavy industry sector gave the important level in marketing potential factor was highest priority ($\bar{X}=4.04$) that slightly differ from learning organization factor ($\bar{X}=4.03$) (see in Table 1), followed by resource management, information technology and research and development process respectively. Light industry gave highest important level on learning organization factor. The second was resource management followed by marketing potential, information technology and research and development process respectively. However light industry sectors just provides medium important level on research and development process corresponding to the various factors in innovation characteristic of company affect innovation power such as external orientation, cooperation between departments, learning and adapting, autonomy and possibility for experimenting, and external factors providing the different innovation of firm. (Van Bommel, 2011). Firm age and firm size related to knowledge maturity and innovation value also depends on the availability of enabling technologies (Petruzzelli et al., 2018). There are some differences between high-tech and low-tech industry. The synergy effects of innovation exist and can be changed depending on the innovativeness levels and industrial categories (Lee et al., 2017). This research studied in full chain perspective of competitiveness innovation from input (resource management), conversion process (R&D process) to output (marketing capability, competitiveness commercialized innovation). Author summarized the concept of tools developed by Charttirot (2014); Jureewan (2014); Pitivong (2015); Jarunee & Weranuch (2017) and put the additional in cooperation or networking perspective with the alliances cooperation for ensuring the innovation through resources management (RM20), the information technology through database arrangement for making a decision that benefit to reduce human error (IT16) and use IT to facilitate the processing system (IT18) that IT strategy and tools mentioned in Vasin & Gamidullaeva's (2015) and Nambisan's (2013) research works to achieved the innovation for competitive advantage. We necessary to learn outside and get benefits through cooperation and information, besides use our resources only.

CONCLUSION

The guideline in industrial business for Thailand competitiveness in global market comprises 5 main factors which are very important on commercial innovation in industrial business of both heavy and light industries. The factors are ranked according to their important levels as follows: learning organization, marketing potential, resource management, information technology, and research and development process respectively. Both heavy and light industries give the most important factor on learning organization and marketing potential in order to be a guideline in industrial business for Thailand competitiveness in global market.

Though the heavy industrial sector gives the importance on marketing potential at the highest factor, but learning organization still plays an important role at 4.04 and 4.03 respectively. The researcher found that the heavy industry has long been providing funding for learning organization than that of the light industry. Due to the very high competition in global market particularly in exponential improvement of IT; thus, the industry gives high importance on marketing strategy to reach prospect customers faster than the competitors. This results on earning more cash in a shorter time which supports the work by stating that innovative marketing

activities can increase the relationship between innovative product activity and high technology organization efficiency at the statistically significant level of 0.001.

Another important factor in innovation management is learning organization because learning and knowledge is the source of advantages in competitive edge and is the main variable on innovation capability in an efficient organization. Encouraging the staffs to have innovative ideas, being open-minded to imitative ideas from both inside and outside the organization, and creating body of knowledge are the foundation for the company's innovation development and competitive edges. It can be clearly seen that the light industry pays the importance on learning organization at the first factor. This can be explained by the fact that most light industry has less capital and lower technology than those of the high technology industry. Thus, their innovation has been developed gradually which is congruent with the study by finding that the exploration orientation and exploit orientation are parts of learning which has significant influence on both gradual and exponential innovative product activities. This study also mentioned that low technology industry group focusing on exploration orientation has positive effect on the gradual innovative product activity at 0.01 significant levels. The result is different from that of high technology industry group showing that the exploration orientation has direct positive effect on the exponential innovative product activity at 0.01 significant levels.

Two factors had less important level both heavy and light industry were information technology and research and development process factors, might be affect the firm performance in more dynamic environments because the interaction of R&D investment and IT investment has a positive effect on firm performance. The complementarities between IT and R&D varies across industry sectors could create additional value impact firm performance. It is mention that Thailand business industries shall more improve the R&D and IT realization and complementarities between them for rapid growth of innovation and firm performance in digital era.

Suggestion for Further Study

The development of learning organization is the key to improve readiness of the staffs in the organization which is the most important finding in this study. Moreover, the researcher recommends that there should be an in-depth study on staff attitude management or inspiration creation on innovation. This knowledge can create good attitude and organizational culture resulting in sustainable commercial innovation.

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