THE EFFECTS OF ENVIRONMENTAL FACTORS AND IT INVESTMENT ON ORGANIZATIONAL PERFORMANCE THROUGH INNOVATION CAPABILITIES AND DISRUPTIVE INNOVATION MANAGEMENT IN THE ELECTRONICS INDUSTRY

WIRAT BUTWAPEE

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT
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Dissertation Title	The Effects of Environmental Factors and IT Investment on Organizational Performance through Innovation Capabilities and Disruptive Innovation Management in the Electronics Industry
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Program	Business Administration
Dissertation Advisor	Assistant Professor Natnarong Jaturat, Ph.D.
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Academic Year	2017

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ABSTRACT

Thailand's electronics industry has been influenced by the competitive environment, especially the impacts of fast changing information technology and high business competition in supporting information technology investment in organization. This research aimed to study the effects of environmental factors and IT investment on organizational performance through innovation capabilities and disruptive innovation management of the electronics industry in Thailand. A questionnaire was administered to 255 electronics manufacturing companies listed in the Department of Business Development, Ministry of Commerce. The data were analyzed by descriptive statistics and the structural equation model (SEM) to find out the relationship between the variables and to test the hypotheses.

The results revealed that environmental factors had no positive impact on innovation capabilities, but were positively correlated with disruptive innovation management. They also indirectly affected organizational performance through disruptive innovation management. On the other hand, IT investment was positively correlated with innovation capabilities, but had no positive impact on disruptive innovation management. These implied that companies must pay attention to cross functional integration for manufacturing products and services to meet the customers' needs.

The findings also suggested that organizations analyze the competitive environment, especially technological and innovation impacts as well as information technology and innovation investment. This will support and create the competitive opportunities through capabilities of innovation and disruptive innovation management.

Keywords: mediating effect, environmental factors, IT investment, innovation capabilities, disruptive innovation management, organizational performance

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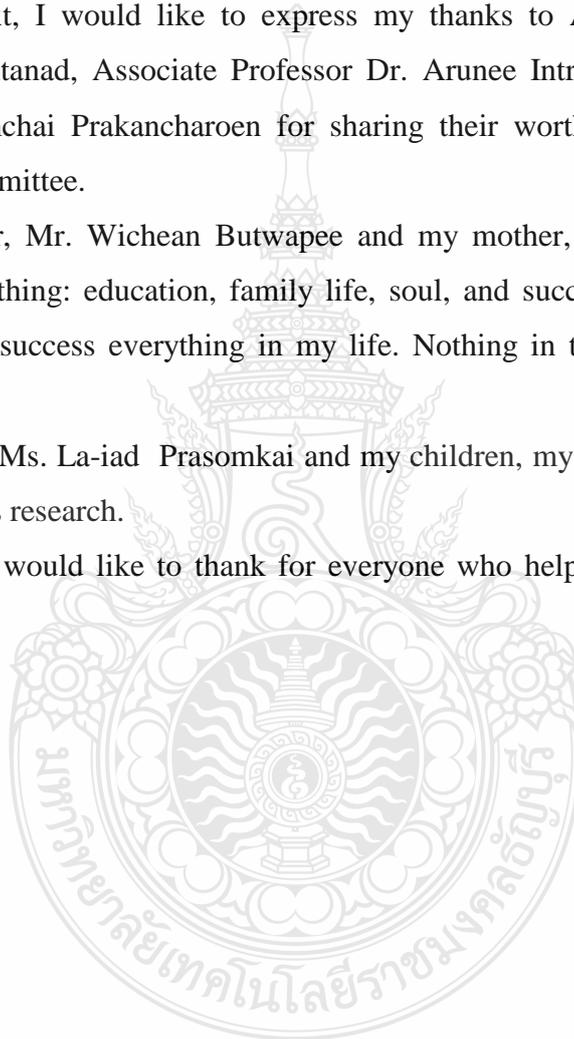
Wirat   Butwapee

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CHAPTER 1

INTRODUCTION

1.1 Background and Statement of the Problem

The economic era with borderless communication, strong business competition throughout the world, and speedy changes according to the information technology evolution allow an economic system of one country to be able influence by another in another global region. At recent, the large nations such as the United States of America, countries in European union, China, Japan have influence over the world economy and the economies developing countries such as India and Indonesia, etc. The science and information technology advancement with the fast and continuous development as well as research and development, would be a better option for entrepreneurs' innovation (Burns & Stalker, 1961). This would result in changes in methodologies and new business operational procedures of the national and global economic systems toward the knowledge-Based economy and creative economy (Dunning, 2002; Oblinger, Barone, & Hawkins, 2001).

The innovations and technologies of leading countries such as the United States of America and Japan normally gain businesses competitive advantages from their advanced information technology and communication infrastructures. Their leading technologies and innovations with the basic infrastructure have been planned for more than ten years. These developed countries pay attention to Information Technology and Communication (ICT) development since they consider it as the key for continual growth and development of the national economy. The ability of technologies and innovations is comparable with the organizational strategies that required attention in development and to aiming at the leading position in businesses competition (Manu, 1992).

The pattern of running business in the information technology era causes many changes in the world in several aspects either in economics and society. These lead to the adaptation toward the ability to compete among the globalization trend. All countries in the world are heading toward changes so called knowledge society and knowledge-based economy which required paying attention toward the use of

knowledge and innovation as the factors in production and development rather than using the capital. This would also lead to the change of global business toward Knowledge-Based Economy and creative economy. Virtual technology is the key factor that leads to the success of an organization. This relates with the survival in the era with fast and continual change in competitive environment (Tsai, 2001).

However, the major cause is the ongoing slowdown of Chinese economy from 10% of GDP that keep reducing at recent(Moneyhub, 2016). It is because China is our trade partner, if it has healthy economy, Thailand will also go together. Since Thailand and China have well traded in the past it is especially in the eyes of other. Besides, there are also other countries in Europe and AEC that can have influence on Thailand which requires for attention.

The electronics and electrical industry is the major industry that generate the main income to Thailand. The businesses at recent are so different from the past since in the current business world, things have always changed in more and more violence ways. The changes in technology or innovation are the one of the influences toward since changes in technology or innovation form both opportunities and obstacles at the same time. That is the business organizations will risk from the market if they ignore or do not keep up with information technology or innovation changes. On the other hand, if the organizations can use any change in technologies to be their business opportunity, know how and when to change appropriately, it would become their competitive advantages to win over the rivals at the end.

The industry business processing consists of various components to facilitate business toward success and efficiency in market competition(M. Porter, 2001). In case of Thailand as the leading country toward the industry development and classed in the group of new industry nation, the government pays attention on new digital economy System developed by investing to improve and lay down the information technology (IT Infrastructure) base for businesses and organizations to apply the new forms of advanced business operations and prompt changes in accordance with the needs of markets or consumers(Cummings & Worley, 2014). The entrepreneurs propose the business strategy to make their organization have better financial performance and lead

the business to survive in the conditions of change in business both from new technology and environment.

Business competition and building competitive advantage are the heart of business operation that required for changes according to the current technologies. The organization must consider and always develop toward innovation as well as drive for the growth of innovation for the long term productivity and future competitiveness (M. Porter, 2001). The innovation makes the point that business should give importance since innovation is about the procedure for forming the benefits for the users or consumers. The results or outcomes of innovation are product and service, new procedure improvement, solutions to consumers' problems, and methods to win over the business obstacles. The electricity and electronics industry is the business that generates the main income for the country and sensitive to changes in technologies and innovations, and management at all levels. They shall always understand and pay attention to development and changes in information technology or innovation. Including innovation is the main factor that leads to the organization success (Tsai, 2001).

The electricity and electronics industry has faced threats from group in the same industry. Especially, the group that is quick toward the new technology advancement such as the internet of things, cloud computing technology, 3D printing, advanced materials, mobile internet, energy storage and others. The pressure from the competitive environment makes the electricity and electronics industry able to adapt itself (Electrical and Electronics Institute, 2016). Besides, the support from the government such as policy that supports the investment basic national infrastructure, research and development toward innovation and to form the competitive advantages.

The overall business performance of Thailand from the group of electrical and electronic appliances in 2016 is at a moderate position where there are strong regressions in some industries. The industrial production index of appliances and electronics have slightly increased from the previous year from the production in the group of appliances industry as a main while the production of electronics has declined. However, for the international trade sector, it has been found to be a declined both in import and export values since the fluctuation in the partner countries economic

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(Electrical and Electronics Institute, 2016). Adaptation is vital in the electrical and electronic appliances industry of Thailand in the future since the business changes rapidly or demand side will be shifted in both new technology or innovation as well as the consumption trends or the fast change in consuming behavior. This would create limitations and risks in the electrical and electronic appliances industry either on the production or international trade. Currently, the electrical and electronic appliances industry of Thailand is facing following problems (The Office of Industrial Economics, 2016);

1) Most of the production is only the middle and end way of production, none of the production from the design or initiative leads to a low value added into the products.

2) The structure of Thailand electronics export is still centered on equipment and parts related to computers especially hard disk drive (HDD) with a lower popularity in the global market. Computer and notebook are now replaced by the portable mobile with high capability with the continual growing trend.

3) Consumption behavior in the Internet of Things era have changed according to the needs in high electronic parts to support for the production of smartphone, tablet and device or gadget more since those are the outstanding products that can connect to the internet with a convenient usage and be able to apply the applications.

4) Lack of labor and imbalance of skills in Thai workers and the needs of market for the high skill workers to support the high electronic parts production.

Exporting information in the group of electrical and electronics industry of Thailand

Table 1.1 Industrial production index (extend the weight of value added)

ISIC Name	Weight	2012	2013	2014	2015	2016
Separate parts air conditioning unit	1.19	11.13	126.77	28.87	125.94	174.33
Separate parts air conditioning, fan coil unit	1.11	112.81	127.88	129.49	127.22	171.73
compressor	0.08	99.40	100.47	99.86	93.68	90.64
** refrigerator	0.62	118.67	108.27	105.38	106.75	111.17

Table 1.1 Industrial production index (extend the weight of value added) (Cont.)

ISIC Name	Weight	2012	2013	2014	2015	2016
** washing machine	0.70	105.79	82.91	86.76	90.57	93.60
** microwave oven	0.47	99.55	98.64	94.08	81.61	83.42
** thermos bottle	0.09	96.62	80.00	87.42	73.95	51.55
** rice pot	0.17	114.19	112.50	105.31	91.19	90.33
** Television - tube, LCD, plasma	0.29	84.82	75.63	72.90	23.35	14.57
Electrical wire	0.52	117.27	122.62	124.98	124.57	123.93
Total Electrical	5.22	110.81	111.49	112.12	106.91	127.43
Semiconductor devices transistors	0.92	110.30	111.86	121.84	118.84	106.07
Integrated circuits(IC) monolithic integrated circuits	0.92	97.95	107.51	120.72	117.42	122.54
Integrated circuits(IC) other IC	5.59	81.87	89.35	98.54	100.74	102.42
*** Hard disk drive	1.14	83.65	77.44	76.03	61.73	53.88
Printer	0.15	123.89	155.83	239.44	161.58	144.62
Total electronics	8.62	87.41	93.08	102.63	100.16	99.07
Total electrical and electronics	13.85	96.24	100.02	106.20	102.70	109.76

Source: Office of economic industry gathered and analyzed by electrical and electronics institution of Thailand, http://www.thaieei.com

Remark   **   effects from the production moved to neighbor countries
                 *** effects from changes in innovation or technology

Considering the information from the table, it is found that the required trends on electronic products in the type of compositions of computers in the global market continued to slow down in the past year. It is expected to influence on the electronics export of Thailand that mainly rely on the global computers supply. Electronics group of computer and devices is the group of electronic products with a high ratio in exporting values in 2013; the highest was 42.4 percent of export values at 13,438 billion US dollar which shrinking at 11.7 percent.

Thailand is considered as the second longest product of electronics, in the world. For export tendency, hard disk drive must unavoidably get the impact from the shrinking of world computer. However, the needs of hard disk drive in the global

market for the use in other aspects still remain, for instance the need of space for online storage (Cloud Storage) via the use of tablet and smartphone (Kasikorn Economic Research Center, 2016). Besides, to build the confidence for the foreign investors who will invest in Thailand is also crucial since confidence of the foreign investors would reflect through the values of foreign investor supporting received from the Board of Investment of Thailand (BOI) in 2015.

The factor of political instability puts more pressure on the confidence of foreign investor (Thailand Board of Investment, 2015). Since the policy to promote and form confidence in any investment may not continually done. If the event cannot end the foreign investors may slow their investment or not invest more in Thailand or some may choose to move their manufacturing base into other countries with similar infrastructure like Thailand such as Malaysia, Vietnam and Philippines (Kasikorn Economic Research Center, 2016). However, in the past 3 years there has been a key phenomenon in the investment society that is the trend to move the manufacturing base from Thailand to the neighbor countries. LG electronics (Thailand) announced to stop the production of TV screen in Thailand from 300,000 - 350,000 units per year and moved to produce in Vietnam. Even Samsung electronics, it also reduced the TV screen production workforce in Thailand and moved to Vietnam for the reason of lower wage. Moreover, to enlarge the business to support the new AEC economic system and previously in the flooding crisis in 2012, Toshiba (Thailand) moved from Thailand to Malaysia. According to the world economic and impact from the political policy, there is then more apparent change in the group of electrical and electronics industry. Samsung and LG from Korea moved to expand in Vietnam and to invest in the products with higher values. While the manufacturing base in Thailand in the last 4 years produced only the old patterns of product in addition, the capital movement in the group of electric and electronics and telecommunication result from the better advantages from the investment in Malaysia where it has the larger electronic parts production base. While the investment in Vietnam would receive the tax exemption for the legal entity for 16 years or 2 folds from Thailand in the industry, that why in the past two years Vietnam pulled Samsung from Korea, and now it has more than five plants to produce the electrical appliances such as TV and telephone (Prachachat, 2016).

From the environmental impact from the business competition, the industries have to fight to operate their business at recent. Many firms adjust the production or operation procedures to conform to changes in global technology. The business group that received the impact from world economic system and policies relating to the support of investment uses the strategic adjustment to reduce the costs by terminating the employment, staff layout. Some companies decide to dedicate the budget to purchase the production machine or new machine to reduce the problem of wage costs.

Table 1.2 Industries with the impact from economic regression and wage problem.

NO.	Business group	Reasons
1	Parts of electronic and IT	Changes in technology
2	Automobile and parts	Domestic market slow down according to the economic
3	Energy	Oil price in down turn global market and ongoing fluctuation
4	Textile and ready-clothes	Moving the production bases to neighbor countries and lower purchasing power
5	Food and transformation product	Agricultural products are influenced by drought
6	Media and entertainment business	Old media are replaced by online media
7	Telecommunication, land and air transportation	Economic slowdown must reduce cost and work on risk management

Sources: Manpower group (Thailand) Ltd.

According to the table, it can be seen that the electric and electronic group will receive more impacts that the electrical and electronics industry entrepreneurs in Thailand shall improve or change the production structure to conform to the needs of the global market and to add more competitive ability in the world. The concept of Internet of Things and Digital Economy will be the factor that promotes the electrical and electronic appliances industry as it reduces the need on the high electronic parts. Most of the entrepreneurs keep producing low technology products and this makes Thai electrical and electronic appliances industry entrepreneurs want to change according to

the innovation for the electrical and electronics industry of Thailand to be able to develop with sustainability and better compete in the global market. Besides, business must understand the form of current business changes and pay attention to the development according to the technological changes.

Schumpeter (1934) stated that the entrepreneurs are finding a way to use innovation technology in the production, service, or new product innovation procedures. Especially, if that innovation can generate monopoly profit for the organization and gain the competitive advantage. Besides, the organization shall take lead and be able to change the Disruptive Innovation Procedures. Any changes are fast and tough, and it totally changes the social basis (C. Markides, 2006). Sometimes, disruptive innovation can come to influence the existing market by fulfilling the needs of consumers that the existing market cannot do such as that the existing market has a more expensive product, less efficiency or difficult to use. For example, as the telegram was replaced by telephone or the loss of Video Tape that was replaced by CD which is going to be replaced by other information storage media with more effectiveness like handy drive or Cloud Computing. If considering at the organizational level, it is found that the organization must form innovation to survive in the fast changing environment (Edquist & Johnson, 1997). Therefore, it is impossible to find an industry without need of continual innovation and creativity since the nature of most industries is fast changing, that is why each of them need to have the innovation creativeness to support those changes. Organization should always remain with the innovation ability since it is crucial for growing the organization (Hurley & Hult, 1998).

From the aforementioned problems, the author is interested and foresees the importance of forming strength for the industry. In this research, the author pays attention to the environment and IT Investment an its impact on the electronics industry, This allows the author to understand the context of impact factors and leads toward the development into Innovation Capability and Disruptive Innovation Management to become the leader in technology and innovation. These would beneficially affect the business organization and lead toward changes in procedures and form competitive advantage in dynamic economic form. Besides, it would be an important information in planning, development and support the government and private sector.

1.2 Purpose of the Study

Business operation forms have changed and there is stronger competition. Information technology and communication have become the basic components in organizational operation for products and services development to meet with the consumption needs. Thus, the government tries to form the secure root for the national economic and social development.

With to the ongoing fluctuation from the business pressure, the organization must learn to adapt themselves to handle with the current world situation and to learn to form competitive advantage as well as become the leader in business strategic adaptation. For Thailand, the government has planned invest in information technology and communication and supported for the innovation development in both government and private sector, business organization, industry and agriculture.

The author is interested in finding solutions to the problem faced by the electrical and electronics businesses in Thailand. This will enable them to compete and dominate in the global market. The objectives of the study are as follows:

1) To study the effect of environmental factor and IT investment on innovation capabilities.
2) To study the effect of environmental factor and IT investment on disruptive innovation management.
3) To investigate the impact of innovation capabilities on organizational performance.
4) To investigate the impact of disruptive innovation management on organizational performance.

1.3 Research Question and Hypothesis

Research Question

This research studied the environmental impact on technology and innovation evolution including the impact from business pressure and the impact of IT investment on organizational performance via strategic or business management procedure from innovation capabilities and disruptive innovation with the following research questions.

RQ 1. How can environmental factor and IT investment influence on organizational performance in the electronic industry?

RQ 2. How can environmental factor and IT investment influence organizational performance in the electronic industry?

RQ 3. How can innovation capabilities and disruptive innovation management influence organizational performance in the electronic industry?

Hypothesis

Electronic industry is very importance for income generation and economic development of the country. To adapt and remain in the environmental condition with impact on business, the organizations with the ability to handle changes in technology and world economic must have innovation as the key tool for the organization management. It will become the benefit that bring the organization toward success and gain business competitive advantage. Besides, disruptive innovation management is also crucial shifting technology to become the business leader and form sustainable competitive advantage. Whether environment and IT investment can impact business performance via the strategy for management of innovation capability and disruptive innovation management procedure will proved in the hypotheses.

From the study of the impact from environment and IT investment on organizational performance through the procedure of innovation capability and disruptive innovation management, the hypotheses can be placed as followed.

To explore and confirm on these three research questions, the hypotheses below were conducted.

H1: Environmental factor has positive effect on innovation capabilities.

H2: IT investment has positive effect on disruptive innovation management.

H3: Environmental factor has positive effect on disruptive innovation management.

H4: IT investment has positive effect on innovation capabilities.

H5: Innovation capabilities have positive effect on disruptive innovation management.

H6: Innovation capabilities have positive effect on organizational performance.

H7: Disruptive innovation management has positive effect on organizational performance.

H8: Environmental factor has positive effect on organizational performance.

H9: IT investment has positive effect on organizational performance.

1.4 Research Framework

From the hypotheses, the conceptual framework of this dissertation is depicted in figure 1.1 below:
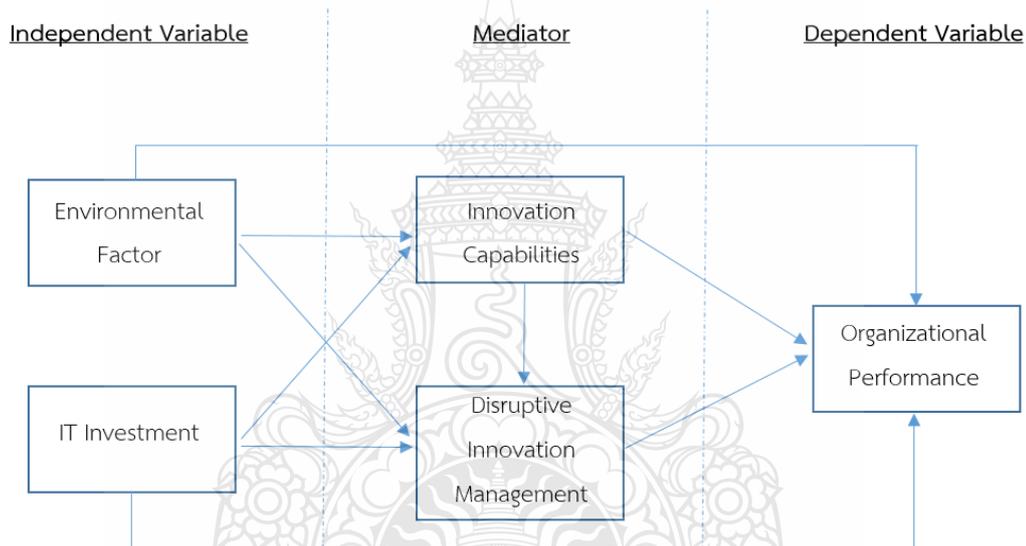
Figure 1.1 Research framework

1.5 Definition of Terms

1.5.1 Environmental Factor

Environmental factor refers to the environment related to the electronics industry business or organization, and may directly or indirectly impact the organization either on the ability to generate business profits and organizational management. External environmental factor can be divided as follows: competitive pressure, government regulation, technology support and industry characteristics.

1.5.2 IT Investment

IT investment refers to the information technology investment which has impact on the organization and support business activities that result in efficiency of the business organization.   IT investment comprises of innovation, infrastructure, management and automation (Hutch et al., 2011).

1.5.3 Innovation Capabilities

Innovation capabilities refer to new idea and procedures that have never existed or adapted, but has been developed from an existing one for more efficiency in the industry. Innovation capabilities can be divided into two categories, product capabilities and process capabilities (Wang & Ahmed, 2004).

1.5.4 Disruptive Innovation Management

Disruptive innovation management refers to the management or operational planning that creates outstanding innovation and is able to replace the old technology and result in a phenomenon that affect the organizations. Disruptive innovation can be classified by the change of technology into two types, which are new-market disruptive and low-end disruptive (C. M. Christensen, Baumann, Ruggles, & Sadtler, 2006).

1.5.5 Organizational Performance

Organizational performance refers to the measuring of the effectiveness or efficiency of the business operation with clear measurement, traceable and having both direct and indirect impacts on the business. Performance of the organization can be categorized into 4 groups such as organizational productivity, organizational effectiveness, industrial ranking and customer satisfaction(Bharadwaj, 2000).

1.6 Scope of the Study

This is a management research that studied the impact of environmental factor and Investment on organizational performance via innovation capabilities and disruptive innovation management.

This research concerns the IT management in the context of Innovation Capabilities and Disruptive Innovation Management in the electronics industry in Thailand as the sample group while the IT management is the representative of the business by answering the questionnaire and interview while SEM was used for data

analysis. This study uses a cross-sectional and mail survey methodology to collect data. The questionnaires will be sent to IT managers or directors.

1.7 Limitation of the Study

This study still has some limitations as follow.

1) The questionnaire responding to the target group of IT management may found some deviated information from the truth since it must be kept in secret or unable to disclose such as investment and financial information.

2) The respondents may not understand the real meaning of some items and that the result reflect the reality of the business companies.

3) The description of each business organization can vary such as the large, medium and small size companies and may have different management style.

1.8 Organization of the Study

This study is organized into five chapters.

Chapter one-introduction; this chapter presents the background and statement of the problem for this study, including research objectives, research questions, hypotheses and conceptual framework, scope of the study, limitation, and contribution of this study.

Chapter two-review of Literature; based on the review of previous studies in related areas to lay a foundation for the study both theoretically and empirically. This chapter is designed to review each of the major theoretical concepts used in research works in the field of environmental factor, IT investment, innovation capabilities and disruptive innovation, as well as organizational performance. In addition, Disruptive innovation is reviewed for relevance and application to the research questions addressed in the study.

Chapter Three-research methodology; presents methodology relevant in the study, based on research questions, research hypotheses and literature review in Chapter one and two. Topics of relevance are the research design, survey methodology, sampling plan, measurement properties of the selected scales, data analysis plan and quantitative measurement. Particular attention is given to the test for validity and

reliability of the research constructs. Qualitative research will also be conducted to affirm the quantitative research results.

Chapter Four-Analysis of the data; presents in this chapter is the results or findings. The data from empirical survey will be analyzed and presented. This includes the analysis of constructs along with their reliability and validity. The hypothesis testing and summary of findings will report to the extent that hypothesized relationships occurred.

Chapter Five-Summary and conclusions; this chapter presents conclusions from the findings, both from a theoretical and practical perspective, including the discussions of the study, contributions, managerial implications, contributions, limitations, as well as recommendation for future research.

1.9 Contribution of the Study

For the electronics industry trend, was is found that most of the electrical appliance products overall is in decline while the electronic industry trend has also slowed down, especially for Hard disk drive (HDD) industry and IC parts. It is expected growth will incline compared to the electrical industry because of the purchasing order and the good sign of increasing employment (Kasikorn Economic Research Center, 2016). The main export products are electrical circuit, PCB, Television, etc. The important markets are the United Stated of America, Japan, Southeast Asia and European Union. The key rivals in ASEAN are Malaysia and Singapore, while the major importing markets of Thailand are the United Stated of America, China, Germany, Hong Kong, and Japan. The electric and electronic industry market in Thailand has a fast growth rate and has attached both Thai and foreign investors who want to invest more, thus leading to a continual collective investment (Thailand Board of Investment, 2015). Forming an opportunity in business competition or going advantage in business competition what is expected to management at all levels. Thailand is located in the place with strategic advantage, it is the door to the heart of Asia and convenient route to trade with China, India and the member countries of AEC. Therefore, we should study the environment and IT investment which bring improvement and development of work procedure as well as form innovation for

product and service development and disruptive innovation. These are the ways to respond to the need of the labor market and speedy change of current technology.

The benefit of this research is determined in terms of providing data for business operation. And this will be the crucial information for the government in planning management, procedures, or supporting business organizations. It is to support the investment toward the goals placed by the governmental units such as establishing the national broadband, digital economy development, new entrepreneurs (Startup) promotion to head the completed digital economy of Thailand 4.0.

CHAPTER 2
REVIEW OF THE LITERATURE

Introduction

Presently, science and information technology advancement have been speedily developed while there is an ongoing change in business environment. Therefore, business organization must learn to adjust themselves with the current world situation. Business environment can result in the growth and profit of any business (Agarwal & Lucas Jr, 2005). The management must pay attention to organizational development toward business competitive ability. Innovation is the heart of development principle toward strength of every organization . Information technology will be the tool to support the rise of innovation in product development process as well as organizational management toward sustainable competitive advantages (Barney, Wright, & Ketchen, 2001). In this chapter theories related to environmental factor and IT investment which can impact organizational performance through innovation capabilities and disruptive innovation management as tools for effective organizational management.

2.1 Environmental Factor

Business running now is much more different from the past since the present business world can always change and even with more violence (Levitt, 1993). Change in technologies or innovations is one thing that has influenced the growth of business organization since changes in technology or innovation can either lead to opportunities and obstacles (Delone & McLean, 2003). Organizations that can take advantage of technological change with the right and adequate adjustment will be able to create a competitive advantage and win over the competitors at the end . Thus, organizations shall analyze both internal and external environments to prevent the impacts from the environment toward organization or to form the appropriate relationship with the participants in the society that the organization has engaged with. Especially, the organization must run everything to bring information to enhance the knowledge, skill and ability in competition (Carneiro, 2000). Management must know how the

environmental factors can have impact on organization strategy while at the same time management must be able to develop a strategy with influence on the environment (Dess & Beard, 1984).

External Environment

External environment is the environment that business cannot control in the desired direction. It is the thing that cannot set for the clear scope and hard to control for the impact over the organization(Russo & Fouts, 1997). Therefore, the external business environment is the whole elements external to the business which result the operation either in some or every part of the business, and is the external driving power with the influence over the ability to achieve organizational goal(Ansoff, 1965). These can change all the time and lead to both opportunities and threats that can influence the organizational operation (Boeker & Goodstein, 1991). We can separate the external business environment as follows: 1) Task environment is the environment in various aspects that directly influence goal achievement in business operation, and 2) General environment is the surrounding that indirectly influences the business operation without a direct impact on the business. General environment, for example include economic, government, culture, society and technology. Through the external environment analysis is a factor that cannot be controlled or hard to control, the external information of the organization is key information for goals and organizational planning and leading in business operation.

External Environment analysis Model

PEST analysis was developed by Francis Aguilar who was the professor at Harvard University in 1967. Francis Guilar suggested the tool for external factor analysis on four aspects which are Political, Economic, Social and Technology (Bullough, Kroeck, Newburry, Kundu, & Lowe, 2012). PEST analysis is the tool that enhances the analysis and helps to understand the environment in big picture and external factors that influence business operation. The organization shall study every information to understand the environment and situational context that the organization shall face through PEST analysis (Mashhadi & Ijaz-Ur-Rehman, 2012). It is also a tool used to analyze the external environment of the organization (Peng & Nunes, 2007).

The analysis of general environment according to PEST analysis can be done as in figure 2.1 that presents the element of PEST analysis.
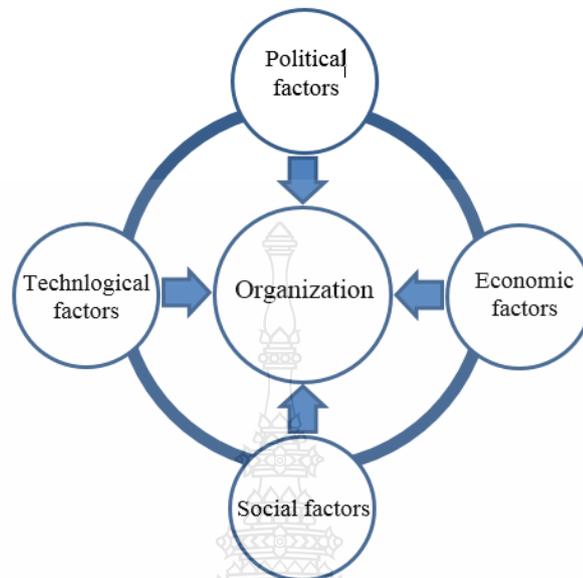
Figure 2.1 Elements analysis of PEST analysis (Peng & Nunes, 2007)

Analysis of the external environment according to PEST Analysis principles consist of political, economic, social and technology.

2.1.1 Political Component

Political component is the factor that changes according to the government conditions and government policy in that period of time. In some phases, the government may promote the export and generate the advantages for the overseas exporting business. Moreover, the agreement and trade laws that always change up to the government policy make the organization keep adjusting or helping the entrepreneurs decide whether the organization is prompt to invest or not.

Government Regulation

Business supporting policy is importance. The government must set for the development goals in clear steps and tie the levels of government assistance or support to the levels of development and learning of business sector. Business organizations shall have the ability to reflect the development in each step and display the development according to the planned goals to promote the organization and form up the inspiration to employ and distribute information technology to the industry

(Nkohkwo & Islam, 2013). Besides, government policy would be successful on the progression of industry in comparison with world industry. The economic development plan must correspond to industry and closely support the world industry . Economic and industrial development plan shall be appropriate by starting from supporting industry according to the level of development and the current state of each industrial development with the long term goal that every industry shall develop higher and become mature to compete in the global level by themselves.

Presently, innovation is the key strategy and government policy that push for the national economic growth in which it is the key driven that affects the domestic business development. Especially, large business organizations adjust their structure to match with the ongoing industry supporting policy to drive toward fresh and valuable idea. However, the SME may be difficult to create innovation because they have a limitation on budget and capital.(The Office of Industrial Economics, 2016).

The key economic variable here is innovation, especially in SME that shall be driven to form the competitive advantage and to become business leader(Manu, 1992). It is now accepted that innovation is not crucial only in business development but it also includes the development of creative potential for innovation for the competition as well (Tushman & Nadler, 1986). Thus, to build innovation in each business, normally different according to situations and contexts, some business may suite with production innovation. While some businesses may select innovation for the process or service suitable to their business, this depends on several factors no matter the capital, personnel or time. Therefore, each business would find out their most suitable innovation to become the number one or lead on that business aspect(Schumpeter, 1934). This includes the strategy that the leading innovative organizations choose to be a guideline to set for the policy to drive business innovation to have the equivalent potential with international competitors.

The group of electronic industry is the group with competitive potential on domestic, regional and global market by depending on the advantages from the cost of production. Therefore, the government sector and relevant units as well as the financial institutions shall participate to leverage the potential of the business group by the promoting the development of both demand and supply on the business sector via policy

to promote the support from the government toward joint venture with the service on businesses pairing, tax measure, R&D supporting and training development (Abramovsky, Harrison, & Simpson, 2004). Government policy is a key criteria to selecting business with high growth since government support policy will be a catalyst to enhance growth in the business sector and lead to business development in the same direction with national economic development (Garcia & Mohnen, 2010).

2.1.2 Economic Component

The national economic factor has direct effects on all businesses since the national economy will establish the buying power of people in the country and the big market in the country as well. The factors in this topic can help in business planning whether to run in short or long term according to the current business conditions and the future economic trends.

Competitive Pressure

Competitive pressure is the pressuring levels from the business competitors in business environment (Zhu & Kraemer, 2005). It drives the companies to continue to improve. It has always been discussed for several decades(Aghion, Blundell, Griffith, Howitt, & Prantl, 2009). The chaotic competitive environment in recent companies result from firms increasing the ability to adjust with the higher costs of new innovation and cooperation (Rese & Baier, 2011). Therefore, innovations and technologies development, and Research and Development (R&D) should be undertaken together.

Competitive environment consists of the environment related to work; the ability of the business to generate profits and the characteristics of the industrial competition with direct impact on the competitive environmental development of customers and sellers of production factor(M. E. Porter & Millar, 1985).

2.1.3 Social Component

Social factor related to the environment, society, culture and ways of living should be recognized first for the right direction of marketing initiative. Since the ways of living of people in each community is different, for launching marketing in any area, we must study the area first in order to be confident that the business will smoothly run and interest the people in the community in positive way without any negative feelings toward them.

Industry Characteristics

Industry is a crucial business activity that generates much income to the country. This is influenced by goals and raw materials in each area. The current industry development needs to have a master plan to development that conforms to the sustainable development(Azapagic, 2004), changes in global economy and the need to resolve and the recent industrial problems (Tillotson, 2004). Investing in IT infrastructure layout and improvement to apply in any business organizations with new forms of business running and prompting to change according to the needs of market or consumers.

Entrepreneurs plan the business strategy to benefits their organization and result in their survival in the changing economic condition in the aspect of environment and technology (Sunding & Zilberman, 2001). The pressure from the competitive environment results in the adaptation of electrical and electronics industry (Thailand Board of Investment, 2015). The electronic parts production industry is a very crucial industry to the economic system and the national economic development since it is export industry with high value and involves a production process that creates high amount of employment (Kasikorn Economic Research Center, 2016). The development of efficient business management to increase the competitive potential for this industry to remain in the future and the basic industry for the high level of innovation and technology development is essential(K. B. Clark & Fujimoto, 1991).

The successful countries that succeed in business and industry with high competitive potential set their own standard criteria and practice to the level of domestic organizational ability. This lead toward competition, effective improvement and always increases organizational efficiency (Shore & Wright, 2000).Von Hirschhausen and Neumann (2008) stated that the electronics industrial production structure can be divided into three parts as follows: Upstream Industry the basic industry for electronics product such as Wafer fabrication, PCB's Design, IC's Design etc. Currently, Thailand produces through the initial stream industry such as agricultural raw materials mostly uses low technologies (prachathai news, 2016). Midstream Industry is the part production and electronics composition industry such as IC, PCB, Capacitor etc. There is a high investment in this industry no matter the direct investment from overseas, joint

venture, and domestic companies in which international companies and joint ventures are in middle use large size machines, raw materials as well as technology from the headquarter overseas (prachathai news, 2016). Downstream industry is the final stage of electronic products production such as computer, cellphone, radio receiver and television etc. in which this final stage of production uses uncomplicated technologies (prachathai news, 2016).

2.1.4 Technology Component

Conducting business with the different innovation and technologies may be able to survive in some companies that do not rely much on technology however, how about those companies that much rely on technology as well as the future trends that there will be more new technology for the business.

Therefore, business that knows the tendency of the market from the external factors first must gain advantage from effective business running. This information would help the entrepreneurs to prompt changes in uncontrollable surrounding factors. PEST analysis is a strong effective tool for solving the problems in this part, especially on business investment in unknown countries either on culture or investment. This tool would help us cut off the risk factors in order to move forward the investment on marketing or sustainable business development (Gupta, 2013).

Technology Support

Information technology and communication is considered to have a significant role toward national economic growth, ICT investment can enhance progress for the economic system and support the business organization in product and service development (Schreyer, 2000). Besides, technology can also leverages national GDP, governmental unit invests in ICT and to bring ICT to use as a tool to increase the efficiency in operational management and service(Bunse, Vodicka, Schönsleben, Brülhart, & Ernst, 2011). When there is an investment, information technology and communication is the key tool of the organization in forming the relationships in businesses, progression, and information technology development that affect more operation in each unit. The organizations as the sub-system in the social system that requires to adapting to survive and grow in the future (Grunig, Grunig, Ehling, & Grunig, 1992). Organization should adjust their structures from the stepping structure

into networking structure. Information technology development can help decrease the work procedures, enhancing the decision and effective cooperation between the units.

Large organizations need to pay attention to the adaptation by bringing technology to use in organizational management for ease in operation, coordination, competition and supporting for changes(Glick, Huber, Miller, Doty, & Sutcliffe, 1990). Besides, business activity needs to be changed according to the social dynamics driven by production information technology; the market must adjust to response to the different needs of customers(Etzkowitz & Leydesdorff, 2000). Therefore, it is necessary for the management in the units to follow changes and applied in their units. Technology has been brought to use in the organization for ease and efficient work and information technology can be applied in various ways.

Technology will help to change and improve the work quality or even reduce the cost of labor and unused materials, and still keep and increase the work quality or better customer service. It is certain that technology is brought to use for changes and improvement in the process of the organization operation in the future (Sitkin, Sutcliffe, & Schroeder, 1994). The tendency of information technology used in the organization reflects that in the future of those who will become the management and professionals. They must know how to use computer effectively and know about information technology management(Rockart & Sloan, 1982).

The future management must know how to apply technology in their work to manage to create the information technology system as needed to help in their decision making under the highly competitive situations. In the developed countries, most of the population work with machines and tools related to information technology with more new service network (Schramm, 1964).

From the facts stated above, it is crucial to analyze the external environment in four aspects in which the external environment affect either direct or indirect toward the organization business operation. The significance of the external environment information analysis is to bring the information to analyze, plan and make decision for operating the organization to be able to compete with the other businesses.

2.2 IT investment

Information technology investment is more than just a business or assets in balance since it can drive the IT business and lead to changes in new forms of products and service innovativeness (Kleis, Chwelos, Ramirez, & Cockburn, 2012). IT investment is required to use financial capital which is considered as the costs of IT. One important thing is to arrange the different financial resources for IT projects and the fixed cost or the overall similar cost unrelated to changes in activity levels (Arrow, 1962). The possibility of receiving the returns from IT investment is depended on the possibility of the success in application as well(Clemons, 1991). For the changes and improvements in IT system, it may be a continual process for a period of time, those costs will be accumulated for several years and sometimes unable to predict after invested (DiMasi, Hansen, & Grabowski, 2003).

Type of IT Investment

For IT investment, the Federal government information technology has divided IT investment into four types as follows; Innovation, Management Support, Process Automation and Infrastructure (Hutch et al., 2011). IT investment can be divided according to the supporting features for the organizational operation as shown figure 2.2.
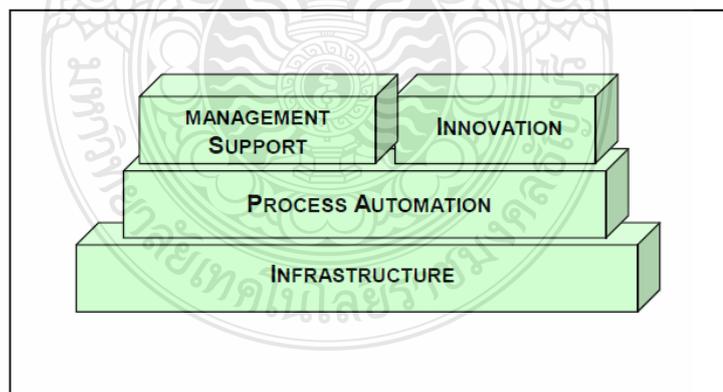
Figure 2.2 Interdependent building blocks of IT investment (Hutch et al., 2011)

This chart explains the process used for information disaggregating about IT investment in each unit. The types of investment can be divided into four types.

2.2.1 Innovation Investment

Innovation investment is to support the innovation related to the production of products or services and processes. This includes what happen from the ability to use knowledge, idea, creativity, skills and experiences from technology or management to develop new products, services, or new production procedures in response to the needs of the market as well as to improve technology, distribute technology, products design and training to add more economic values and benefits for the public from business emerging (Hutch et al., 2011).

The government plays role to support innovation investment in the industry since innovation development is so crucial for many firms especially, the direct relevant industries to technology such as the electrical and electronics industry. IT investment creates the competitive potential and differences between the competitors and form the forms of product and service that meet to the needs of the labor market (M. E. Porter, 2008).

2.2.2 Management Support Investment

Management support investment is the IT investment that uses information technology to support the need and the business goal of the organization. Information technology system can be brought to help support the operation and increase the organizational efficiency well in general. This is significantly required in every organization. The main goal is to respond to the business competition and increase the organization potential. Management Support investment brings IT to respond to the business competition. Besides, IT is used as a tool to preserve the ability to compete and protect the market margin from the competitors.

2.2.3 Process Automation Investment

Process automation is the main activity that is crucial for the organization. It sets for the clear work functions with the details related to the staff operation. Therefore, the management must pay attention to the part of management, planning and control for quality and efficient operation. Moreover, to pay attention in the part of ongoing process which sometimes needs some investment on this part for the ongoing operation and automatic processing. The investment on this aspect is done to reduce the

costs of the internal operation for quick work process and automatic operating (ter Hofstede, van der Aalst, Adams, & Russell, 2009).

2.2.4 Infrastructure Investment

Infrastructure investment is an IT investment for the basic infrastructure related to tools sharing such as computer, printer, server, Application, communication for staff operation and machine for better speed (Hutch et al., 2011). In conducting business today, IT investment is so important especially for IT investment related to IT infrastructure or planning for information technology and communication ground. This becomes the secure base for the company to develop the business. IT management must capable to manage the investment to response to the operation since what is invested has quite high costs in business conducting (Shleifer & Vishny, 1989).

IT infrastructure is like all the investments for computing and communication technology that consists of hardware, software, telecommunication and any services including others that push the system to work such as stored data, data storage tool and information display as well as IT service personnel. Therefore, IT infrastructure in general is considered to be the root of IT sharing. It is the major source of resources that the organization can bring to use for their benefits (Yew Wong & Aspinwall, 2004). From the above mentioned, it can be concluded that IT investment is deciding to invest by purchasing IT to support the business operation in any part in response to the operation from the planning to purchase the raw materials, bringing them into the production process and submitting them to customers (Jaturat, Piboongungon, & Charoenruengkit, 2011). IT investment is to support for the main activity of the organization thus, investment can affect the organization operation.

The researcher studied the types of IT investment to support the organization's activities on four aspects; innovation, infrastructure, management and automation. It is in conformity to the management that the researcher studied in the part of innovation capabilities and disruptive innovation management and study on the impact on organizational performance.

IT investment aims to add ability for the organization to increase productivities and ability to generate profits to the organization(M. Porter, 2001). To be able to use the IT information for business planning decision to form the correct

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business choices, the firm must continue invest in IT every year since it can quickly expire. Therefore, the firm shall adjust the IT investment strategy to response to the organizational strategic plan and make the organization's IT becomes comparable with the competitor. Ronfeldt defines IT investment as the IT investment related to the physical assets, for example, purchasing of hardware, software, database system as well as data communication connecting network system (Ronfeldt, 1991).

IT investment is the investment in the part of hardware and telecommunication technology (Dos Santos, Peffers, & Mauer, 1993). David Van stated that IT assets can include the mechanism that will be used to support in the information processing procedure that would help in creating the business activities. Besides, there is the part related to hardware and software of the computer, server, and other telecommunication tool such as employment and contractual project to form the new intellectual property or ability of the organization(Jones, Van der Laan, Frost, & Loftus, 2008). Michael Harris stated that IT investment has quite a large meaning as it is not only the Hardware and Software. IT investment includes the IT personnel and professional service as well as the consultancy and personnel development, travel and costs of communication training, all the equipment used in IT department (Irani, Ghoneim, & Love, 2006).

Debabroto Chatterjee has considered IT assets as the physical assets of hardware and software, also the intellectual property of the personnel and policy, and the processes that include the physical and human elements together for IT service (Chatterjee, Das, & Turgut, 2002). Moreover, Jason Dedrick stated that the study about IT investment and production is noticed in various studies that IT investment is not only the hardware and service investment but it includes the worth of financial invested in computer and cut off deterioration costs of the financial cost in service provided(Dedrick, Gurbaxani, & Kraemer, 2003). Besides, new IT would have double efficiency in every year and a half (Brynjolfsson & Hitt, 1998). The companies need to use efficient IT in comparable to the competitors with strategic plan for additional suitable IT investment. The decision to invest in IT is crucial for the companies. Since the needs for IT to apply in each firm is different according to the types of industry and business sizes, the decision to select the amount of IT investment in each company shall be considered for the appropriate operation (Nonaka, 2008; Richardson, 1972).

IT investment is more than just a business or assets since actually it has the ability to drive IT business and lead toward changes from the investment in traditional technology into the information investment. IT investment of the business would have efficiency from the double capacity and protected not only from about economizing (Brynjolfsson & Hitt, 2000). However, support and service will continue but it is not normal in an investment. The proof comes from human which is a more crucial asset than tangible assets and shall be preserved for the IT investment. Therefore, IT transaction account must be considered in the organization's investment as well as differences between existing technology and new one (Brynjolfsson & Hitt, 2000).

IT investment will add the values to both tangible and intangible assets for the company as normally practiced; IT investment is dependent on the tangible cost and benefit (Anandarajan & Wen, 1999). IT investment is necessary both for the short-term profits generating, to support the business operation and in the long term for the returns of shareholders as well as chance of conducting new business. The specific goal is that IT investment for the short term generates profits by stressing on the limited costs and strict control while creating strategy (Hatten & Hatten, 1987). The successful company that cannot find out the opportunity for business in the future can grow less in the long term, the challenge here is to reduce cost of IT from the basic operation and changes in the cost of strategy for the business progress(McFarlane, 1984) (Love, Irani, Standing, Lin, & Burn, 2005).

IT Investments and Innovation

This concept is related to research and the basic concept of project selection steps with the decision-making processes. IT is the tool that function to change the core stages of innovation life cycle that is impossible in the past (Brynjolfsson & Schrage, 2009). For example, in an ideal process that the company has to rely on personnel, customer, supplier and stakeholders and for the advance idea about products, processes or service innovation(Lengnick-Hall, 1996). The company still be able to use the basic structure of the value chain (Gassmann & Enkel, 2004). These strategies can be used to develop via the mechanism with the fund to invest in the basic IT infrastructure (C. P. Armstrong & Sambamurthy, 1999). IT infrastructure is to make the information more valuable, easier and be efficient to control and coordinate in the ideal processes. IT

infrastructure investment is functioned as the main role to distribute the information into the levels lower in the organization.

This is to increase the access to information while promoting the personnel potential with the relationship to the related knowledge and the information about IT infrastructure including hardware and networking and telecommunication system. These information base that can be shared such as electronic information exchanging, email, accessing to universal file and video conference (C. P. Armstrong & Sambamurthy, 1999; Broadbent, 1998). Those are the services from IT investments. Besides the level of IT infrastructure absorption would set for the efficiency of the organization to use the benefits from the process in the ideal innovation process (Duncan, 1995; Shane, 1993). IT investment for the employment and training for CIO technical knowledge and CIO business is crucial for business management that seek for the perception via innovation (Boynton, Zmud, & Jacobs, 1994).

Economic infrastructure is to integrate different knowledge of each person in the advanced production of product and services. The company with the ability to study customer response, besides being the starting point of the sale system to help the firm follow up and gather information related to product and processes(Chen & Popovich, 2003).

2.3 Innovation Capabilities

Currently, business organizations either in public and private sectors are interested in forming new innovations to form competitive advantages in the future. The tools for the success in new innovations in organizations requires having the information with quality to benefit for use and it must also connect with the operators and any internal and external knowledge together. Innovations forming is the main tool for generating the competitive advantages and taking the lead as market leader. It creates competitive flow and speedy change(Pfeffer, 1994). For innovation, it is to form the acceptance and brining the idea, process, new products or service to use in the organization for the efficiency (Sawhney, Verona, & Prandelli, 2005).

Rogers Everett (1995) explained about the innovations that it is the concept, process, working method or other new things for the organization or work units use.

Innovation is to bring the concept, procedure, or working process to apply for organizational benefits. Innovations is the concept that brings new creative concepts to use for the success of the organization(Hurley & Hult, 1998). Therefore, the management shall be aware of the importance of the development and organization strategic operation. Valuable resources from the ability of the organization will develop and form a sustainable competitive advantage (Barney, 1991). One of the innovation characteristic is the fresh innovation with changes according to the academic view and application (R. A. Burgelman & Sayles, 1986).

New perception can be divided into two aspects according to Wang and Ahmed (2004) who stated that the novel in the eyes of customer and organization is different. The novel in the view of the customer considers the innovation attribute, risk of usage and levels of behavioral change that affect customers. While the novel in the view of the organization is the conformance issue between the organization and external environment such as technology or marketing (Atuahene 1995; R. G. Cooper & De Brentani, 1991). Another attribute of innovation is that it should be practical to use in real life and it makes innovation different from invention. Sometimes, invention may not be applicable in practice especially, in the business while innovation can add value to the organization performance results(J. R. Cooper, 1998; Padmore, Schuetze, & Gibson, 1998).

The difference is dependent on the study objective such as when studying innovation, it is comparable to the organization procedure or if researching on how to make an organization an innovative organization. The study considers the results of innovation, however, the patterns of innovation are diverse in view of academic such as dividing innovation according to types, whether they are product or process innovation. Dividing innovation according to incremental innovation or radical innovation or administrative or technological innovation (J. R. Cooper, 1998). Though, innovation can be in various forms, it has the meaning of changing the organization in a way in response to the emerging changes from internal or external environment, or to prepare to handle the environmental influences (Hult, Hurley, & Knight, 2004). Therefore, both public and private sector organizations pay attention to innovation, moreover, many

group of academics are interested in studying more on innovation (Shanske, Ferreira, Leonard, Fuller, & Marion, 2001).

Shanske et al. (2001) suggest that entrepreneurs need to have five innovation activities as follows: (1) Suggestion for new products, (2) Suggestion for new production method, (3) Opening for new market, (4) Opening new raw material sources and (5) Improving the industry structure, forming innovation required for these innovative activities. M. Du Plessis (Du Plessis, 2007) mentioned innovation as the forming of new knowledge and idea for new business outcomes by paying attention to the internal business processes improvement as well as business structures to create the products and services according to the market needs. Innovation is then the key process from bringing knowledge and creativity to mix with the management ability and to form a new or innovative business that would lead to new investment that results in the higher national competitive potential(Need, 2006).

In this research, the author studies and divides the types of innovation according to the innovative goals or stresses on the part of products and services. The ability of innovation can be divided into two types: product innovation capabilities and process innovation capabilities.

2.3.1 Product Innovation Capabilities

Product Innovation is a new form of product and new service which result from customer's suggestion to response to their needs or market demands. Product innovation has similar attributes with technical innovation. That is, these innovations are the element of operation with impact on technical systems of the organization as well as receiving the new idea to use in product and service production (A. G. Clark et al., 2007) ; (Kimberly & Evanisko, 1981). The goal is to lead toward new innovation product development and to reach consumers or the organizations more effectively and efficiently (Benner & Tushman, 2003) . Though product innovation is clearly visible and touchable, product innovation is so crucial for the organization that it must be supported or aimed to form the product and service with quality as needed by consumers to gain the business advantages (Crevani, Palm, & Schilling, 2011).

The ability of production innovation will reflect the business capacity to form and use the new ideas in their new product and service development for the economic

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benefits for the business (Fritz, 1989) . It must also result from the consistency of new product and service development into the market, the right time to enter the market and competitive advantages over the competitors (Wang & Ahmed, 2004).

Henard and Szymanski (2001) mention the idea in a way that the product innovation capacity shall be considered in the novel side of the original product. It can also be considered from the views of consumers and entrepreneurs. From consumers, they may look at the innovative attributes, risks of usage and impact on consumer behavior while from the entrepreneur view, it may be consider from the levels of technology and marketing strategy used in the business product innovation (Danneels & Kleinschmidtb, 2001).

2.3.2 Process Innovation Capabilities

Most of the innovation processes stress on the quality control for the relevant operation to the production and operation improvement. Besides, there are also other factors crucial to the activity and the elements of the relevant processes in the system(Gopalakrishnan & Bierly, 2001) . This is to support the production process and overall efficiency such as the use of computer in designing procedure for a new work process for the better efficiency of products and services (Ruk, 2004). Process innovation has impact on the organization members and the relationship between them which are rules and regulations, roles, functions and structure, communication, exchanges between organization members and the environment etc.

The order of process innovation consists of four steps: 1) Gradual innovation in which the system is slightly improved and may be often seen rather than other forms of process innovation; 2) Orders of innovation has an improvement process that affect form of products but still adhere to the form and concept of the traditional production method; 3) Immediate innovation is the total change in production methods and concepts and 4) Innovation in form of total change in production where process innovation can be found in the each period of change in industrial era (van Dierendonck & Rook, 2010).

On the part of process capabilities, it is rarely seen since this kind of ability is classified as part of technological innovativeness. Technological innovativeness is the part the associated with the machine and production methods and it is the main part in

innovation production process (Wang & Ahmed, 2004). Therefore, the ability of technology innovation is hidden in the ability of production and process innovation. It relies on process innovation as much since process is about method, production process and management system that developed to become innovation by new technology or technological innovativeness (Wang & Ahmed, 2004). Therefore, the ability of process innovation is an issue to consider in adopting a new technology and technological changes for use in production process and forming new products and service of the business (Salavou, Baltas, & Lioukas, 2004).

Innovation Capabilities and Organization Performance

The study results on the direct impact of innovation capabilities and organization performance revealed that the factors of organizational process can affect results such as quality of products and costs and marketing outcomes (Tatikonda & Montoya-Weiss, 2001). Besides, Ittner and Larcker (1998) studied and found that there was the significant relationship between innovation capabilities and organization performance such as the returns from assets and growth rate in the computer industry by the emerging innovation can be seen from the gradual to immediate levels. The ability to create innovation is the top key factor towards organizational performance(Mone, McKinley, & Barker, 1998) . This can be proved from many studies, R. G. Cooper (2000) suggests that the organization must be creative in innovation to form the advantages for the organization survival (Li & Calantone, 1998).

2.4 Disruptive Innovation Management

Disruptive Innovation

Disruptive innovation concept is the idea of Christensen who stated about the changes in technology and he invented disruptive innovation that continually gains interests and much attention for several years. Disruptive innovation pay attention to bringing new attributes of product and service into the market as well as pays attention to the important alternate changes of product or service, process as well as the management method to form the leading opportunity to rule over the market for products and service (Sandström, 2010). Besides, C. M. Christensen and Bower (1996) mentioned about changes in technology that emerged in many manufacturing industries

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such as the disk drive manufacturing industry during 1970-1990. It could not form a new architect for the product and resulted in small companies that could not compete with competitors. Besides, the traditional firm also lost the market margin for the new competitors market(C. M. Christensen & Overdorf, 2000).

Christensen explains about the form of failure in those in the leading position of small size disk drive manufacturing industry market with the less memory unit which becomes the problem and lower work efficiency compared to the first time. It can be seen that the product can be a success in the part of small market with continual reducing of profit growth. Traditional operation is the basic for creating new products and service. This reduces labor cost and changing some internal organizational activities for more efficiency (C. M. Christensen & Overdorf, 2000). Therefore, disruptive innovation can be considered as the challenge in business in the aspect of new value creating and distribution of products in new form (Sandström, 2010). While there are 10 % of the firms that can preserve the level of business growth in the long run, another 90% is unable to preserve the sustainable level of growth in itself. These companies use marketing strategy to try to keep the market margin by using good governance management no matter the competitors analysis, customer needs analysis, interest of market and estimate of the worth of investment (Grant, 2016). It cannot response to the objective to preserve business growth and remain with the ongoing success. Besides, the business success in the past may include bringing the traditional business management principle that may not be sufficient for the organization that shall seek for the sustainable business growth and competition(Davenport & Prusak, 1998).

Thus, Clayton Christensen from Harvard university stated that the key problems of any business organizations are to use the best management concept with the consistency, but on the other hand this become the factor of organizational failure since it is held by the organization as the main guideline for implementation. Keeping old customer group generates profits for the company thus, the firm does not focus on new products or services inventing but to top-up development of the existing products for the higher efficiency. Thus (Kim & Mauborgne, 1999) mentioned these factors as the keys for new or small organization business to invent the products and services with new innovation to respond to the needs of the key customer group that is important for the

organization survival. Disruptive innovation on product and service then emerges and steps into the race with the market leaders. Therefore, it can be said that disruptive innovation is the process that leads to changes that creates sustainable business growth by using innovation and forming differences from the market leader no matter the technology or marketing to push for the market competition. The new competition forms are rapid and changes with uncertainty. Innovation is the key to form the business competitive advantage(Mohr, Sengupta, & Slater, 2009).

Besides, the uncertainty of innovation and market pressure (Thomond & Lettice, 2002), the makes it difficult to assess market acceptance and potential, that adds complexity and changes of market. Moreover, many companies have not arranged for new ideas, the chance to perceive about the point with outdate trend in the market for the speedy adjustment with changes in market conditions(C. C. Markides, 1999). Disruptive innovation is to change the form of the existing business and having a good chance to grow and generate new profits with the violence of innovation for growth (Assink, 2006). Thomond and Lettice (2002) described disruptive innovation as having the potential to create benefits or provide service with the significant of changes in the existing market needs. Those who can form basic changes in the organization activity and being the representative of the large business from the existing operation (C. Markides, 2006).

Disruptive innovation with social changes that is practiced by working and learning by the reframing scope to know about the problems and point at the origin of problems(Koberg, Detienne, & Heppard, 2003). Therefore, disruptive innovation is the sample of mutual business suggestion aiming at customers or close to the customers to know about their actual needs. Besides, Christensen also divided the changes in innovation into sustaining innovation and disruptive innovation(C. Christensen, 2013).

But technology that can response to the needs to become a part of the market the ignored by present entrepreneurs or not considered as important can be seen from figure 2.3 that presents the principle of Disruptive innovation.

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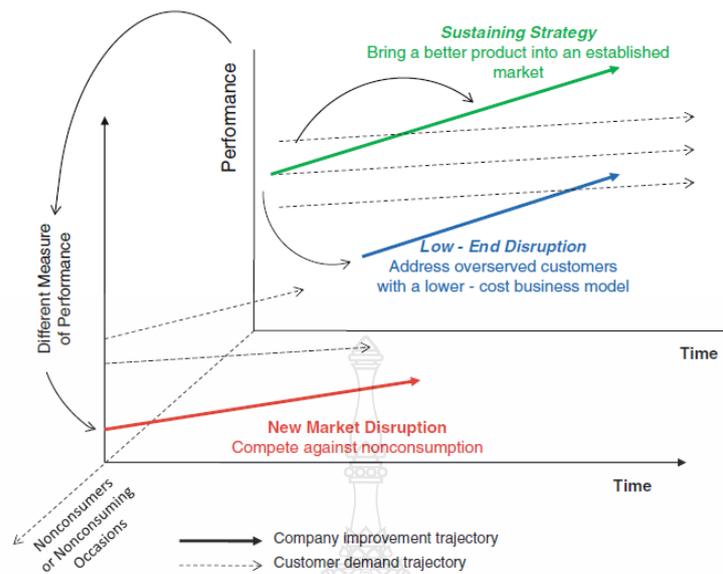
Figure 2.3 The disruptive innovation theory(C. Christensen, 2013)

Disruptive innovation is to form new values and new market or new initiating business(Danneels, 2004). Disruptive innovation is divided into two forms: low-end disruptive innovation and new-market disruptive innovation (C. M. Christensen et al., 2006). That is the business organizations have the risk to loss from the market if they ignore or not know about change in technology. On the other hand, if any organization can use technological changes as a business opportunity, the organization will be able to form competitive advantages and win over competitors (D'aveni, 1995).

2.4.1 New-market Disruptive Innovations

New-market disruptive innovations is a form of target group in new markets or a better existing product to respond to the needs of consumers. New-market disruptive innovation group of consumer will emerge if the new product has high quality and suite or matches with the needs of new group of customers (C. M. Christensen et al., 2006).

2.4.2 Lower-end Disruptive Innovations

It is the target group of customers that want to consume but the business organizations ignore to respond to the needs of customers. Therefore, the characteristic of target group is the customers who are satisfied to buy the products or services with moderate price but with proper quality to use or so called as Lower-end consumers.

Besides, this group of consumers do not volunteer to buy expensive product in exchange for the best quality. These characteristics are not attractive for most business organizations, thus if any organizations can catch the market group, they will get the whole market margin. When seizing this group of customers, Products can slightly be improved a higher price to gain higher market margin and keep growing(C. M. Christensen et al., 2006). Lower-end disruptive innovation will happen when any product in the market has the ability and attributes more than the needs of some customer groups. Disruptive innovation then begins with focusing on the group of customers that may generate moderate profits to the company, but still need to agree to use products with a bit lower quality at cheaper price(Assink, 2006).

The company may reduce the quantity of products that exceed the needs of consumers, may briefly reduce the price or add some value to the new customer group (C. M. Christensen et al., 2006). Therefore, it can be said that disruptive innovation is the new innovation, new idea or technology of product and service from a low quality usage to the most demanding usage. Besides, Disruptive innovation responds to the needs of new market(C. Christensen, 2013).

2.5 Organization Performance

Organizational performance is the information that is used as the evidence for organizational assessment to know about the performance according to policy, plan, project and management. This would relate to the successful standard in organizational operation as well as bringing the strategy toward the practice and measuring the organization outcomes do know whether its succeeding or not. The significance of organizational efficiency according to Petersen and Plowman, business management to a lay mean is to reduce the cost of production, produce with quality and efficiency and the ability run the business. The highest efficiency is to produce the products or services in the required amount and quality within an appropriate time with the least cost considering the situations and the existing financial bond. Therefore, the idea of performance consists of five elements which are the cost, quality, quantity, time and production method(Petersen & Plowman, 1958).

According to Umble, Haft, and Umble (2003), it is stated that the organizational performance is the level of operation expected by the organization. On the part of Child (1972), the meaning given for organizational performance result as the ability of the organization to achieve the goals set. The organization has function and responsibilities to complete the organization efficiency as targeted, it depends on the condition whether the organization can use the benefits from the environment and achieve the goal. The most important thing behind or together with effectiveness is an efficiency that refers to the high capacity and working system that high result on the productions that have more values than the resources use.(Quinn & Cameron, 1983). Work performance is the best balance between the activity for adaptation and preserving the condition. Organizational activity is the tool for decision making, whether organizational performance is good or not. For example, using effective procedures, producing product and service, organization investment, following regulations of behavior and the response to various internal desire (Batemen, 2002). To measure the operational success no matter the activities in any organization if there are the criteria for assessment, it would lead to the high benefits since how the performance has been achieved will be known. This will be a guideline an ongoing improvement and development.

Therefore, the organization performance result is the ability of the organization to achieve the target as planned by using the benefits from the wise use of resources and preserve them as well as form a new innovation to develop the potential in business competition, customers satisfaction and adapting itself for survival (Kaplan & Norton, 1996). The organization's performance result can be divided into two aspects; Economical Value Added and Marketing Value Added; both can be measured by four elements (Bharadwaj, 2000).

2.5.1 Organizational Productivity

Organizational productivity refers to the ability to create products and services with the standard quality within time frame at a cheap cost to sustainably compete in the market. Besides, to form an economic advantage, it can always come from image and marketing acceptance. Felipe (1999) stated that product and service quality can indicate the profit rates of the organization.

2.5.2 Organizational Affectiveness

Organizational effectiveness is the effective procedure and technology that is used to lead the overall operation in dimensions such as production or service, quality control or insurance, storing or distributing product, follow up and calibration, problems solution and improvement as well as ongoing development. Organizational efficiency results in both economic value added and marketing value added. This can confirm that product or service is certified by standard, it has a consistent quality since the consistent efficiency of the operation procedure makes the customers confident that the supplier and distributor are credible.

2.5.3 Industrial Ranking

Industrial Ranking is the ranking of Benchmarking of consumers in comparison with the same types of products or the same group in all dimensions together for quality, quantity, physical attributes, packaging, and size and distribution channel. Thus, this depends on the time period and consumer behavior as well quality and effectiveness, though they may be less popular in some period, in the long term they will be ranked in the top level.

2.5.4 Customer Satisfaction

Customer Satisfaction can make the business keep their long-term balance since the satisfaction of the target customers will lead to the satisfied performance. The organization can keep this dimension of performance for a long time and can stimulate the internal process in the whole system together for the organizational learning and development of the personnel and total organization capacity. Thus, to confirm that the organization truly processes both on the personnel potential development and a good working environment development together with technological infrastructure development (Kaplan & Norton, 1996).

The results from the study on the impact of innovations and performance result have shown that the factors of organization procedure affect the outcomes such as quality and costs of products and lead to the marketing results; the ability of innovation has a positive relationship on organizational performance(Tatikonda & Montoya-Weiss, 2001). Damanpour and Gopalakrishnan (2001) explained that the organization with the high performance has the ongoing product and process innovation development.

Besides, it has been found that the significant relationship between innovation and organizational performance measurement such as the returns of assets and growth rate in the computer industry by the rising innovation is gradually up and developing (Ittner & Larcker, 1998).

The ability to form innovations is the top key factor toward organizational performance. It can be proved from many study results by suggesting that the organization must be creative on innovation to form the advantages for the organizational survival (R. G. Cooper, 2000).

2.6 Theoretical Framework

The electrical and electronics industry is the main industry that generates most income for Thailand. Present by it is so different from the past since the current business world always changes. Changes in technology or innovation are what influence on the step toward number on the organization. Changes in technology or innovation can create both business opportunity and obstacle at the same time. That is the business organizations are at a high risk of disappearing from the market if the organization ignore or cannot catch up with changes in information technology or innovation. From the above details, the theories related to the analysis of external factors a business operation and are threats beyond organizational control.

The researcher brings PEST analysis to analyze the organizational factors from four external environment aspects which are political, economic, social and technological factors (Buys, 2014) . Economic environment is the characteristics and directions of the economy that the organization uses as the key information for competition and to influence both domestic and global markets(Goldstuck, 2003). PEST analysis is the basic tool to use as the in-depth information to analyze the impact on the organization on the aspects of political, economic, social and technological factors potentially in the business development framework. PEST analysis will help the organizational know about the external environment that affects the organization on four aspects and the key issues that the organization must perceive for their suitable planning and internal organizational management. Each factor to consider in PEST analysis consist of any issues(Manktelow & Carlson, 2005).

External Factors and IT Investment

    Political Factor

        It is the analysis that relates to politic and governance as well as the policy that support for Thailand electrical and electronics industry. These factors influence the organizational operation both in short term and long term. For example, the national social and economic development plan including the trade agreement and regulation can always change due to government policy and the political stability. It will result in the organization adjusting themselves or help the entrepreneurs to decide whether the organization will invest or not (Wheelen & David, 2002).Political problem is so important for the decision on IT Investment.

        The organization must analyze the environment to predict the future IT investment whether it will be worth or not. If the organization supports or launches the policy to help the business organization about the investment, the business operation will have a clear goal and gain better success. Therefore, for IT Investment the organization must study the possibility and the challenge in the business operation. It is different is each country according to the laws and regulations in business operation such as taxes and government currency exchange (Tarabay & Eigbire, 2009).

    Economic Factor

        Economic Factor is to consider the economic impact both domestic and international since the national economy will set for the purchasing power of domestic people as well as the domestic market. The factor in this topic can help in business planning whether to process in the short or long term from the current business situations and the future trend (Wheelen & David, 2002). Economic factor is the factor related to the economic environment issues that may hardly affect the organization. The key measurement that is required to inspect the external economic environment is GDP, interest rate, inflation, exchange rate, number of unemployed, wage and price controls (Kovats, Campbell 2005) run. Therefore, the & Matthies, ions on IT investment is the challenge of all business organizations. There are two main objectives in business investment decision: forming the business values and reducing cost of business operation.

The organization must study the competitors for the IT investment decision and not to lose advantage their competitive advantages (Prusak, 2004).

Social Factor

Social factor is the factor related to the environment, cultures, and people's way of living before beginning to invest and process on marketing. Since the people's way of life in each community are different, to run marketing in any area, a study must be made on that area first to be confident that business will be able to smoothly thrive and be interested by people in a community in the positive way (Wheelen & David, 2002). Social factor that emphasizes human resource, considering attitude and belief in connecting with supply and demand of business organization (Prusak, 2004). Besides, it also covers the market size and crucial target in demographical factor such as skill and education, growth rate of population in the region. These things have the main role since the truth is that it can affect sales (Sethibe, Campbell, & McDonald, 2007).

Therefore, the social factor helps on IT Investment decisions and pays attention to social environment. If the business organizations can respond to social needs, they then can run business according to the social condition and gain advantages in the business competition era.

Technology Factor

Businesses can conduct with different innovation and technology development since some companies may survive without technology. Some may rely on technology for living since we must consider if there are new technologies on business processes (Wheelen & David, 2002). Technology factor is related to the quick changing of technology advancement where business organization pay attention changes and study them for IT investment decisions including studying on the risk of IT investment, gains and losses (Sethibe et al., 2007). PEST analysis is to analyze the use of technology in the organization which helps in the working process and for more effective ness in organizational management. This also reduces the cost and increase the productivities and work process. Thus, the organization must pay attention to ongoing technology improvement with future changes.

PEST Analysis and Innovation

The current business operation pays attention to new innovation creating in response to the needs of consumers. If any business organizations can adjust with the fast-changing environment, the business organization will have the advantage in successful business competition.

Therefore, the organization must analyze the external environment with the business impact to set goal and stimulate work, including the forming of innovation as the crucial tool for competitive advantages and advancement as well as quick and ongoing business changes.

PEST analysis is a tool for external environment analysis. If any organization has clear and precise information, it will be able to form innovation in response to the needs and flexibility of the fast-changing situation. Thus, the management shall be aware of the crucial analysis of the external environment that could affect the organization like government policy, economic, social and technology. These factors can affect the development and organization strategic processing. The resources with values from the organizational ability will develop and form sustainable competitive advantage (Barney, 1991). External environmental factor affect the organization's operation are uncontrollable factors and influence the operation and decision of the organization such as government policy, economic impact, social condition and technological innovation therefore, it has to adjust into the current violent environment (Tornatzky, Fleischer, & Chakrabarti, 1990).

From the significance of business analysis, the researcher pays attention to PEST Analysis theory to analyze the organization external environment and adapt with changes in the environment which result in innovation development of the organization in response to the real need of consumers. Industry business operation has many elemental aspects to lead the business toward success and efficiency in market competition (M. E. Porter, 2000).
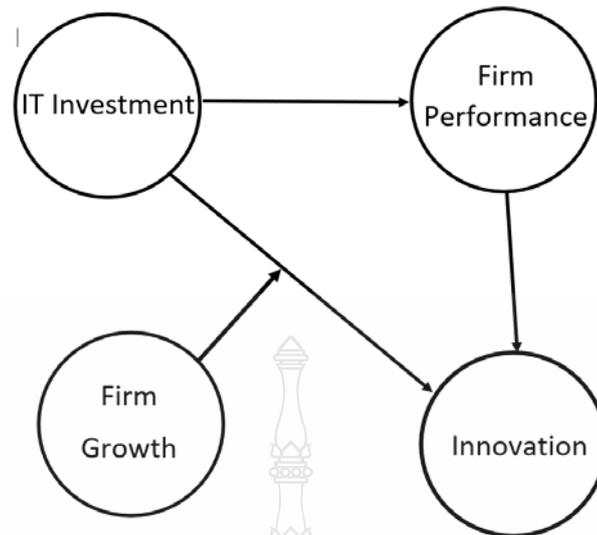
Figure 2.4 IT investment effect to firm performance through innovation
(Bagheri, Hamid, Rezaei, & Mardani, 2012)

Bagheri et al. (2012) studied the relationship of IT investment and the direct impact of the firm performance including the indirect effect through with firm growth as the control variable. Information technology is important to improve the efficiency in organizational therefore, the organization must develop and improve the efficiency in information technology.

The study result shows that IT investment has a positive relationship to with the firm performance via innovation. IT investment would increase the firm performance on the aspect of financial and operation. The study also found that IT investment has significance effect on the innovation.

Finally, the research result presents that it is the impact on the efficiency of the company's operation both the direct impact on organizational efficiency and indirect impact through innovation. It shows that the company shall consider IT investment with the potential that it will lead to efficiency in organizational operation.

Figure 2.5 Presents the impact of IT investment with the direct and indirect impact on the Business Performance.
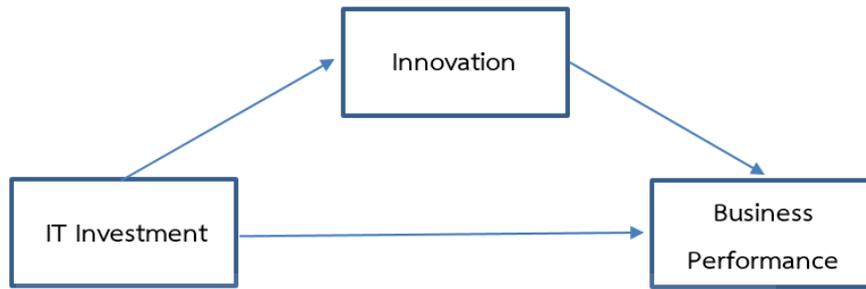
Figure 2.5 IT investment effect to business performance through innovation (Karanja, 2011)

Thus, Karanja sets for the way to study the information from 441 sample companies in a manufacturing industry. It used the mix analysis between hierarchical linear regression and mediated regression models (Karanja, 2011). From the study, it can be seen that the theory of information technology factor of the organization can help the company to respond to the needs of innovation to gain competitive advantage, especially on the innovation forming in the synthesizing and integrating the use of relevant resources and knowledge from various sources which affect IT investment in either direct or indirect business values forming.

Figure 2.6 Shows the impact from the External Task Environment that affects other organizations both in direct and indirect ways.
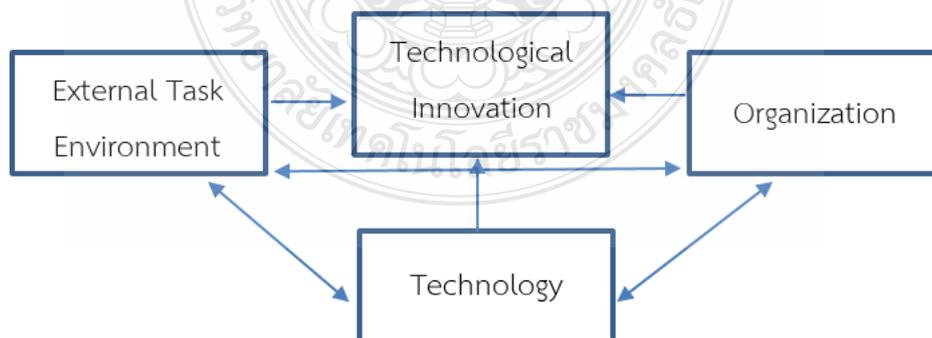
Figure 2.6 The context of technological innovation (Bradford, Earp, & Grabski, 2014)

This research studied the limitations and benefits of end-to-end success and managed on the access into Centralized end-to-end identity and access management from the operation and role of ERP monitoring staff of the organization by studying the impact from technology, organization and environment (Bradford et al., 2014). Thus, it was found that the factor of organization and technology would directly affect the operation of centralized end-to-end identity and access management. Besides, ERP system would help facilitate the development with its own integration and standard as well as automatic management. ERP system supports the organization and staff of the company who sense the crucial benefit as well as the increasing ability in the security improvement and efficiency in the personally preparation of the users and password and audit management.

The result of this research which is the efficient framework can be used with the centralized end-to-end identity and access management. Besides, the results from this study can be adapted to some to the real business market problems.

Figure 2.7 Presents the impact on Disruptive Innovation
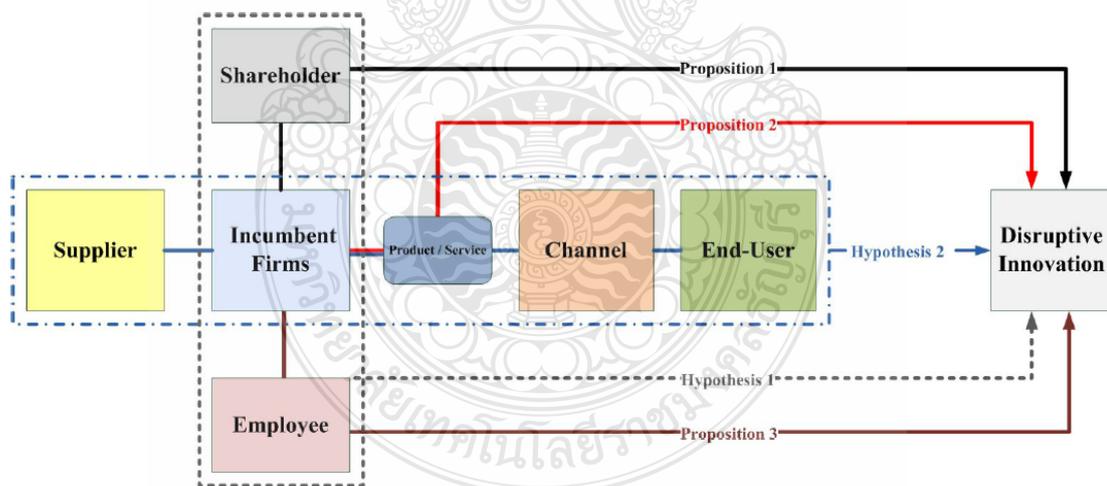
Figure 2.7 Innovator's dilemma to value chain and organization's dilemma (Lee & Huang, 2012)

From the research by Lee and Huang (2012), they studied about Disruptive Innovation theory in which Prof. Clayton Christensen from Harvard University, United States had invented the theory to study on how business can form innovation. He found

a form of innovation with the specific characteristic that is, it begins from product or service, suggesting or a new idea. To provide a new value to customers or consumers but using the method that begins from lower market to compete for the market margin from the existing players or the large players in the market then aim to better and quicker develop their own products and services and win over the old market to become the new model for the new market.

From the investigation, Lee and Huang (2012) suggest that the firm showed improve the form of owning or at least form interest on the part of the company shareholders as well as the differences and conflicts of interest in the short and long term.

2.7 Research Model

Environmental Factor is the external environment with impact on the business operation of the electrical and electronics industry in Thailand. The industry must recognize the current status and be a crucial information in organizational planning and management. PEST analysis theory analyzes the organizational external environment applied. While on the IT investment, it is the study related to IT investment for new technologies that would enhance the improvement and development of the organization but there is the mediator that function on the management called the innovation capabilities. Lastly, the disruptive innovation management is a significant management tool for creating competitive advantage to become a sustainable leader in the future business competition.

In this part, the author brings the objectives stated in Chapter one and Research Framework to develop as the Research Model for the hypothesis testing, to study on the possibility from the literature review on relevant theories and researches in chapter two the research summarizes the research model as follows; Independent variable consisting of two main variables, Environmental Factor and IT Investment, while mediator has the key variables such as Innovation Capabilities and Disruptive Innovation Management. Lastly, the dependent variable is Organizational Performance. The statistic of this model is based on the structuring equation model (SEM) analysis.
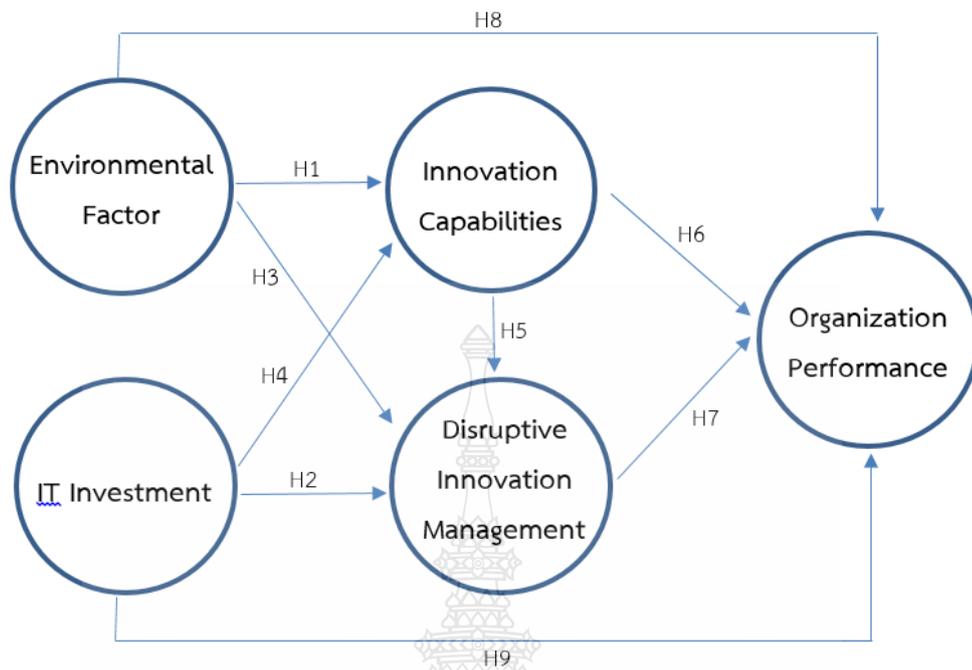
Figure 2.8 Research Model
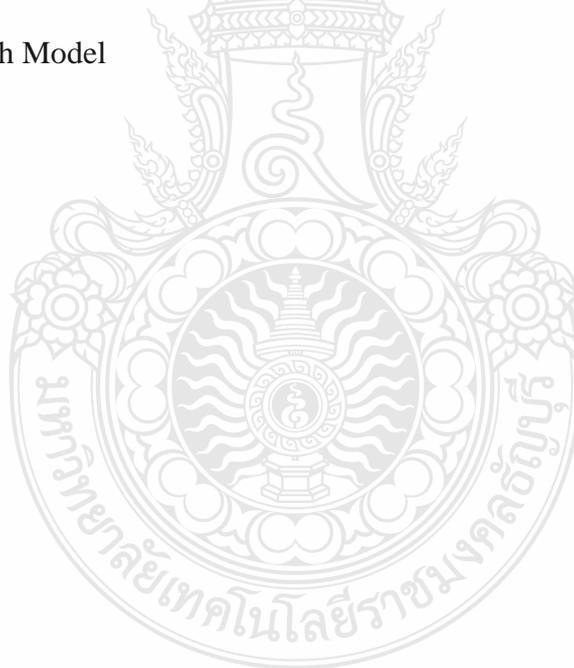
CHAPTER 3
RESEARCH METHODOLOGY

Introduction

The following chapter describes the research methodology that has been used empirically to test the hypotheses developed in the preceding chapter by analyzing the relationships between the independent variable, dependent variable and mediator. The chapter comprises of five sections, the first section introduces the hypothesized structural model, the second section outlines the research design and the setting of the study, the third and the fourth section specify the quantitative and qualitative methodology, and the last section discusses the sequence of analysis.

3.1 Hypothesized Structural Model

The proposed hypothesized structural model was developed based on the aforementioned research frame work and hypotheses in the preceding chapter (as illustrated in figure 3.1).
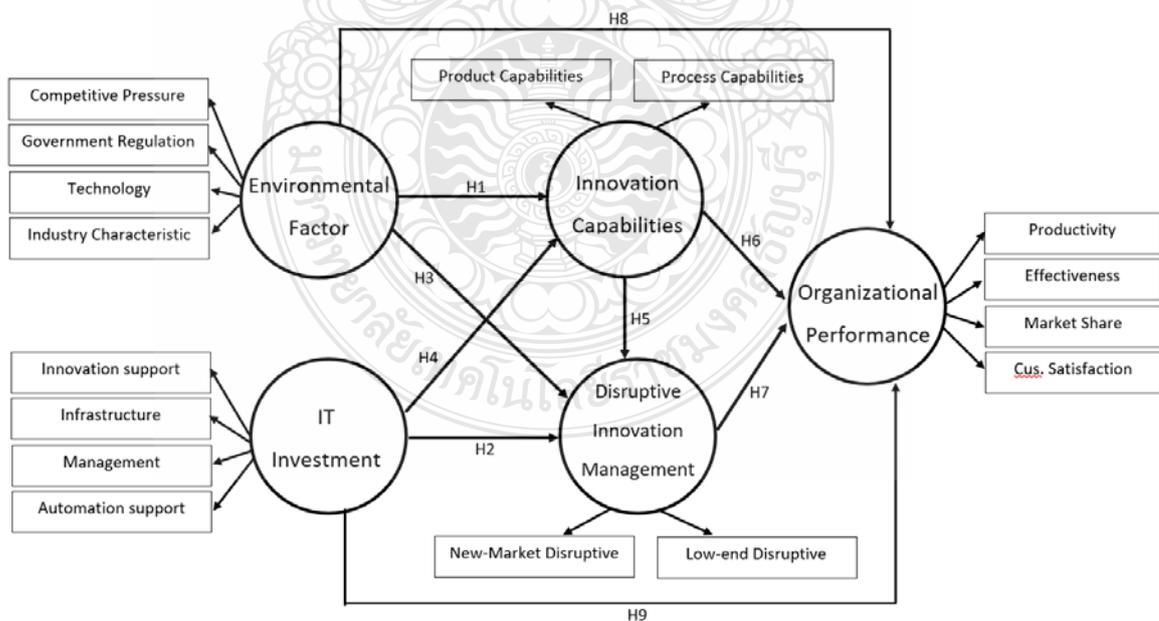
Figure 3.1 The hypothesized structural model

The study deploys structural equation modeling (SEM) techniques as statistical tools for the analysis of the data in the study. SEM is considered a second generation statistical approach, which allows simultaneous analysis of multiple criterions and independent constructs. This advantage overcomes the shortcoming of the traditional statistical analysis especially the model with more than one layer of relationship, where single analysis of each individual layer need to be done. SEM determines the structural model (of relationship amongst a set of independent and dependent constructs) as well as, the measurement model (such as loadings of observed variables to the latent variables) at the same time.

3.2 Quantitative Methodology

Qualitative methodology involves collecting, analyzing and integrating of the quantitative data. The study used a cross-sectional, mail survey methodology and questionnaires as instrument for data collection.

There are several advantages of mail survey that have been recognized by researchers, such as relatively low cost, reliable, fast and cover a large and dispersed geographical areas and populations. Mail surveys help the test measurement scales and also seek out and test relationships between variables (Dunkelberg & Sonquist, 1977).

3.2.1 Population and Sampling

The key objectives of this study are to examine the relationship between Innovation Capabilities, Disruptive Innovation Management and Operation Performance. The target population was the electrical and electronics industry. The data were collected from the database of department of the business development of the ministry of commerce of Thailand. The study focused on one industry as it allows more control of extraneous variables and provides robust results for theory testing. A total number of 2,865 companies was used as the sampling frame.

The study assigned two groups in the study population based on the guidelines of industrial clustering provided by the Federation of Thai Industries. The sample size was calculated accordance the rules of structural equation model (SEM). Bentler and Chou (1987) proposed a simplified guideline which provides the trustworthiness of solutions and parameter estimates, and advised that the ratio of "sample size" to

60

"number of free parameters" under normal and elliptical theory, could go as low as a 5:1 ratio, particularly, in the study with many indicators of latent variables and with large factor loadings. The higher the ratio, the more trustworthy they are, although it is not evident of which to base a recommendation. A ratio of at least 10:1 may be considered adequate and appropriate sample size. The free parameter from the conceptual model is 41, the study thus targeted an initial sample size of 204 samples from the electronics industry in Thailand. Distribution of sampling from each group was on weighted proportional basis.

Table 3.1 The population and distribution of sample size

Division of Electrical and Electronic Manufacturing	Population (N)	Sample (n)
The production of electronic devices and circuits	701	50
The production of computers and peripherals	224	16
The production of communication	156	11
The production of electronics consumer	92	7
The production of testing equipment and measuring control equipment	130	9
The production of electric motors	375	27
The production of power lines and electrical wiring	169	12
The production of lighting equipment	151	10
The production of appliances in the house	417	30
The production of oother electronics	450	32
Total	**2,865**	**204**

Source: The database of department of business development under the ministry of
        commerce of Thailand (2016).

3.2.2 Data Collection

The data of production of electronics organizations was obtained from the database of department of business development under the ministry of commerce of Thailand. Organizational data comprised of primary contact information, firm size, business sector, year of establishment.

This study adopted the key informant survey research methodology for data collection. This method relies on one or a few persons to provide surveyed information. The key informants were deemed especially qualified because of their position, experience, and specialized knowledge. This technique, has received some criticism of invalid data when only single respondent is used, however, it has been advised that there is no other viable alternative in order gain information from top managers (John & Reve, 1982).

The key informant survey research strategy suggests that the key informants should be both knowledgeable about the issues being studied and willing and able to communicate this information (Campbell, 1955). The target respondents for this study were innovation or directors who are well aware of the business strategy, actively engaged in the company's product and process knowledgeable about innovation capabilities and disruptive innovation management of the organization performance. These respondents were considered key informants.

The mail survey methodology was used to collect data to address the study's research hypotheses. The questionnaire was sent to the IT managers/directors by mail. The mail package contained an introduction letter from the Rajamangala University of Technology Thanyaburi, an information sheet about the study, a questionnaire survey, and a postage-paid, addressed return envelope to the faculty of business administration.

3.2.3 Research Instrumentation
Questionnaire

The questionnaire was the main research instrument in this study, with the objective to elicit as much related information as possible from the respondents. These were the main categories of questions that were asked, covering the aspects that would meet the set objectives.

The questionnaire for this study was thoroughly designed to address the research hypotheses formulated to develop the conceptual framework. The questionnaire is divided into six sections; sections 1: environmental factor, sections 2: IT investment, section 3: innovation capabilities, section 4: disruptive innovation management, section 5: operation performance, and section 6: demographic and background characteristics of the respondents.

Thus, section 1 of the questionnaire focused on the environment factor including competitive pressure, government regulation, technology support and industry characteristic. The following seven-point Likert scales were used to rate each question, where 1 = strongly disagree, 2 = quite disagree, 3 = slightly disagree, 4 = neither agree nor disagree, 5 = slightly agree, 6 = quite agree, and 7 = strongly agree.

Section 2 of the questionnaire focused on the Information Technology Investment including innovation, infrastructure, management and automation. The following seven-point Likert scales were used to rate each question, where 1 = strongly disagree, 2 = quite disagree, 3 = slightly disagree, 4 = neither agree nor disagree, 5 = slightly agree, 6 = quite agree, and 7 = strongly agree.

Section 3 of the questionnaire focused on the innovation capabilities including product innovation capabilities and process innovation capabilities. The following seven-point Likert scales were used to rate each question, where 1 = strongly disagree, 2 = quite disagree, 3 = slightly disagree, 4 = either agree nor disagree, 5 = slightly agree, 6 = quite agree, and 7 = strongly agree.

Section 4 of the questionnaire focused on disruptive innovation management including new-market disruptive and low-end disruptive. The following seven-point Likert scales were used to rate each question, where 1 = strongly disagree, 2 = quite disagree, 3 = slightly disagree, 4 = neither agree nor disagree, 5 = slightly agree, 6 = quite agree, and 7 = strongly agree.

Section 5 of the questionnaire is focused on organization performance including organizational productivity, organizational effectiveness, market share and customer satisfaction. The following seven-point Likert scales were used to rate each question, where 1 = strongly disagree, 2 = quite disagree, 3 = slightly disagree, 4 = neither agree nor disagree, 5 = slightly agree, 6 = quite agree, and 7 = strongly agree.

The last section is the survey of the demography and background characteristics of the respondent including gender, age, educational qualification, experiences in the innovation functions and responsibility for the purposes for respondent analysis.

Testing on the Response Bias

In this study, questionnaire was used as an instrument to survey the attitude of the target respondents towards innovation capabilities, disruptive innovation management and organization performance, however chances are that the respondents may provide inaccurate or untruthful response which is a "response bias". The research instrument for this study was designed at best, on the methodology to detect and prevent respondent's social desirability and nonresponse biases.

Social desirability bias refers as a phenomenon where respondents provide socially acceptable answers or present in a more favorable way, especially in the surveys which are not confidential. This could avoid embarrassment or the reluctance to admit to undesirable attitudes. Social desirability bias can be avoided with a proper designed questionnaire which represents no influence content. The researcher may also explain and give a clear objective of the results expected from the survey. It could also be helpful to emphasize to the respondents that participation in the survey is done on behalf of the organization or job responsibility, rather than personal opinion.

Non response bias refers to the situation that the target respondents do not return the questionnaire or unwilling to participate in the survey. It also refers as the situation where respondent's opinion is systematically different from the opinions of those who are willingly to participate and return the questionnaire for the survey. Mail survey has been criticized on the nonresponse bias. The two types of problem generated from the non-response: first, it reduces the size of the sample and therefore increases sampling error, and second, the creation of bias which results when respondents' opinions differ in meaningful from non-respondents.

The return rate of mail questionnaire must not be less than 20% to be acceptable. Non-response bias can be tested by comparing characteristics of respondents who returned completed surveys and respondents who failed to return a completed survey.   To assess non-response bias in mail survey is to use statistical significance difference tests (Krause & Scannell, 2002), two sample t-test assuming equal variances for 10 percent of sample to compare between the early returned respondents and the follow-up respondents, if there is no statistical significant differences with t-test at

p<.05, it suggests that nonresponse bias is not detected (J. S. Armstrong & Overton, 1977).

3.2.4 Measurement Variables

Scale.

This study used the Likert 7 scale to quantify the attitude from the survey questionnaire. The Likert 7 scale was used as proxy of interval scale for presenting the level of importance a firm gives to environmental factor, IT investment, innovation capabilities, disruptive innovation management and organizational performance.

Level of importance

    1 = Not at all important

    2 = Less important

    3 = Slightly important

    4 = Neutral important

    5 = Rather much important

    6 = Very important

    7 = Extremely important

Level of a firm's benefit from organizational performance

    1 = completely dissatisfied

    2 = Very dissatisfied

    3 = Somewhen dissatisfied

    4 = Neither satisfied or dissatisfied

    5 = Somewhen satisfied

    6 = Very satisfied

    7 = Completely satisfied

Measurement

The attributes of the environmental factor analysis to measure four aspects: competitive pressure, government regulation, technology support and industry characteristic. The element of each variable is resented in presented in table 3.2.

Table 3.2 Element of the measurement variables for environmental factor.

Variable	Element	Measurement
Competitive Pressure	External factors that are important for the economic analysis of organizations are affected. The global economy, and the impact on the domestic economy.	- Interval variable - Likert 7 scale
Government Regulation	External factors that are important. The analysis related to government's policy of supporting investment and assist in their operations.	- Interval variable - Likert 7 scale
Technology Support	External factors that are relevant to information technology. This is important in the development of information systems to support the activities of both the production and management of the organization.	- Interval variable - Likert 7 scale
Industry Characteristic	Characteristics of the industry refers to the intensity of competition in the electrical and electronics industry, which is relevant to the operations of the organization.	- Interval variable - Likert 7 scale

Analysis of the external environment and the opportunities and threats of the business process revealed the impact of the external environment on the electrical and electronics industry. This includes the impact of external organizations including competitive pressure, government regulation, technology support and industry characteristic.

Table 3.3 Element of the measurement variables for IT investment.

Variable	Element	Measurement
Innovation Investment	Information technology investment related work to support innovation leading to the creation of product and service.	- Interval variable - Likert 7 scale
Infrastructure Investment	Infrastructure work to support the effectiveness of the activities of the organization.	- Interval variable - Likert 7 scale
Management Investment	Administration to motivate or support the activities of the organization.	- Interval variable - Likert 7 scale
Automation Investment	The operation of the organization's activities and is the main event that will cause the products and services that make operations more efficient.	- Interval variable - Likert 7 scale

The attributes of the information technology investment ae measured by four variables which are innovation, infrastructure, management and automation. The element of each variable is resented in presented in table 3.4.

Table 3.4 Element of the measurement variables for innovation capabilities.

Variable	Element	Measurement
Product Innovation capabilities	Product Innovation capabilities was indicative of the ability of businesses to create and implement new ideas in the development of new products or services.	- Interval variable - Likert 7 scale
Process Innovation capabilities	The process innovation capabilities was the ability to relate to the use and production methods that industry will have to give priority to the production of products or services.	- Interval variable - Likert 7 scale

The attributes of the innovation capabilities was measured by two variables which are product innovation capabilities and process innovation capabilities. The element of each variable is resented in presented in table 3.5.

Table 3.5 Element of the measurement variables for disruptive innovation management.

Variable	Element	Measurement
New-Market Disruptive	Modify target style of a new market or better products available in the market to meet the needs of consumers.	- Interval variable - Likert 7 scale
Low-end Disruptive	The target is markets with customer need, and they are satisfied to purchase goods or services at low price, but of good quality.	- Interval variable - Likert 7 scale

The attributes of the disruptive innovation management were measured by two variables which are new-market disruptive innovation and low-end disruptive innovation. The element of each variable is resented in presented in table 3.6.

Table 3.6 Element of the measurement variables for organization performance.

Variable	Element	Measurement
Organizational Productivity	The ability to create a product or service which has standard quality in a timely and efficient-cost to compete on price as regularly and sustainably.	- Interval variable - Likert 7 scale
Organizational Effectiveness	The efficiency of the process and used technology which effects the operation of the production of goods or services.	- Interval variable - Likert 7 scale
Industrial Ranking	It is sequencing of consumers' market position which compare with the same products or similar groups.	- Interval variable - Likert 7 scale

Table 3.6 Element of the measurement variables for organization performance. (Cont.)

Variable	Element	Measurement
Target Group Satisfaction	Target group satisfaction is the organization's operating result which will keep the sustaining balance with the target group.	- Interval variable - Likert 7 scale

The impact of the innovation capabilities and disruptive innovation management on organization performance is measured by four variables which are organizational productivity, organizational effectiveness, market share and customer satisfaction. The element of each variable is resented in presented in table 3.6.

3.2.5 Validity and Reliability

Content validity is the evaluation which relies on subject-matter experts who are familiar with the construct being used in the questionnaire to help determine if the research instrument can provide answers to the research questions. The questionnaire was reviewed and assessed by six subject-matter experts, consisting of four university academicians and two professionals from business sector based on IOC (Index of Item-Objective Congruence) method. The results from the evaluation was be used to adjust and improve for the accuracy and validity of the questionnaire.

3.3 Qualitative Methodology

Qualitative methodology is a method which provides detailed explanation and descriptions of the procedures, situation, communications, experiences and knowledge related to the questions raised in the study. Qualitative can be defined into three different level of data collection: Individual surveys, Individual Interviews and, and Expert Panel Interview. All of these could provoke deep level of responses in an open-ended environment in the data collection process which allows richness of information (Hopp, 2005).

The individual interviews are considered one among the most powerful means for obtaining crucial research data, and also is an effective tool to learn about expert opinions and explore reaction on important events. Interviews are challenging and yet

rewarding forms of measurement (Hopp, 2005), as they provide detailed explanation and descriptions of the procedures, situation, communications, experiences and knowledge related to the questions raised in the study.

Interviewing requires personal sensitivity and adaptability as well as the ability to stay within the bounds of a series of prearranged queries providing specific subject related data points. This process reduces bias that might be generated by the researcher's influence or as to any indiscrimination.

3.3.1 Population and Sampling

The qualitative research populations are the same as the quantitative research. This step does not define the amount of research samples, but it iterates interview until a working hypothesis is accepted.

3.3.2 Research Instrumentation

In-depth Interview. An in-depth interview is the face-to-face interview with CIO. The questions are open-ended questions that provide the answer explaining without controlling. The answer would be phased by statement responds.

The questions of deep interview comprise 8 parts as follows:

1) Consent to participate
2) Confidentiality policy
3) IT Strategy questions
4) Innovation capabilities concept questions
5) Disruptive innovation management concept questions
6) Organization concept questions
7) Open question
8) Gratefulness

3.3.3 Result Methodology

The interview for the qualitative research was analyzed by means of inductive description. Firstly, the in-depth interview with the first CIO was conducted, then proposed as working hypothesis. Secondly, the next interview was performed again. The answer from next CIO was tested with the working hypothesis. The working hypothesis was adapted into the new working hypothesis. If the result from the next interview disagreed with the previous working hypothesis, the process was repeated in

such a way that the next interview was generalized with the working hypothesis until it has been accepted in all hypotheses.

3.4 Sequence of Analysis

The analysis of the study is presented in the following sequence:

3.4.1. Quantitative Research

Survey pretesting

1) Content validity testing (IOC method)

2) Reliability testing, 30 tryout sampling

- Cronbach's alpha testing

3) Redesigning of the questionnaire if required

(in case of Cronbach's alpha less than 0.7)

Statistics Analysis

1) Descriptive statistical analysis

- Mean, Frequency

2) Reliability testing

- Cronbach's alpha testing

3) Validity testing

- Confirm factor analysis (convergent validity)

- SEM method (discriminate validity)

4) Structural equation modeling

4.1) Development of the model

4.2) Analysis of the model

4.3) Measure of fit

- Consider X2, X2/df, degree of freedom, P-value, RMSEA, GFI

- If the model does not fit, modify the indices and re-analyze the model

4.4) If the model fits

-Analysis of the regression weight, p-value

-Analysis of direct/indirect relationship

4.5) Quantitative research reporting

3.4.2. Qualitative Research

    1) Individual interview

        -Description content analysis

        -Propose of the working hypotheses

    2) Iteration of the interview

        -Description content analysis

        -Repeat until the working hypotheses are justified

    3) Qualitative research reporting

3.4.3. Analysis of both Quantitative Research and Qualitative Research

3.4.4. Conclusion

CHAPTER 4
RESEARCH RESULT

Introduction

Chapter four presents the results from the statistical analysis of the research questions, hypotheses, and the data collected. This chapter is organized into four sections. The first section covers instrument validation and pretesting, and data preparation. The next section presents demography summary and descriptive statistics. The following section covers statistical analysis and structural equation model analysis, and the last section is the discussion of the results of hypothesis testing and the summary.

4.1 Instrument Validation and Pretesting

The validation of the measurement of content validity was evaluated by using Index of Item-Objective Congruence (IOC) method to verify and evaluate content validity of the items used in the questionnaire. The IOC for this study was evaluated by six subject-matter experts; two IT managers and four academic researchers. The overall assessment score was 0.82 which was considered acceptable. Comments and suggestions on the wordings and rewordings, sequence of questions and presentation of the questions were noted and incorporated and modified data collection questionnaire.

The pretest was conducted in order to determine if the questions have some ambiguity which could lead to respondent's misinterpretation. Assessment of reliability was done by comparing the answers from respondents (Weisberg, Krosnick, & Bowen, 1989). A reliable questionnaire should repeatedly yield the same response from respondents. The tryout questionnaires were distributed to 30 selected respondents in the field of information technology in the electronic industry. The data collected from the pretesting allows for a preliminary evaluation of reliability. Cronbach's alpha was used as means to assess internal consistency of how closely the set of items in a group were related, thus the coefficient of reliability. Theoretically, the value of the Cronbach's alpha ranges from zero to one, a higher value indicates more reliability. A value of .80 or higher is considered reliable (Field, 2009); the Cronbach's alpha

coefficient from the pretest was 0.95, indicating that the items have relatively high internal consistency among items used in the study and the questionnaire is acceptable.

4.2 Data Preparation

    4.2.1 The Population and Sample Response Rate

        The population surveyed for data collection was the electronic industry. A total of 2,865 contact information was obtained from the database of the department of business development of the ministry of commerce of Thailand.

        Anderson and Narus (1990), and Asder et al. (2001) suggested the return rate of mail questionnaire should not be less than 20 percent in order to be acceptable. Therefore, in order to avoid issues with low response rate, the questionnaires were mailed to the information technology directors or managers of the 1,250 companies from ten clusters in the electronic industry on weighted proportional basis. The data were collected through a combination approach where the respondents are provided with options to complete and return the questionnaires through an addressed postage-paid return envelope, by fax or through web-based questionnaire.

        While the low response rate might raise concerns on response bias, there was no significant differences in means with t-test at $p < .05$ between early (responded within the first month) and late response, therefore, no nonresponse bias detected (Armstrong & Overton, 1997).

        A total of 259 questionnaires are received which accounts to 20.72 percent response rate. There were 4 returned questionnaires with insufficient data, skipping sections or uncompleted. These questionnaires were dropped from the statistical analysis. In conclusion, there were a total of 255 complete questionnaires received from the 1,250 questionnaires mailed, thus the effective response rate was 20.40 percent.

        The characteristics of the returned questionnaire by electronic industry clusters are shown in table 4.1.

Table 4.1 Characteristics of the returned questionnaire

Industry clusters	Sample Size	Sent	Return	Response Rate
The production of electronic devices and circuits	50	306	83	24.12
The production of computers and peripherals	16	98	24	24.49
The production of communication	11	67	16	23.88
The production of electronics consumer	7	43	11	25.58
The production of testing equipment and measuring control equipment	9	55	8	14.55
The production of electric motors	27	165	32	19.39
The production of power lines and electrical wiring	12	74	12	16.22
The production of lighting equipment	10	62	14	22.58
The production of appliances in the house	30	184	36	19.57
The production of other Electronics	32	196	223	11.73
Total	**204**	**1,250**	**259**	

4.2.2 Data Coding and Entry

All variables in this study were named by using relevant abbreviations in order to simplify understanding and interpretation. All variables coding was illustrated in table 4.2 After than SPSS was used to analyze the items with assigned numbers.

Table 4.2 Abbreviation of constructs and observed variables

Construct Group	Observed variable	Abbreviation	Type of Variable
Concept and Design	Environmental Factor	ENF	Independent
	IT Investment	ITI	Independent
Implementation and Control	Innovation Capabilities	INC	Mediator
	Disruptive Innovation Management	DIM	Mediator

Table 4.2 Abbreviation of constructs and observed variables (Cont.)

Construct Group	Observed variable	Abbreviation	Type of Variable
Measurement and Delivery	Organizational Performance	ORP	Dependent

4.3 Demographic summary

The questionnaires which were sent to the research sample were defined that the respondents were CIO or IT leaders who were responsible for IT management. The questions asking about demographical consisted of six parts including, type of business, form of business, type of production, number of employees, registered capital and number of year in operation. The summarized demographic data and detail of the companies are shown in Table 4.3.

Table 4.3 Summary of the demographic

Topic	Frequency	Respondent Percentage
Type of Business registration		
Public limited company	25	9.8
Limited company	225	88.2
Partnership	5	2.0
Other	0	0.0
Nature of investment		
Thai firms	115	45.1
Joint venture with foreign	53	20.8
Foreign firms	87	34.1
Type of manufacturing		
Manufactured products for internal use	46	18.0
Manufactured products as contract Manufacturer	117	45.9
Manufactured products for both internal and contract manufacturers	74	29.0
Other/Please specify	18	7.1

Table 4.3 Summary of the demographic (Cont.)

Topic	Frequency	Respondent Percentage
Number of employees		
Less than or 100 employees	98	38.4
101 - 500 employees	99	38.8
501 – 1,000 employees	34	13.3
More than 1,000 employees	24	9.4
Size of registered capital (Baht)		
Less than or 10 million	71	27.8
11 – 50 million	68	26.7
51 – 100 million	55	21.6
More than 100 million	61	23.9
Number of year in operation		
Less than 5 years	23	9.0
5 - 10 years	43	19.9
11 - 15 years	75	29.4
More than 15 years	114	44.7

Data was collected from 255 queries sent to respondents of the management level. The characteristics of the majority of the organizations were registered as limited companies which accounted for 88.2 percent. Also, 45.1 percent were companies run by Thai owners with the hiring rate between 101-500 employees accounting for 38.8 percent. Moreover, 26.7 percent were companies with capital between 11 – 50 million(baht) and 44.7 percent were companies with more than 15 years operation.

4.4 Descriptive Statistics

The following section summarized features of the data collected for the study and presented in a quantitative and a comparable fashion.

4.4.1 Environmental Factor

The effect of Environmental Factor was an independent variable of the study. It was divided into four variables including competitive pressure, government regulation, technology support and industry characteristics. The statistical results of the minimum, maximum, mean, standard deviation, and interpretation of results are presented in table 4.4.

Table 4.4 The descriptive statistics of environmental factor

Variable	Min	Max	Mean	Std.
Competitive Pressure				
COP1	1	7	4.95	1.34
COP2	1	7	5.01	1.25
COPAv	1	7	4.98	1.23
Government Regulation				
GOR1	1	7	4.59	1.32
GOR2	1	7	4.38	1.35
GORAv	1	7	4.48	1.26
Technology Support				
TES1	1	7	4.51	1.26
TES2	1	7	4.44	1.29
TESAv	1	7	4.48	1.23
Industry Characteristics				
INC1	1	7	4.44	1.20
INC2	1	7	4.35	1.18
INCAv	1	7	4.40	1.10

The item with the highest mean value was "the impact by cost of manufacturing and service" (M=5.01, SD=1.25) under the impact of competitive pressure variable. The item with the lowest mean value was "the impact by manufacturing supply chain practices" (M=4.35, SD=1.18) under the impact of industry characteristics variable.

4.4.2 IT Investment

The importance of IT investments was an independent variable of the study. It was divided into for variables including innovation investment, infrastructure investment, management investment and automation investment. The statistical results of the minimum, maximum, mean, standard deviation, and interpretation of results are presented in table 4.5.

Table 4.5 The descriptive statistics of IT investment

Variable	Min	Max	Mean	Std.
Innovation Investment				
INS1	1	7	4.30	1.49
INS2	1	7	4.67	1.39
INSAv	1	7	4.49	1.34
Infrasructure Investment				
INF1	1	7	4.71	1.30
INF2	1	7	4.91	1.30
INFAv	1	7	4.81	1.21
Management Investment				
MAS1	1	7	4.76	1.28
MAS2	1	7	4.76	1.35
MASAv	1	7	4.76	1.22
Automation Investment				
AUS1	1	7	4.97	1.30
AUS2	1	7	5.04	1.30
AUSAv	1	7	5.01	1.23

The item with the highest mean value was "the importance of IT investment in improving the efficiency for manufacturing process" (M=5.04, SD=1.30) under the importance of automation investment variable. The item with the lowest mean value was "the importance of IT investment for research and development of innovation" (M=4.30, SD=1.49) under the importance of innovation investment variable.

4.4.3 Innovation Capabilities

The effect of environmental factor and IT investment with the context of Innovation capabilities was the mediator variable it was divided into two concepts including the product innovation capabilities and process innovation capabilities. The statistical results of the minimum, maximum, mean, standard deviation, and interpretation of results are presented in table 4.6.

Table 4.6 The descriptive statistics of innovation capabilities

Variable	Min	Max	Mean	Std.
Product Innovation				
PDC1	1	7	4.91	1.27
PDC2	1	7	4.91	1.34
PDC3	1	7	4.70	1.44.
PDCAv	1	7	4.84	1.17
Process Innovation				
PCC1	2	7	5.00	1.19
PCC2	1	7	4.96	1.34
PCC3	1	7	5.00	1.31
PCCAv	1	7	4.99	1.148

The item with the highest mean value was "emphasis on employees' involvement in manufacturing process improvement" (M=5.00, SD=1.31) under the emphasis on process capabilities variable. The item with the lowest mean value was "research and development unit for products and services" (M=4.70, SD=1.44) under the emphasis on product capabilities variable.

4.4.4 Disruptive Innovation Management

The effect of environmental factor and IT investment with the context of Disruptive Innovation Management was the mediator variable. It was divided into two concepts including the new-market disruptive innovation management and low-end disruptive innovation management. The statistical results of the minimum, maximum, mean, standard deviation, and interpretation of results are presented in table 4.7.

Table 4.7 The descriptive statistics of disruptive innovation management

Variable	Min	Max	Mean	Std.
New-Market Disruptive				
NED1	1	7	5.03	1.27
NED2	1	7	4.82	1.20
NED3	1	7	4.86	1.19
NED4	1	7	5.05	1.26
NEDAv	1	7	4.94	1.08
Low-End Disruptive				
LOD1	2	7	5.26	1.14
LOD2	1	7	5.09	1.19
LOD3	1	7	5.01	1.27
LOD4	1	7	4.97	1.16
LODAv	1	7	5.08	1.02

The item with the highest mean value was "the importance of the products in response to basic customer requirement" (M=5.26, SD=1.14) under the importance of low-end disruptive innovation variable. The item with the lowest mean value was "the importance of competitor's analysis for product development" (M=4.82, SD=1.20) under the importance on new-market disruptive innovation variable.

4.4.5 Organizational Performance

The organizational performance was a dependent variable. It was divided into four kinds including organizational productivity, organizational effectiveness, market share and customer satisfaction. The statistical results of the minimum, maximum, mean, standard deviation, and interpretation of results are presented in table 4.8.

Table 4.8 The descriptive statistics of organizational performance

Variable	Min	Max	Mean	Std.
Organization Productivity				
ORP1	1	7	5.12	1.15
ORP2	2	7	5.27	1.18
ORPAv	1	7	5.20	1.09
Organization Effectiveness				
ORE1	2	7	5.18	1.13
ORE2	2	7	5.16	1.09
OREAv	1	7	5.17	1.06
Market Share				
MKS1	1	7	4.61	1.13
MKS2	1	7	4.58	1.15
MKSAv	1	7	4.59	1.03
Customer Satisfaction				
CUS1	2	7	4.99	1.09
CUS2	2	7	5.10	1.17
CUSAv	1	7	5.05	1.05

The item with the highest mean value was "achieved manufacturing according to quality and efficiency aspect" (M=5.27, SD=1.18) under the company has achieved organizational productivity variable. The item with the lowest mean value was "position than those of your competitors in the same industry" (M=4.58, SD=1.15) under the market share variable.

4.5 Normality Testing

Normality test was used to determine whether the data set were normally distributed. A good questionnaire design should yield normal distribution of data. Statistically, two common indicators which are referred to for normal distribution assessment are skewness and kurtosis. Skewness is a measure of the symmetry,

whereby skewness value is zero for a symmetry or normal distribution data set. Kurtosis is a measure of combine sizes of the two tails, the kurtosis value for normal distribution was 3. However, it is often reported in the form of "excess kurtosis" by subtracting 3 from the normal value, therefore, the kurtosis value equals to zero. Hildebrand (1986) proposed that the value of skewness should be between -1 and +1 to judge with normal distribution. George (2011) proposed that the value of kurtosis between -2 and +2 are considered acceptable in order to prove normal univariate distributions. The data for this study are well within normal distribution. The result of the data set from this study indicated the value of skewness ranged from -0.672 to -0.037, with standard error of skewness at 0.153, and the value of kurtosis ranged from -0.647 to -0.644, with standard error of kurtosis at 0.304. In both cases, all the values fell within the limit which indicated normal distribution of the data.

4.6 Structural Equation Model

The reliability was assessed through the determining of Cronbach's alpha coefficient. The model fit was evaluated through confirmatory factor analysis (CFA) by AMOS statistical software. AMOS is an extension graphical module of SPSS module and has been widely used for structural equation modeling, path analysis, and confirmatory factor analysis. The software provided visual and graphical features for model drawing and analyzing with quick computation for SEM analysis. The CFA analysis through AMOS software allowed the adjustment of the model until model become acceptable.

4.6.1 Reliability Analysis

The assessment of the reliability of the variables used in the model was done through the analysis of Cronbach's alpha. Cronbach's alpha is used to measure internal consistency and to analyze whether how closely a set of items used in the model related to each other (Cronbach, 1951). The theoretical value of the alpha ranges from zero to one, of which the higher value indicated better survey quality therefore more reliable. It is suggested that the Cronbach's alpha coefficient of 0.7 or higher is considered acceptable (Carman, 2000). The results of Cronbach's alpha coefficient analysis are shown in table 4.9

Table 4.9 Results of Cronbach's alpha coefficient analysis

Construct	Item	Cronbach's Alpha	Mean	Std.
ENF	COPAv	0.883	4.98	1.23
	GORAv	0.885	4.48	1.26
	TESAv	0.915	4.48	1.23
	INCAv	0.833	4.40	1.10
ITI	INSAv	0.842	4.49	1.34
	INFAv	0.851	4.81	1.21
	MASAv	0.836	4.76	1.22
	AUSAv	0.872	5.01	1.23
INC	PDCAv	0.840	4.84	1.17
	PCCAv	0.876	4.99	1.14
DIM	NEDAv	0.905	4.94	1.08
	LODAv	0.879	5.08	1.02
ORP	ORPAv	0.852	5.20	1.09
	OREAv	0.892	5.17	1.06
	MKSAv	0.788	4.59	1.03
	CUSAv	0.839	5.05	1.05

The Cronbach's alpha coefficient results for all the items used in the model ranged from 0.788-0.915, the mean values ranged from 4.40 - 5.20, and the standard deviation ranged from 1.02 - 1.34.

Environmental factor construct consisted of four items which the overall Cronbach's alpha coefficient was 0.839, mean values ranged from 4.40 – 4.98, and standard deviation ranged from 1.10 – 1.26, this explains the reliability of this construct and acceptable for the measurement of the environmental factor in the model.

IT investment construct consisted of four items which the overall Cronbach's alpha coefficient was 0.893, mean value ranged from 4.49 – 5.01, and standard deviation ranged from 1.21 – 1.34, this explains the reliability of this construct and acceptable for the measurement of the IT investment in the model.

Innovation capabilities construct consisted of four. Two of which the overall Cronbach's alpha coefficient was 0.884, mean values ranged from 4.84 – 4.99, and standard deviation ranged from 1.14 – 1.17, this explains the reliability of this construct and acceptable for the measurement of the Innovation capabilities in the model.

Disruptive innovation management construct consists of two items which the overall Cronbach's alpha coefficient was 0.868, mean values ranged from 4.94 – 5.08, and standard deviation ranged from 1.02 – 1.08; this explains the reliability of this construct and it is acceptable for the measurement of the disruptive innovation management in the model.

Organizational performance construct consisted of four items which the overall Cronbach's alpha coefficient was 0.878, mean values ranged from 4.59 – 5.20, and standard deviation ranged from 1.03 – 1.09, this explains the reliability of this construct and it is acceptable for the measurement of the organizational performance in the model.

The total reliability statistics, was 0.915 for 16 items. The Cronbach's alpha coefficients were well above 0.7, indicating reliability and acceptance for the analysis.

4.6.2 Multicollinearity Testing

The testing of multi-collinearity is an analysis for the non-relationship between variables. The tolerance must be more than 0.1 and the value of variance instruction factor (VIF) must be lower than 10 (Hair, Anderson, Babin, & Black, 2010). The analyzed tolerance values range from 0.26-0.58 and VIF values ranged from 1.72-3.72, indicating that there are no multi-collinearity among variables. The analyzed values are shown in table 4.10

Table 4.10 Multicollinearity testing results

Construct	Items	Collinearity Statistics	
		Tolerance	VIF
ENF	GORAv	0.55	1.79
	TESAv	0.48	2.07
	INCAv	0.58	1.72
ITI	INSAv	0.40	2.45
	INFAv	0.29	3.39
	MASAv	0.33	3.01
	AUSAv	0.34	2.91
INC	PDCAv	0.26	3.72
	PCCAv	0.27	3.60
DIM	NEDAv	0.28	3.52
	LODAv	0.33	2.94
ORP	ORPAv	0.28	3.56
	OREAv	0.28	3.49
	MKSAv	0.55	1.81
	CUSAv	0.36	2.71

4.6.3 Construct Validity

The construct validity is the evaluation to the degree of which the test is actually measuring the theoretical construct it claims and attempts to measure. The construct validity is divided into 2 subcategories; convergent validity testing and discriminant validity testing. The convergent validity is the test whether constructs that are expected to be related are in fact related to the others. Discriminant validity is the test whether constructs are related or do not have relationship.

Convergent validity assessed   the extent that the indicators could represent the construct, in the other word, convergent validity examines the degree to which the measurement is similar to other measurements. In this study, convergent validity has been evaluated through factor loadings. The factor loading of all items should exceed 0.6, however, the minimal acceptable level is 0.4.

Confirmatory factor analysis (CFA) was used to evaluate relationship between variables with the priority in evaluating the relationship pattern of the variables in the model. CFA is an evaluation whether the set of variables are good representatives for the construct (Hair et al., 2010). The assessment indicators include *p*-value (Chi-square Probability Level), CMIN/df (Relative Chi-square), GFI (Goodness of Fit Index), AGFI (Adjusted Goodness of Fit), RMSER (Root Mean Square Error of Approximation), and NFI (Normed Fit Index). The *p-value* should be significantly associated with each loading. The CMIN/df value should be less than 3. The values of GFI, TLI, and NFI should be higher than 0.90 and AGFI should be higher than 0.8 (Hu & Bentler, 1999), the RMSEA should be lower than 0.08. IF the above criteria are met, the CFA would consider the data-fit model.

Convergent validity can be evaluated with the average variance extracted (AVE) The model would be acceptable if the AVE is equal or higher than 0.5 (Fornell & Larcker, 1981; Hair et al., 2010). AVE was calculated based on the calculation formula as follows:

$$AVE = \frac{\sum_{i=0}^{n} Li^2}{n} > 0.5$$

The evaluation of convergent validity is done through CFA. The observed variable can be considered a good representative of the construct if the factor loading value was higher than 0.6. Further, all average variance extracted (AVE) of all variables should not be higher than 0.5, and the composite reliability (CR) of all variables should be higher 0.6.
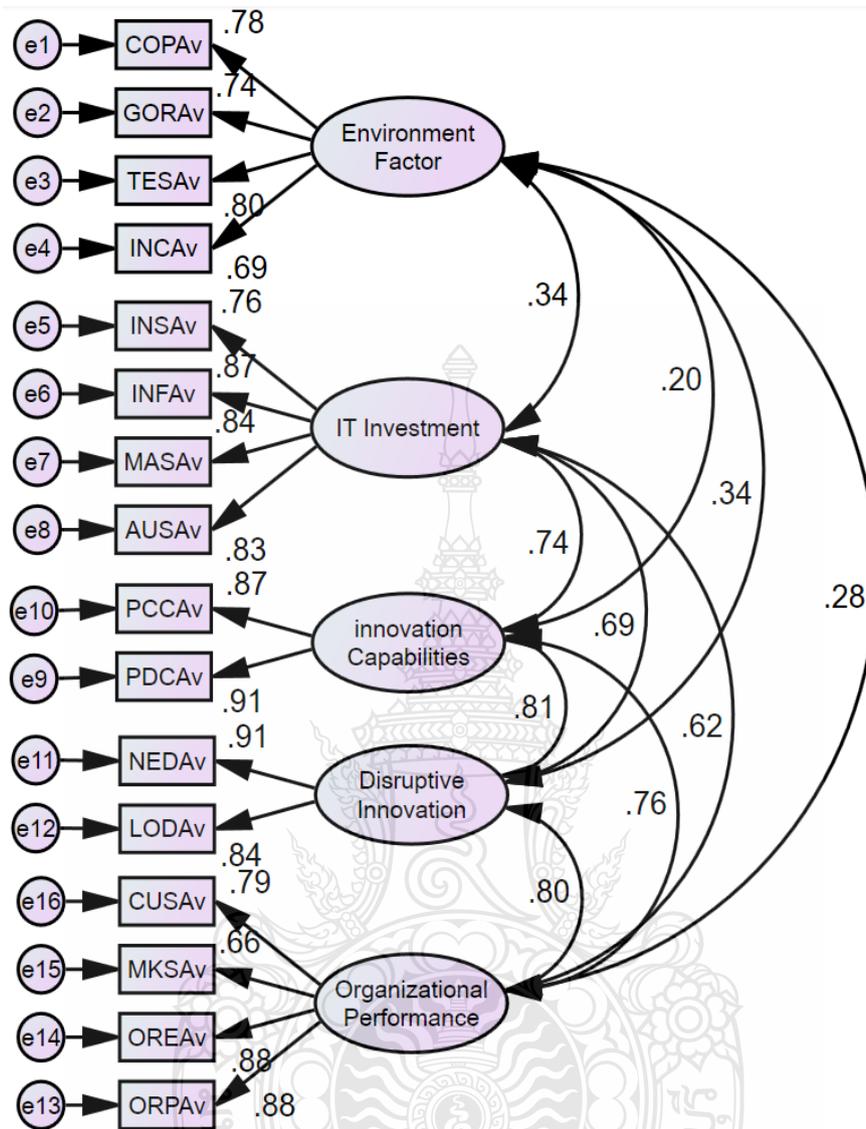
Figure 4.1 Measurement model

The CMIN/df value was 2.549, GFI value was 0.894, AGFI value was 0.846, and the RMSEA was .078, as well as other fit indices such as RMR (0.152), NFI (0.922), CFI (0.953), and Hoelter's value at 132 which all were higher than the acceptable level, with the *p*-value at <0.001.

4.6.4 Convergence Validity Testing

Table 4.11 Factor loading, R^2, composite reliability, average variance extracted of independent variable (ENF)

Variables	Factor Loading	R^2	Composite Reliability	AVE
ENF			0.840	0.568
COPAv	0.78	0.61		
GORAv	0.74	0.56		
TESAv0.	0.80	0.64		
INCAv	0.69	0.47		

Environmental factor (ENF) construct had factor loading values range from 0.68 to 0.80, which were all higher than 0.6, and the R^2 values range between 0.47 to 0.64 which were under the acceptable range. Composite reliability at 0.840 indicates the acceptability of construct reliability. The acceptable AVE value must be higher 0.5 (Fornell & Larcker, 1981), the AVE from the model was 0.568 indicating acceptability of the construct reliability.

Table 4.12 Factor loading, R^2, composite reliability, average variance extracted of independent variable (ITI)

Variables	Factor Loading	R^2	Composite Reliability	AVE
ITI			0.895	0.682
INSAv	0.76	0.60		
INFAv	0.87	0.71		
MASAv	0.84	0.69		
AUSAv	0.83	0.74		

IT Investment (IT Investment) construct had factor loading values range from 0.76 to 0.87, which were all higher than 0.6, and the R^2 values ranged between 0.60 to 0.74, below the acceptable range. Composite reliability at 0.897 indicates the

acceptability of construct reliability. The acceptable AVE value must be higher 0.5 (Fornell & Larcker, 1981), the AVE from the model was 0.682 also indicating acceptability of the construct reliability.

Table 4.13 Factor loading, R^2, composite reliability, average variance extracted of mediating variable (INC)

Variables	Factor Loading	R^2	Composite Reliability	AVE
INC			0.884	0.793
PDCAv	0.91	0.82		
PCCAv	0.87	0.77		

Innovation capabilities (INC) construct had factor loading values range from 0.87 to 0.91, which were all higher than 0.6, and the R^2 values ranged between 0.77 to 0.82, below under the acceptable range. Composite reliability at 0.884 indicates the acceptability of construct reliability. The acceptable AVE value must be higher 0.5 (Fornell & Larcker, 1981), the AVE from the model was 0.793 also indicating acceptability of the construct reliability.

Table 4.14 Factor loading, R^2, composite reliability, average variance extracted of mediating variable (DIM)

Variables	Factor Loading	R^2	Composite Reliability	AVE
DIM			0.868	0.767
NEDAv	0.91	0.81		
LODAv	0.84	0.71		

Disruptive innovation management (DIM) construct had factor loading values range from 0.84 to 0.91; they were all higher than 0.6, and the R^2 values ranged between 0.71 to 0.81 which are under the acceptable range. Composite reliability at 0.868 indicates the acceptability of construct reliability. The acceptable AVE value must be higher 0.5 (Fornell & Larcker, 1981), the AVE from the model was 0.767 also indicating acceptability of the construct reliability.

Table 4.15 Factor loading, R^2, composite reliability, average variance extracted of dependent variable (ORP)

Variables	Factor Loading	R^2	Composite Reliability	AVE
ORP			0.881	0.652
ORPAv	0.88	0.70		
OREAv	0.88	0.68		
MKSAv	0.66	0.47		
CUSAv	0.79	0.67		

Organizational performance (ORP) construct had factor loading values range from 0.66 to 0.88, they were all higher than 0.6, and the R^2 values ranged between 0.47 to 0.70, below the acceptable range. Composite reliability at 0.881 indicates the acceptability of construct reliability. The acceptable AVE value must be higher 0.5 (Fornell & Larcker, 1981), the AVE from the model was 0.652 also indicating acceptability of the construct reliability.

4.6.5 Discriminant Validity Testing

The squared correlation values ranged from 0.753 to 0.894; the values should be in the range of ≥ 0.2 but not over 1.00 (Hair et al., 2010). The testing of squared correlation was then accepted. The discriminant validity could also be checked from the comparison between AVE value and the squared correlation (Hair et al., 2010). Through the evaluation of the AVE, the discriminant validity of the instrument should be more than the squared correlation as recommended by (Fornell & Larcker, 1981).

Discriminant validity testing is an evaluation to confirm that the observed variable represents on the same latent variable and is not associated with other observed variable of the other latent variables. IT provided evidence that the construct is unique and captured some phenomena that are not similar to other constructs. This study has verified the discriminant validity of the instrument by examining based on the following criteria. (Fornell & Larcker, 1981)

$$\sqrt{AVE} > r^2 \, (correlation)$$

The testing results showed that the values as obtained supported the discriminant validity as shown in table 4.16. The value of AVE for each construct was greater than the level of correction involving the construct.

Table 4.16 Squared correlation between constructs

	ENF	ITI	INC	DIM	ORP
ENF	0.75				
ITI	0.34	0.82			
INC	0.20	0.74	0.89		
DIM	0.34	0.69	0.81	0.87	
ORP	0.28	0.62	0.76	0.80	0.80

The squared root AVE in diagonal

The discriminant validity testing results as shown in table 4.17, the results indicate that AVE values are greater than the level of correction of each dimension of the INC and DIM construct. As to consider the model Further, the CMIN/df value was 2.461, GFI value was 0.902, AGFI value was 0.852, and the RMSEA was 0.076, as well as other fit indices such as RMR (0.151), NFI (0.923), CFI (0.952), and Hoelter's value at 143 were all are higher than the acceptable level, with the *p*-value at <0.001. This indicates that model is well acceptable.

Table 4.17 Summary of items used in the hypothesized model analysis

Construct	Variable	Items	Decision
ENF	Competitive Pressure	COPAv	Kept
	Government Regulation	GORAv	Kept
	Technology Support	TESAv	Kept
	Industry Characteristics	INCAv	Kept
ITI	Innovation	INSAv	Kept
	Infrastructure	INFAv	Kept
	Management	MASAv	Kept
	Automation	AUSAv	Kept

Table 4.17 Summary of items used in the hypothesized model analysis (Cont.)

Construct	Variable	Items	Decision
INC	Product Capabilities	PDCAv	Kept
	Process Capabilities	PCCAv	Kept
DIM	New-market Disruptive	NEDAv	Kept
	Low-end Disruptive	LODAv	Kept
ORP	Productivity	ORPAv	Kept
	Effectiveness	OREAv	Kept
	Market Share	MKSAv	Kept
	Customer Satisfaction	CUSAv	Kept

4.7 Structural Equation Model Analysis (SEM) of the Proposed Model

This section presents the analysis of the proposed model through SEM analysis as to test the hypotheses and identify the answers for research questions set forth.

A goodness-of-fit test was carried out in order to measure how well the observed data correspond to the proposed model. The goodness-of-fit test was used to compare the observed values to the predicted values.

For this study, the two structural models were proposed. The structural model one is meant to evaluate the direct effects of the constructs and variables, and the structural model two is meant to evaluate the direct effects and indirect effects of the constructs and variables through the mediating variables.

4.7.1 Structural equation model one:

The structural model one examined the relationship between environmental factor, IT investment and organizational performance as shown in figure 4.2.
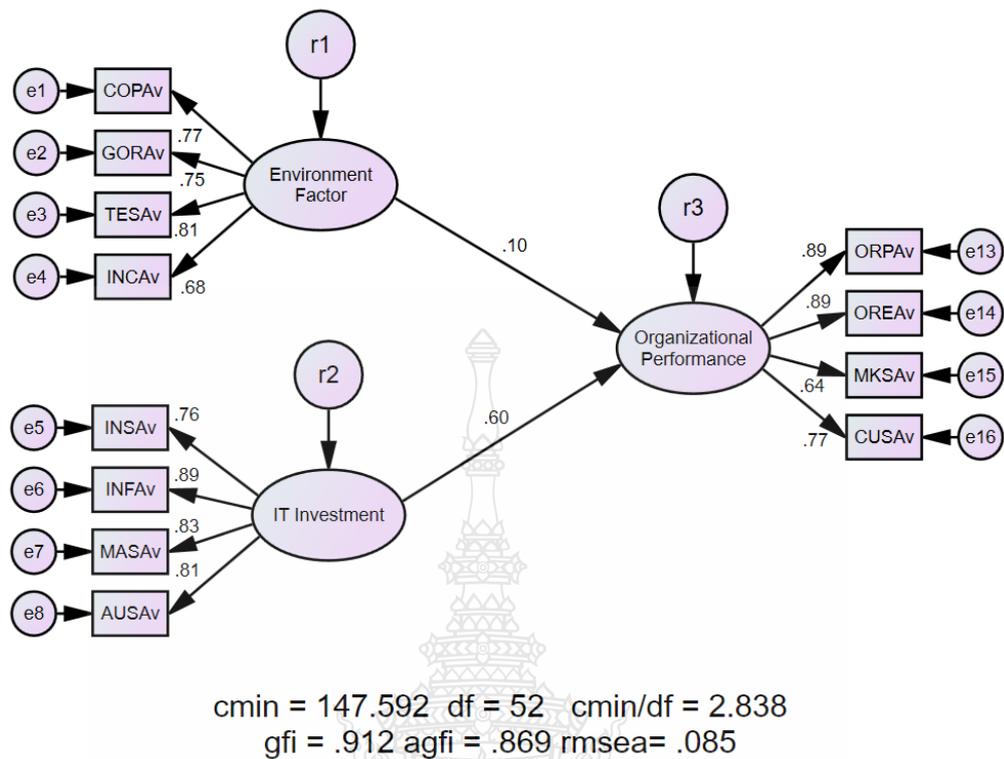
Figure 4.2 Structural equation model one

The structural model one investigated the direct effects of environmental factor, IT investment on organizational performance.

The goodness-of-fit was conducted. The results of the assessment are as follows: Chi-Square = 147.592, df = 52, Chi-Square/Degree of freedom = 2.838, *p*-value = .000, GFI = 0.912, AGFI = 0.869, RMR = 0.169, RMSEA = 0.855 , NFI = 0.918, and Hoelter's value = 136(0.01), the summary and the comparison with acceptable level, for each value, is shown in table 4.18.

Table 4.18 Model fit analysis for model one

Model Fit Criteria	Value	Acceptable level
Chi-Square	147.592	-
Degree of freedom	52	-
Chi-Square/Degree of freedom	2.838	≤ 3
p-value	0.000	$P > .05$
GFI	0.912	≥ 0.90
AGFI	0.869	≥ 0.80
RMR	0.169	Close to zero
RMSEA	0.855	< 0.10
NFI	0.918	> 0.90
CFI	0.945	> 0.90

The result suggest that the model did not meet the criteria of the model fit as some of the indicators were still unfavorable for the acceptable level. The model was adjusted by using modification indices, the covariance between residual error; e15 and e16, el3 and e15, e6 and e5, e7 and e6, e8 and e5, e8 and e7 was added. The results after modification show that the model fit with all the indicators values within the acceptable level, The indicators values were Chi-Square = 117.560, df = 46, Chi-Square/Degree of freedom = 2.556, p-value = .000, GFI = 0.931, AGFI = 0.882, RMR = 0.168, RMSEA = 0.78 (PCLOSE = 0.005), NFI = 0.935, and Hoelter's value =154(0.01) the summary and the comparison with acceptable level for each value are as shown in table 4.22.
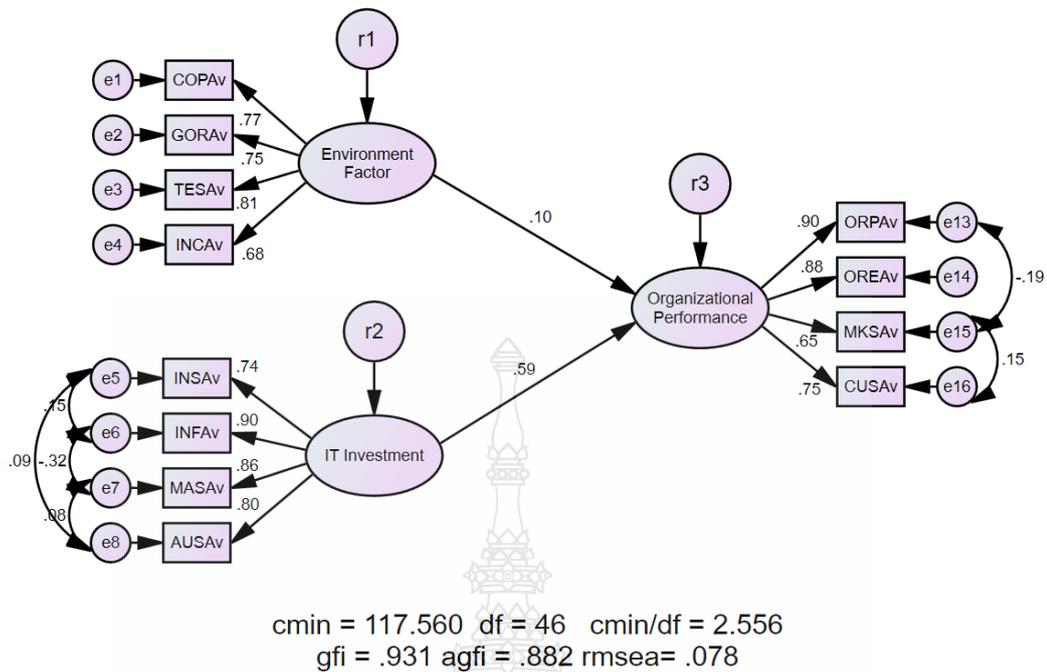
Figure 4.3 Structural equation model one (with modification indices)

Table 4.19 Model fit analysis for model one (with modification indices)

Model Fit Criteria	Value	Acceptable level
Chi-Square	117.560	-
Degree of freedom	46	-
Chi-Square/Degree of freedom	2.556	≤ 3
p-value	0.000	$P > .05$
GFI	0.931	≥ 0.90
AGFI	0.882	≥ 0.80
RMR	0.168	Close to zero
RMSEA	0.78	< 0.10
NFI	0.935	> 0.90
CFI	0.959	> 0.90

The analysis of the structural model one indicates that there is a direct relationship between ITI and ORP at $\beta = 0.585$ ($p<0.001$), however, the results indicate that there is no direct relationship between the two constructs ($\beta = 0.105$ ($p > 0.05$).

The results of significance for the model one are presented in table 4.20.

Table 4.20 Hypothesis testing for model one

	Estimate	**S.E.**	**C.R.**	*p*-value
H8: ENF → ORP	0.105	0.061	1.712	0.087
H9: ITI → ORP	0.585	0.072	8.135	***

*** *p*-value <0.001 (statistical significance at 0.001 level)
** *p*-value <0.01 (statistical significance at 0.01 level)
* *p*-value <0.05 (statistical significance at 0.05 level)

4.7.2 Structural equation model two:

The structural model two examined the relationship between environmental Factor, IT investment and organizational performance through innovation capabilities and disruptive innovation management as the mediator, as shown in figure 4.4.
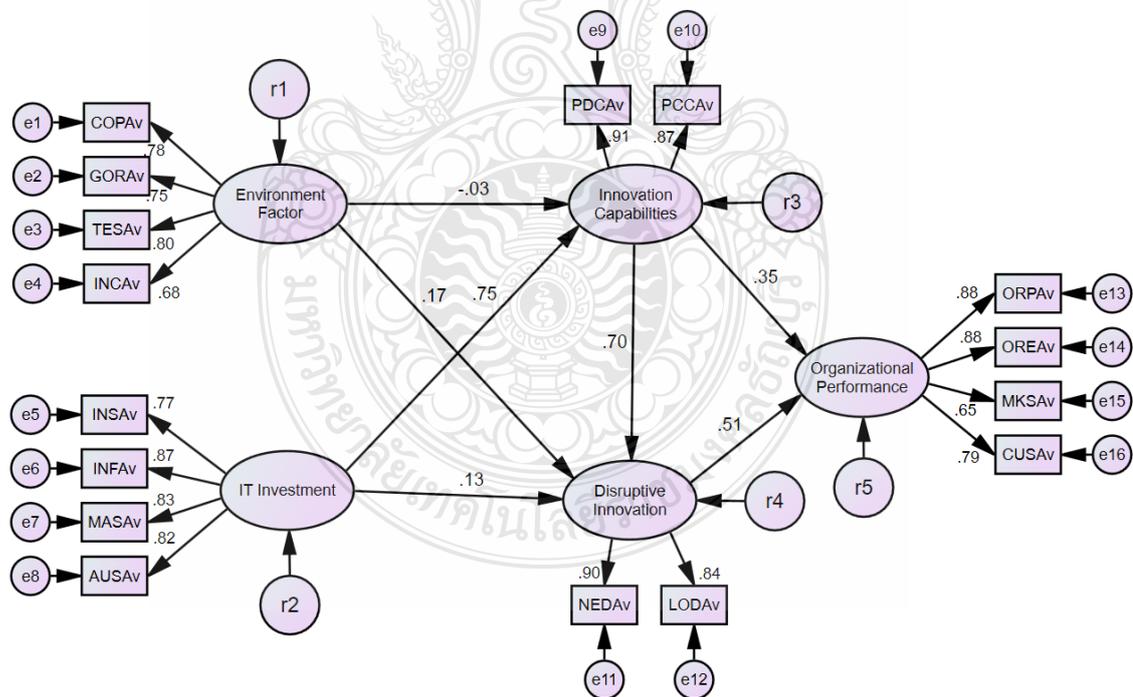
cmin = 263.164 df = 97   cmin/df = 2.713
gfi = .885 agfi = .839 rmsea= .082

Figure 4.4 Structural equation model two

The structural model two examined the relationship between environmental factor, IT investment and organizational performance through innovation capabilities and disruptive innovation management, as the mediator.

The goodness-of-fit was conducted. The results of the assessment are as follows: Chi-square = 263.164, df = 97, Chi-square/Degree of freedom = 2.713, *p*-value = .000, GFI = 0.885, AGFI = 0.839, RMR = 0.153, RMSEA = 0.082, NFI = 0.908, and Hoelter's value = 128(0.01), the summary and the comparison with acceptable level for each value, is shown in table 4.21.

Table 4.21 Model fit analysis for model two

Model Fit Criteria	Value	Acceptable level
Chi-Square	263.164	-
Degree of freedom	97	-
Chi-Square/Degree of freedom	2.713	≤ 3
p-value	0.000	*P > .05*
GFI	0.885	≥ 0.90
AGFI	0.839	≥ 0.80
RMR	0.153	Close to zero
RMSEA	0.082	< 0.10
NFI	0.908	> 0.90
CFI	0.939	> 0.90

The result suggests that the model did not meet the criteria of the model fit as some of the indicators were still unfavorable at the acceptable level. The model was adjusted by using modification indices, the covariance between residual error e5 and e8, e5 and e6, el3 and e14, el3 and e15, el5 and e16 was added. The results after modification show that the model fits with all the indicators values within the acceptable level, the indicator values were Chi-square = 221.523, df = 90, Chi-square/Degree of freedom = 2.461, *p*-value = 0.000, GFI = 0.902, AGFI = 0.852, RMR = 0.151, RMSEA = 0.076, NFI = 0.923, and Hoelter's value = 143(0.01); the summary and the comparison with acceptable level for each value is shown in table 4.22.
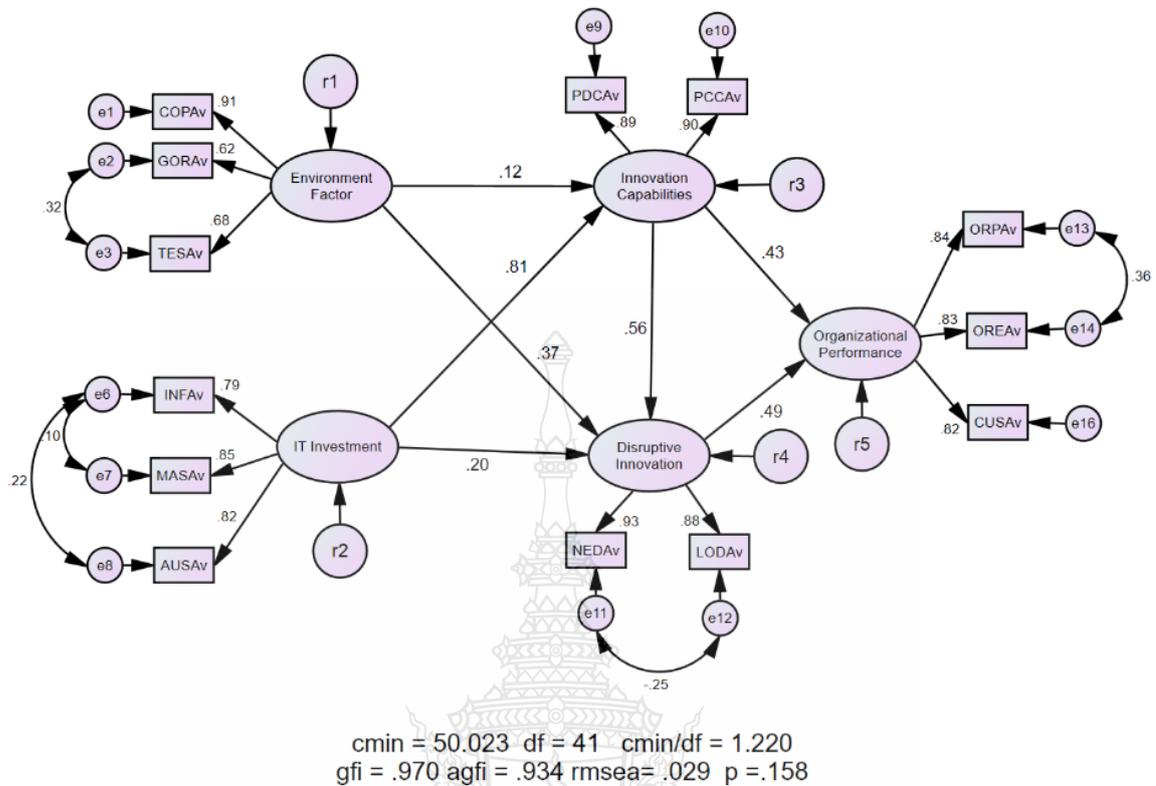
Figure 4.5 Structural equation model two (with modification indices)

Table 4.22 Model fit analysis for model one (with modification indices)

Model Fit Criteria	Value	Acceptable level
Chi-Square	50.023	-
Degree of freedom	41	-
Chi-Square/Degree of freedom	1.220	≤ 3
p-value	0.158	*P > .05*
GFI	0.970	≥ 0.90
AGFI	0.934	≥ 0.80
RMR	0.043	Close to zero
RMSEA	0.029	< 0.10
NFI	0.978	> 0.90
CFI	0.996	> 0.90

The analysis of structural model two indicates that there is no direct relationship between environmental factor (ENF) and organizational performance (ORP), and as well, there is no direct relationship between IT investment (ITI) and organizational performance (ORP). For the relationship between environmental factor (ENF) and organizational performance (ORP), β value was 0.023 and for the relationship between IT investment (ITI) and organizational performance (ORP), β value was 0.049 and none of these were statistically significant.

After analyzing model two, it indicated that environmental factor (ENF) has a positive direct effect on disruptive innovation management (DIM) ($\beta = 0.175$), and IT investment (ITI) has a positive direct effect on innovation capabilities (INC) ($\beta = 0.770$). In addition, environmental factor (ENF) had positive no direct on innovation capabilities (INC) ($\beta=0.036$), and IT investment (ITI) had a positive in direct effect on disruptive innovation management (DIM) ($\beta=0.112$).

As for the relationships of INC and DIM, both had positive direct effect on ORP at $\beta=0.427$ and $\beta=0.487$ respectively, and this suggested that innovation capabilities and disruptive innovation management highly affects organizational performance.

The results on the significance of model two are presented in table 4.23

Table 4.23 Hypothesis testing for model two

	Estimate	S.E.	C.R.	*p*-value
H1: ENF → INC	0.036	0.060	0.613	0.540
H2: ITI → DIM	0.112	0.078	1.425	0.154
H3: ENF → DIM	0.175	0.052	3.383	***
H4: ITI → INC	0.770	0.072	10.659	***
H5: INC → DIM	0.644	0.081	7.906	***
H6: INC → ORP	0.636	0.102	3.543	***
H7: DIM → ORP	0.475	0.102	4.656	***
H8: ENF → ORP	0.023	0.050	0.459	0.646
H9: ITI → ORP	0.049	0.070	0.700	0.484

*** *p*-value <0.001 (statistical significance at 0.001 level)
** *p*-value <0.01 (statistical significance at 0.01 level)
* *p*-value <0.05 (statistical significance at 0.05 level)

4.8 Summary of Structural Equation Model Analysis

The two-structural modeling were constructed to compare the mediating effect of the mediator. The mediator for this study are innovation capabilities (INC) and disruptive innovation management (DIM). From to the model one, on the research finding of the effect of environmental factor (ENF) and IT investment (ITI) on organizational performance (ORP), environmental factor (ENF) had a positive indirect effect on organizational performance (ORP), and IT investment had a positive direct effect on organizational performance (ORP).

The path coefficient should ideally get smaller with the mediator being added into the model (Preacher & Hayes, 2008). As for the model two, the research finding of the effects of environmental factor (ENF) and IT investment (ITI) on organizational performance (ORP) through innovation capabilities (INC) and disruptive innovation management (DIM) was that environmental factor (ENF) and IT investment (ITI) have no positive direct effect on organizational performance (ORP), but both had the positive indirect effect on organizational performance (ORP).

The comparison of the path coefficients between model one with model two are presented in table 4.24

Table 4.24 Comparison of the path coefficients between model one and model two. The comparison of the path coefficients between model one with model two are presented in table.

Table 4.24 Comparison of the path coefficients between model one and model two

	Model 1 (β)	Model 2 (β)
ENF → ORP	0.102	0.023
ITI → ORP	0.594***	0.049
INC → ORP		0.427***
DIM → ORP		0.487***
INT → DIM		0.544***
ENF → DIM → ORP		0.650***
ITI → INC → ORP		1.406***

*** p-value <0.001 (statistical significance at 0.001 level)
** p-value <0.01 (statistical significance at 0.01 level)
* p-value <0.05 (statistical significance at 0.05 level)

The standardized direct, indirect and total effect coefficients and the R^2 associated with the SEM as shown in table 4.25

Table 4.25 Standardized direct, indirect and total effects among variables

	R^2	Standardized Direct Effect					Standardized Indirect Effect					Standardized Total Effects				
		ENF	ITI	INC	DIM	ORP	ENF	ITI	INC	DIM	ORP	ENF	ITI	INC	DIM	ORP
ENF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ITI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
INC	0.57	0.125	0.813	-	-	-	-	-	-	-	-	0.125	0.813	-	-	-
DIM	0.68	0.173	0.196	0.563	-	-	0.064	0.484	-	-	-	0.102	0.654	0.563	-	-
ORP	0.72	0.024	0.056	0.427	0.487	-	0.62	0.636	0.240	-	-	0.860	0.692	0.667	0.487	-

According to table 4.25, it can expressed by equation as below:

INC $=$ 0.125 * ENF + 0.813 * ITI ; $R^2 = 0.57$

DIM $=$ 0.173 * ENF + 0.196 * ITI + 0.563 * INC ; $R^2 = 0.68$

ORP $=$ 0.024 * ENF + 0.056 * ITI + 0.427 * INC + 0.487 + DIM ; $R^2 = 0.72$

Where:

INC $=$ Innovation Capabilities

DIM $=$ Disruptive Innovation Management

ORP $=$ Organizational Performance

The structural model exhibits reasonable predictive ability as it explains 57 percent of the variance in innovation capabilities (INC), 68 percent of the variance in disruptive innovation management (DIM) and 72 percent of the variance in organizational performance (ORP).

4.9 Hypothesis Testing

The following research questions were raised in the earlier discussion: 1. How can environmental factor and innovation capabilities influence organizational performance? 2. How can IT investment and disruptive innovation management influence organizational performance? 3. How can innovation capabilities and disruptive innovation management influence organizational performance?

Therefore, the following hypotheses have been proposed:

H1: Environmental factor has a positive effect on innovation capabilities.

H2: IT investment has a positive effect on disruptive innovation management.

H3: Environmental factor has a positive effect on disruptive innovation management.

H4: IT investment has a positive effect on innovation capabilities.

H5: Innovation capabilities have a positive effect on disruptive innovation management.

H6: Innovation capabilities have a positive effect on organizational performance.

H7: Disruptive innovation management has a positive effect on organizational performance.

H8: Environment factor has a positive effect on organizational performance.

H9: IT investment has a positive effect on organizational performance.

4.9.1 Hypothesis H1 Testing

H1: Environmental factor has a positive effect on innovation capabilities.

The analysis of the relationship between environmental factor (ENF) and innovation capabilities (INC) indicated that there is no positive relationship between ENF and INC. The results indicate that the path coefficient between ENF and INC is low (β=0.124); standard error (S.E.) was 0.060, critical ration (C.R.) was 0.613 and the

p-value was higher than 0.05. The factor loading values for each item of the observed variables: competitive pressure, government regulation, technology support and industry characteristics were 0.78, 0.75, 0.80 and 0.68 respectively. It was found that the *p*-value which means to measure the evidence against the null hypothesis, whereby the smaller the *p*-value indicated stronger evidence against the null; The *p*-value for this relationship was greater than 0.05. This suggests that the result does not have statistical significance, indicating that hypothesis H1 is not supported.

Considering the observed variables used for ENF construct. (competitive pressure, government regulation, technology support and industry characteristics), all these aspects may not have direct influence on the innovation capabilities of the electronic industry in Thailand.

4.9.2 Hypothesis H2 Testing

H2: IT investment has positive effect on disruptive innovation management.

The analysis of the relationship between IT investment (ITI) and disruptive innovation management (DIM) indicated that there is no positive relationship between ITI and DIM. The results indicate that the path coefficient between ITI and DIM is low (β=0.202), standard error (S.E.) was 0.078, critical ration (C.R.) was 1.425 and the *p*-value was higher than 0.05. The factor loading values for each item of the observed variables, (innovation support, infrastructure, management and automation support) were 0.78, 0.84, 0.83 and 0.86 respectively. It was found that the *p*-value which means to measure the evidence against the null hypothesis, whereby the smaller the *p*-value indicated stronger evidence against the null; the *p*-value for this relationship was greater than 0.05. This suggests that the result does not have statistical significance which indicates that hypothesis H2 is not supported.

Considering the observed variables used for ITI construct, which are innovation support, infrastructure, management and automation support, all these aspects may not have direct influence with the disruptive innovation management of the electronic industry in Thailand.

4.9.3 Hypothesis H3 Testing

H3: Environmental factor has positive effect on disruptive innovation management.

The analysis of the relationship between environmental factor (ENF) and disruptive innovation management (DIM) indicated that there is a positive relationship between ENF and DIM. The results indicated that path coefficient between ENF and DIM is 0.374, standard error (S.E.) is 0.052, critical ration (C.R.) is 3.383 and the p-value is <0.01. The path coefficient and the p-value indicated a high significant relationship with between ENF and DIM, which also suggest the ENF positively affects DIM. This therefore indicates that the hypothesis H3 is supported.

4.9.4 Hypothesis H4 Testing

H4: IT Investment has positive effect on innovation capabilities.

The analysis of the relationship between IT investment (ITI) and innovation capabilities (INC) indicated that there is a positive relationship between ITI and INC. The results indicated that path coefficient between ITI and INC as 0.812, standard error (S.E.) as 0.072, critical ration (C.R.) as 10.659 and the p-value as <0.01. The path coefficient and the p-value indicate high significant relationship with between ITI and INC, which also suggests that ITI positively affects INC. This therefore indicates that the hypothesis H4 is supported.

4.9.5 Hypothesis H5 Testing

H5: Innovation capabilities have positive effect on disruptive innovation management.

The analysis of the relationship between innovation capabilities (INC) and disruptive innovation management (DIM) indicated that there is a positive relationship between INC and DIM. The results indicate that path coefficient between INC and DIM is 0.563, standard error (S.E.) is 0.081, critical ration (C.R.) is 7.906 and the p-value is <0.01. The path coefficient and the p-value indicate a high significant relationship between INC and DIM, which also suggest the INC positively affects DIM. This therefore indicate that the hypothesis H5 is supported.

4.9.6 Hypothesis H6 Testing

H6: Innovation capabilities have positive effect on organizational performance.

The analysis of the relationship between innovation capabilities (INC) and organizational performance (ORP) showed that there is a positive relationship between

INC and ORP. The results indicate that path coefficient between INC and ORP is 0.436, standard error (S.E.) is 0.102, critical ration (C.R.) is 3.543 and the *p*-value is <0.01. The factor loading values for each item of the observed variables: organizational productivity, organizational effectiveness, Market share and customer satisfaction were 0.84, 0.82, 0.68 and 0.82 respectively. These values indicate significant positive relationship between innovation capabilities and organizational performance and therefore, the hypothesis H6 is supported.

4.9.7 Hypothesis H7 Testing

H7: Disruptive innovation management has positive effect on organizational performance.

The analysis of the relationship between disruptive innovation management (DIM) and organizational performance (ORP) indicated that there is a positive relationship between DIM and ORP. The results indicate that path coefficient between DIM and ORP is 0.492, standard error (S.E.) is 0.102, critical ration (C.R.) is 4.656 and the *p*-value is <0.01. The factor loading values for each item of the observed variables, (organizational productivity, organizational effectiveness, Market share and customer satisfaction) were 0.84, 0.82, 0.68 and 0.82 respectively. These values indicate significant positive relationship between disruptive innovation management and organizational performance and therefore, the hypothesis H7 is supported.

Organizational performance is a dependent variable of the model. Observed variables for organizational performance measurement has been the greatest challenges for strategic management research due to the wide variety of concept and definition of organizational performance. Variables used for this study were organizational productivity, organizational effectiveness, Market share and customer satisfaction. All these aspects of organizational performance have been thoroughly reviewed from the earlier relevant studies and have represented good measurement for organizational performance construct.

4.9.8 Hypothesis H8 Testing

H8: Environment factor has positive effect on organizational performance.

The analysis of the relationship between environmental factor (ENF) and organizational performance (ORP) indicated that there is no positive relationship

between ENF and ORP. The results indicated that the path coefficient between ENF and ORP was low (β=0.023), standard error (S.E.) was 0.050, critical ration (C.R.) was 0.459 and the p-value was higher than 0.05. The factor loading values for each item of the observed variables, which were competitive pressure, government regulation, technology support and industry characteristics were 0.78, 0.75, 0.80 and 0.68 respectively. It was found that the p-value which means to measure the evidence against the null hypothesis, whereby the smaller the p-value indicated stronger evidence against the null, the p-value for this relationship was greater than 0.05. This suggests that the result does not have statistically significance indicating that hypothesis H8 is not supported.

Considering the observed variables used for ENF construct, which are competitive pressure, government regulation, technology support and industry characteristics, all these aspects may not have direct influence with the organizational performance of the electronic industry in Thailand.

4.9.9 Hypothesis H9 Testing

H9: IT investment has positive effect on organizational performance.

The analysis of the relationship between IT investment (ITI) and organizational performance (ORP) indicated that there is no positive relationship between ITI and ORP. The results indicated that the path coefficient between ITI and ORP was low (β=0.049), standard error (S.E.) was 0.070, critical ration (C.R.) was 0.700 and the p-value was higher than 0.05. The factor loading values for each item of the observed variables, which were innovation support, infrastructure, management and automation support were 0.78, 0.84, 0.83 and 0.86 respectively. It was found that the p-value which is means measuring the evidence against the null hypothesis, whereby the smaller the p-value indicated stronger evidence against the null; the p-value for this relationship was greater than 0.05. This suggests that the result does not have statistically significance indicating that hypothesis H9 is not supported.

Considering the observed variables used for ITI construct, which are innovation support, infrastructure, management and automation support, all these aspects may not have direct influence with the organizational performance of the electronic industry in Thailand.

The summary of hypothesis testing as shown in table 4.26

Table 4.26 Hypotheses testing results

Hypothesis	Result
H1: Environmental Factor has positive effect on Innovation Capabilities.	Not Supported
H2: IT Investment has positive effect on Disruptive Innovation Management.	Not Supported
H3: Environmental Factor has positive effect on Disruptive Innovation Management.	Supported
H4: IT Investment has positive effect on Innovation Capabilities.	Supported
H5: Innovation Capabilities have positive effect on Disruptive Innovation Management.	Supported
H6: Innovation Capabilities have positive effect on Organizational Performance.	Supported
H7: Disruptive Innovation Management has positive effect on Organizational Performance.	Supported
H8: Environment Factor has positive effect on Organizational Performance.	Not Supported
H9: IT Investment has positive effect on Organizational Performance.	Not Supported
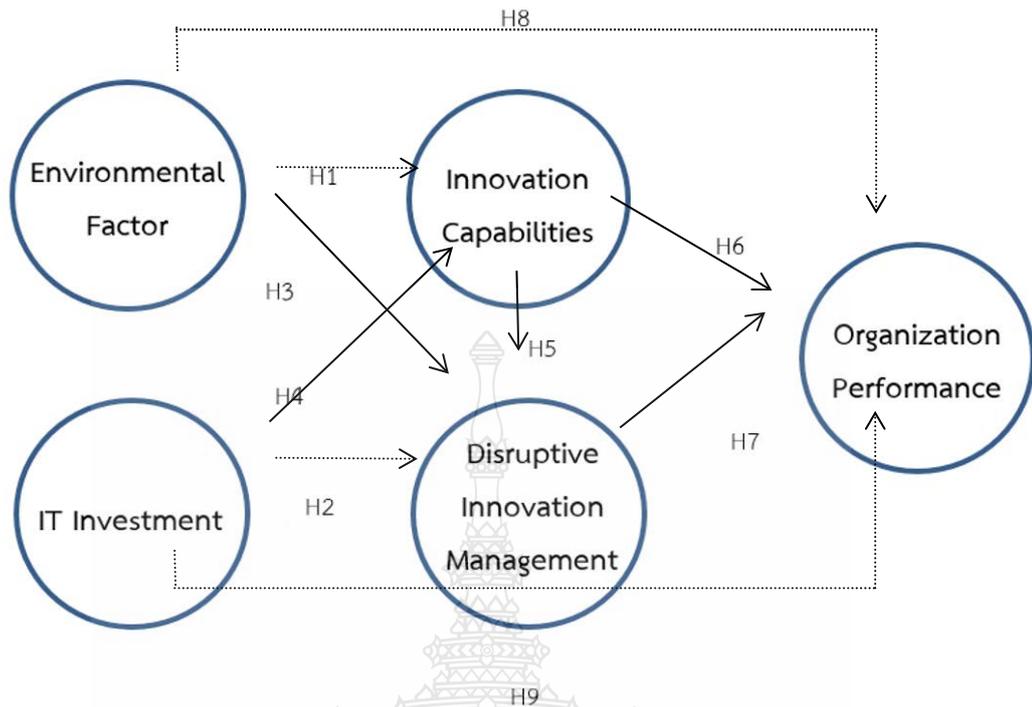
Solid line indicated hypotheses supported (H3-H7)

Dashed line indicates hypotheses not supported (H1-H2, H8-H9)

Figure 4.6 Graphical presentation of tested hypotheses

4.10 Qualitative Results

The qualitative research results through in-depth interview were to affirm the quantitative research results. The following were detailed descriptions of the individual interview with the IT executives and managers from 5 electronic industry companies.

Table 4.27 Results of in-depth interview question 1

"How technology and innovation advancement influenced your company's business conducting**"**

Participants	Answer of the question
IT Manager Company 1	Since the company's product is the equipment that requires developing toward better efficiency, thus, technology can be a tool in research and development to form new innovation. Besides, technology is crucial in organizational management, and effective and efficient business competition.
IT Manager Company 2	Technology helps in creating better efficiency in production, it leads to better management process and can be used in the analysis to form new product and innovation in response to the needs of customer and adds more business competitive ability.
IT Manager Company 3	Technology and innovation result can be either positive or negative. It is the tool that help in doing better work and management efficiency while at the same time, competitors may use them as tools for simpler product development.
IT Manager Company 4	Technology and innovation lead to better effectiveness of operation and goods production, including better efficiency and effectiveness, creative innovative management.
IT Manager Company 5	Technology enters to have the role in all part of the organization in management, operation, production as well as customer relations.

Table 4.28 Results of in-depth interview question 2

"How does your company consider the importance of information technology?"

Participants	Answer of the question
IT Manager Company 1	Technology investment is so important for the company no matter the information system infrastructure planning investment, arranging for the advance tools in production process, innovation development, or creating quality IT personnel. IT is the cost that generates incomes for the company, thus it shall be give move attention.
IT Manager Company 2	IT investment is the cost, thus IT investment can be infrastructure investment which is not often since it has high value; or it can be IT operation, implementation and quality management investment such as purchasing of software as well as IT training for staff.
IT Manager Company 3	The company pays importance on goods production with the quality above rivals, thus there shall be IT investment for the quality of operation that will result in productivity as well as effective management.
IT Manager Company 4	There is a new technology research and investment on hardware, software, and personnel to support the quality in operation process and production.
IT Manager Company 5	The company will study the worthiness of investment for the initial evaluation before purchasing or employment according to set goals. There will be an IT investment to support the efficiency in the operation since IT investment requires a purchasing budget.

Table 4.29 Results of in-depth interview question 3

"What are the main objectives of your goods and service production?"

Participants	Answer of the question
IT Manager Company 1	To produce the goods with high efficiency and diversity and dominate over the competitors with low cost of production, satisfy customers and join the responsible in society.
IT Manager Company 2	To product the goods with quality that meet the needs of consumers as a key to effective and efficient production process as well as low cost of production.
IT Manager Company 3	To give importance to quality and effective production goods at the low cost of production and better quality.
IT Manager Company 4	To produce goods that can meet most needs of consumers and to produce good with quality as well as reduce cost of production.
IT Manager Company 5	Quality goods production with effectiveness and efficiency to compete with the competitors.

Table 4.30 Results of in-depth interview question 4

"What are your company's policies and guidelines for products and services development?"

Participants	Answer of the question
IT Manager Company 1	To produce goods with high efficiency and at low cost of production. To always bring modern technology to develop products by setting the policy from top down with the operation plan and guideline that stress on the participation of everyone in the company.
IT Manager Company 2	The company has a clear operation plan or guideline that everyone in the company work toward the same goals which are efficient operation, quality of production and lower production costs.

Table 4.30 Results of in-depth interview question 4 (Cont.)

"What are your company's policies and guidelines for products and services development?"

Participants	Answer of the question
IT Manager Company 3	Efficiency in production, lower production costs, simple, convenience and speed in operation system.
IT Manager Company 4	To produce product with efficiency that meet the needs of customers and lessen the loss of raw materials and at low cost.
IT Manager Company 5	Having both short and long-term plan and staff training for quality goods production.

Table 4.31 Results of in-depth interview question 5

"What does your company place importance on production of goods and service in response to the need of customers?"

Participants	Answer of the question
IT Manager Company 1	To produce goods that meet customer requirements by studying their needs to set the direction of production to serve the customer needs with customer relations system to connect with them.
IT Manager Company 2	Customers will bring the main revenues to the company thus, we shall be aware of the important of customers or service to customers as the first priority. Besides, staff is a key resource that the company has to take good care of as well. To produce products with quality as customer needs, it requires conducting needs analysis and staff training where all need will be integrated in order to get the good result performance.
IT Manager Company 3	Customer is the part that company places special importance since when the customers are satisfied, they will stay with the company. Also, company seeks to form new customer base with the responsible units to conduct customer analysis in both groups in response to their needs.

Table 4.31 Results of in-depth interview question 5 (Cont.)

"What does your company place importance on production of goods and service in response to the need of customers?"

Participants	Answer of the question
IT Manager Company 4	To produce goods that serve to the needs of both existing and new customer group and conduct market needs survey to bring the information to help producing goods that meet the needs of customers.
IT Manager Company 5	The company tries to keep the old customer base and increase new customers by producing the products that serve their needs, adding more deals for new customers and forming good relationship with them.

Table 4.32 Results of in-depth interview question 6

"How does the external business competitive environment influenced on your organization?"

Participants	Answer of the question
IT Manager Company 1	The main impact on the company is economic recession problem and change in technology adoption by consumers, lower incomes from exporting lesser products and changes in consumer behavior from technology adjustment.
IT Manager Company 2	The strongest impact is change in technology that forces the company to change and improve on production procedure in new forms and requires using large capital on both hardware and software, and personnel. Moreover, the economic recession has also led to lower export rate.
IT Manager Company 3	The company has equally been highly influenced by economic and technology from economic recession and changes in customer used of advanced technology.
IT Manager Company 4	There are strong impacts from global economic downturn that lead to lower export rates and technology impact on higher wages and costs.

Table 4.32 Results of in-depth interview question 6 (Cont.)

"How does the external business competitive environment influenced on your organization?"

Participants	Answer of the question
IT Manager Company 5	The impact is on the lower need of product or electronic parts production from the world economic downturn and higher wage.

Table 4.33 Results of in-depth interview question 7

"How does your company plan on strategic solutions toward external competitive environment?"

Participants	Answer of the question
IT Manager Company 1	In short term plan, it is to produce products with high quality and efficiency at low costs, reducing the staff mistakes. For the long-term plan, it is to create the consumer confidence, good welfare for staff, generate income and to contribute in social responsibility.
IT Manager Company 2	To keep the old customer base and new customer base that create satisfaction for customer on the quality production. Promote good management system and efficient operation procedure.
IT Manager Company 3	To reduce the production cost ensuing high quality and efficiency of production. Also, to set long-term plan to support change in the environment.
IT Manager Company 4	To form confidence among customers by setting it as the company's policy for all units to place importance on quality product to serve customer needs.
IT Manager Company 5	During the economic recession, the company shall find the way to reduce the production costs, management, and operation while remaining at a high production efficiency.

Table 4.34 Results of in-depth interview question 8

"How is your company financial performance compared to the past three years?"

Participants	Answer of the question
IT Manager Company 1	The export volumes are reducing because of the changes in equipment needs in the electronic market. The main reason comes from change in consumer behaviors in using small and portable devices with high efficiency. Another is the impact from the world economic recession while minor impact comes from law and politics since the company plans with the guideline and process to reduce the impacts besides, the production efficiency will be increased in technology use in production, production process, management and regular research and development on products.
IT Manager Company 2	From 2014 until now, the world economy is in downstream, the export or need of electronic products has reduced as well as the profits. On the part of production, there will be higher efficiency since modern technology helps in production or operation processes as well as for better administration.
IT Manager Company 3	The export financial performance has slowed down but production is more efficient since we have brought modern machines for production and administration process.
IT Manager Company 4	Higher and lower financial performance according to the export rate; compared to the past three years, it is not much lower.
IT Manager Company 5	Lower financial performance comparing to the past three years since the economic downturn.

CHAPTER 5
CONCLUSION AND RECOMMENDATIONS

Introduction

This chapter presents the empirical findings for the research questions posited for this study from data analysis in the preceding chapter, as well as, the discussion of the consistency and contradiction with relevant studies and existing literature, followed by theoretical contribution and practical implications. This chapter is concluded with limitation of the study and recommendations for future research.

5.1 Summary of the Findings

The purpose of this study was to investigate the relationships between environment factor, IT investment, innovation capabilities, disruptive innovation management and organizational performance. Emphasis was on analysis of the mediating effects of innovation capabilities and disruptive innovation management as the mediator and its impact on organizational performance of Thailand's electrical industry.

The respondents consisted of chief executive managers of firms. The majority of respondents had organizations register as limited companies, run by Thai owners with hiring rate between 101-500 employees. Their companies had business capital between 11 - 50 million baht and were established the more than 15 years.

The study deployed Structural Equation Modeling (SEM) techniques as statistical tools for the analysis of data for the relationships among the multiple and interrelated variables. The results was in line with the PEST perspective and disruptive innovation theory, this emphasizing the innovation capabilities and disruptive innovation management. However, the empirical findings were both consistent and contradicted some relevant literature.

5.2 Research Question and Answers

This study earlier raised three major research questions:

RQ1: How can environmental factor and IT investment influence innovation capabilities of electronic industries?

RQ2: How can environmental factor and IT investment influence disruptive innovation management of electronic industries?

RQ3: How can innovation capabilities and disruptive innovation management influence on organizational performance of electronic industries?

Nine hypotheses were developed and tested in order to find answers the above research questions. The answers are presented below:

Table 5.1 Summary of research questions, tested hypotheses and results

Research questions	Hypothesis	Statistic Technique	Result
RQ1	H1: Environmental factor has a positive effect on innovation capabilities.	SEM	No
	H4: IT investment has a positive effect on innovation capabilities.	SEM	Yes
	H8: Environment factor has a positive effect on organizational performance.	SEM	No
RQ2	H2: IT investment has a positive effect on disruptive innovation management.	SEM	No
	H3: Environmental factor has a positive effect on disruptive innovation management.	SEM	Yes
	H9: IT investment has a positive effect on organizational performance.	SEM	No
RQ3	H5: Innovation capabilities have a positive effect on disruptive innovation management.	SEM	Yes
	H6: Innovation capabilities have a positive effect on organizational performance.	SEM	Yes
	H7: Disruptive innovation management has a positive effect on organizational performance.	SEM	Yes

5.3 Discussion of the Researches Findings

This section provides results interpretation, discussion, and conclusion of the research question.

5.3.1 Discussion of Research Question 1

The industry environment refers to the organizational factors in the electronic industry that affected the organizations the in the industry (Porter, 1980). Besides, external environment refers to economic environment, social environment, politics and successful technologies (Hoskisson, 2012). It is crucial to the organization since the environmental condition can effect both opportunities and threaten the organization. The hypothesis testing of H1, H4 and H8 are as follow: hypothesis 1 - environmental factor has no positive effect to innovation capabilities; hypothesis 4 - IT investment has a positive effect to innovation capabilities, and hypothesis 8 - environment factor has no positive effect on organizational performance. They conformed Smith (1978) to who studied on the external environmental impacts related to the industry and found that the most influential environment in an organization is technology. It requires the management to understand and use technology all dimensions to strengthen competitive advantages. The study of Carneiro (2000) revealed that business should be concentrated on the competitive environment analysis either internal or external for create opportunities and prevent risks from the environment. Therefore, organizations should pay attention to the environment and establish a strategy for opportunities which could create benefits in the process. Besides, Hansen and Lunnan (2009) reported that if the organization correctly analyzes the environment factor, it will make the firm successful (Sirmona and Trahms, 2011). Innovation capability involves technology and dimensions, both the ability in technology and behavioral intention aimed at changing organizations (Avlonitis, Kouremenos, & Tzokas, 1994). Beside, paying attention to innovation capabilities as a tendency for creating new products in business process to meet consumers' needs and to create the value which leads to competitive advantage.

However, the Thai Electronics industry is affected by the uncertainty and insecurity of law and politics; thus it makes foreign investors lack confidence in the Thai economic system. Besides, there are problems from the impact of the economic system both domestic and international for instance, the problem of low wage, high cost

of production and change technology. These factors are the key obstacles in innovation and technology for Thailand electronics. Comparing to the leading countries such as, USA, Japan, or the western countries, mostly there are external environment that support their organization to create new innovation and technology. Besides, they have the basic infrastructure for information technology and modern communication.

5.3.2 Discussion of Research Question 2

Research question 2: How can environmental factor and IT investment influence disruptive innovation management of Thailand electronics industry? The researcher conducted the survey within Thailand electronics industry; made use of the database of the department of business development, Thailand Ministry of Commerce. The importance given to the IT investment in Thailand electric and electronics industry consisted of innovation investment, infrastructure, management and automation support. The factor that gained top attention from the organization was the automation support while the least was on innovation investment. The hypothesis testing of H3 revealed that IT investment has positive effect on innovation capability. According to the study of IT investment by Brynjolfsson and Hitt (2000), IT investment is more than just the business or assets, it actually has the potential to push the organization toward change. It conforms to the research by Bagheri (2012) who studied the relationship between IT investments and found a direct and an indirect effect on firm performance through innovation and concluded that information technology is crucial in organizations' operational improvement. Therefore, it requires that the organization's information technology development and improvement always remain efficient. Also, IT investment will support the company's performance regarding effective and efficient financial operation through innovation at a significant level. Finally, the result conforms to the research by Porter (2001). The researcher concluded that IT investment makes the organization increase productivity, compete and earn profits. It also helps the company to operate business for mainly responding to customer satisfaction. Due to the effect of the variables, IT investment has an indirect effect on organizational performance via innovation capabilities. It reflects that, IT investment is the organizational investment mainly on information technology and communication supporting tools for developing innovation and technology ability in the manufacturing of product and service.

Moreover, to improve operational process for the effectiveness and efficiency of the organization it does not directly relate to the strategic management business competition but it directly affects innovation capabilities and indirectly affect organizational performance through innovation capability and disruptive management finally.

However, hypothesis testing of H2 and H9 were not supported. It indicated that they are not affected by IT investment for disruptive innovation management and organizational performance. Disruptive innovation results from the integration of related innovation and technology strategy and the ability to analyze the competitive environment and sustainability. Therefore, IT investment is the organization investment mainly in the information technology and communication supporting tools to develop innovation and technology ability. Moreover, to improve the operational process for the effectiveness and efficiency of the organization. This is not directly related to the strategic management of business competition, but it is a support tool for the organization's operation. It can be concluded that IT investment will directly affect innovation capabilities and indirectly effect organizational performance through disruptive innovation management.

5.3.3 Discussion of Research Question 3

The research question number 3: How can innovation capabilities and disruptive innovation management influence organizational performance of Thailand electronics industry. The answer to this question including hypothesis testing of H5, H6 and H7, which were all supported, indicated that the importance of development and improvement in innovation capabilities come with product capabilities, process capabilities and paying attention to development of product and service. This impacts disruptive innovation management; it can be categorized into new-market disruptive and low-end disruptive. Moreover, both innovation management and disruptive management affect organizational performance, including organizational productivity, organizational effectiveness, market share, and customer satisfaction.

This result concords with Peng and Nunes (2007) who state that innovation capabilities have direct influence on organizational performance. The development of products and services and the process of development leads to organizational performance. The reason is that the Thailand electronics industry pays attention to

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innovation capabilities development on the part related to product capability development rather than process capabilities development. Innovation capability development leads to a better organizational performance with productivity as well as more efficient and effective customer satisfaction. This conforms to the research by Porter (1980) that to form business competitive advantage, organizations shall have the ability to lead on cost of product and service lower than competitors and respond to needs of consumers.

The strategy for a new environment and a direction of organization better than competitors innovative strategy: this refers to the position of organizational competition in establishing a new attribute of a product and service that differs from the past by technology as a key element in all activities (Christensen and Wheelwright, 2009). Moreover, Porter (1980) stated that the goal of competitive strategy is to seek for the position in the industry that would enable the organization to integrate business management science. This would allow the organization's leaders to gain access to the competitive business environment that the organization will face, especially to position itself in competition. Although technology can partially support the potential of a product or service better than competitors, technology cannot be completely manipulated, because knowledge can flow to external ones, which can be copied, except the organization always continues to improve its capacity.

As a result, most industries can pay attention to the management of innovation and the development to suite target customers. In order to be a leader in the production of products and services, it is important to focus on products for customer groups that need high efficiency of products and services.

The idea of disruptive innovation pays attention to introducing the new functions of products and services into the market, paying close attention to switching products and services, managing approaches to form opportunities to become leaders of products and services. It would lead the organization to become the leader in business and network of worth value for investment and generate profits for the company (Christensen and George, 2002).

According to innovation capabilities and disruptive innovation, business competition in the 21st century is the new competitive landscape. It is the era to apply

information technology and communication in all activities. Those who are the leaders in information technology will be able to apply them to suite with changes in environment, both internally and externally to gain business competitive advantage.

5.4 Theoretical Contribution

There are the implications for theory in several ways. First and most importantly, the study provides further evidence that supports the disruptive innovation of the organization. According to the concept of strategic management of innovation and technology, the two innovation factors that influence organizational performance are management for business competitive advantage and superior financial performance. Technology has an increasing important role in innovation formation. It creates new results on economics, society, politics and the environment. It one of the ideas that leading organizations toward a competitive advantage (Mintzberg and Ahlstrand, 2009). Innovative organizations are always encouraged to try new things and usually become a success (Ireland and Hoskisson, 2006).

Therefore, to develop a theory that mentions competitive advantage and sustainability, the concept related to internal and external environment of the business toward a leader and sustainable analysis with the 5 force model consisting of Rival, Buyer, Suppliers, Substitute product and new entrants (Porter and Claas, 1995), and the concept of Barney which states that to form a competitive advantage, organizations shall have qualifications of value , rareness, non-substitutability (Barney et al., 2001). The most important part that will support or drive toward the successful organization is information technology. However, technology changes so quickly and results on shorter product life, therefore, the business strategy needs to understand more on technology and innovation. Organization should apply technology and build the business to have competitive advantage and sustainability. The former concept of competitive strategy stresses on cost competition because the life cycle of the product is shorter and technology quickly changes.

The hypothesis testing shows that the electronics industry in Thailand pays attention to high-efficiency product and service development for the sustainability to gain higher market share. Therefore, the important thing for the electronics industry in

Thailand is cost of raw materials and labor which lead to higher price of product. This is may be captured by the new competitor companies that try to create products and service at lower cost.

According to the concept of disruptive innovation theory, the market can be divided into two types. Low-end disruptive is the concept of presenting simpler and cheaper product with lower quality than competing product, then slightly developing it to be better and raise the price until the product reaches the large market. Another concept is new-market disruptive, which is to present new technology or better product than those in the market to respond to the need that has never been served by any competitor (Burgelman et al., 2009). Disruptive innovation is another concept that can answer the need of continual growth and is a successful factor that leads the organization toward a sustainable competitive advantage (Christensen et al., 2002).

Therefore, this research result shows the importance of technology and innovation that leads toward changes. It allows for the new market with a variety of needs. The organization should find a way to develop simpler products at cheaper price to response to the needs of customers. Disruptive Innovation concept pays attention to bringing new features of product and services to add value to them using, procedure and opportunity management approach to become the market leader. It will make the organization step up to be the leader in business and network to gain profits.

In relation to the disruptive innovation for Thailand's electronics industry, the organization can use both product innovation and process innovation for management. The organization shall be able to answer whether they aim to focus on innovative product or process. It can be said, both product and process can support and connect to each other. At the moment, the organizations use the tools of business management concept through competitor or customer analyses do not correspond to the goal to form continual growth for the business. Using the old academic principle in business administration may not be sufficient for the organization that seeks for business growth and ability in sustainable competitive advantage. Therefore, the factor that makes business organizations a success or failure can be explained from the concept of disruptive innovation of technology, which is the intervention of innovation.

Disruptive innovation is not only is the process that leads to business change but also growth for competitive advantage. Since a new technology leads to the fading of an old technology, it results in total change in customer behavior. The organization shall understand "disruptive innovation" concept and bring to use for organizational competitive strategy. Technology and innovation lead to change in new market with variety of needs. Every organization shall try to find a way to develop a simpler and cheaper product to satisfy customer needs.

Finally, innovation is the necessary creative thinking for the present since the continually high competitiveness on product and service on market is was driven by technology. However, the gap that leads to the competitive advantage on cost is narrow, thus the strategy is fading away and the industry cannot hold on the past success for future growth.

5.5. Implications for Practice

The findings of this study have some contribution to managerial practices. The 21st century is the era with high and advance technology that has results in a worldwide shift toward knowledge base and creative economics. Changed form of environment leads to high complication and uncertainty for organizations. Therefore, the variety of information technology operation in a market needs higher bargaining power such as work efficiency and prompt response to customers' demand and ability to adjust themselves faster into the fast changing and complicated competitive environment.

Research summary is divided into two levels.

5.5.1 The implications for organizational level

This research has explored the concept of people who work for Thailand's electronic industry by using PEST Analysis as a tool for analyzing the effect from environment. The effects can be divided into four aspects: competitive pressure, government regulation, technology support, and industry characteristics. The most influential factor is technology support. It indicates that technology has the highest impact on business operation, and this conforms to researchers in the past. Thus, the electronic industry in Thailand has to concentrate to technology development both in

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technology and information knowledge-based system. Especially, on new technology support such as Internet of things (IOT), cloud technology, mobile the Internet, advanced materials, etc. These are the key instruments that facilitate and form work in product and service, effective manufacturing process, and support in effective data analysis in response to consumers' demand.

According to the study result, environmental factor does not have an impact on innovation capabilities, but on disruptive innovation management. In addition, environmental factor has an indirect impact on the organizational performance through disruptive innovation management. In addition, the environmental factor has an indirect impact on the organizational performance through disruptive innovation management. This shows that all environmental factors have a significant effect on the success of organizational performance on the part of productivity, effectiveness, market share, and customer satisfaction. Moreover, IT Investment, paying attention to information technology investment can crucially support innovation capabilities development and have direct effect regarding of product capability and process capabilities and this also effects organizational performance as well.

Innovation technology are the main part of present and future business processes; therefore, this is the key tool of Thailand's electronics industry that can make organization have the operation performance higher than others. Organization need to become the leader and analyze the industry about the structure, and a performance results to understand what can support organizations to sustainable business and gain competitive advantage.

Every level of management has to pay attention to the dynamic and development in innovation and technology. Moreover, innovation is comparable to the main factor of organizational success as well as understanding the strategy for competitive advantage. Business competition nowadays is quite competitive and rapidly changes, thus management has to understand and acknowledge how to adjust themselves with the environment. They have to stress on creative innovation to adjust technology according to the new forms of world technology as well as integrate any sciences of strategic management and innovation technology for business sustainability.

5.5.2 The implications for national level

Even though information technology advancement results in overall advancement, the lack of information technology strategy and management has become a big problem for development and improvement. With it is the ability to compete at the national level, good governance and management of information technology is adequate and appropriate. Thailand's electronic is the industry that generates the main income at recent. The outcome is the strongest impact on Thailand especially on innovation and technology. However, the crisis of the current world economic recession is a challenge for participate in national policy establishment.

The Thai electrical and electronics industry association and Kasikorn Research Center report on the operation of Thailand electrical and electronics industry. The problems facing the industry include the impact from innovation and technology according to changes in the modern world's technology such as internet of thing(IOT), cloud technology, mobile internet, advanced materials etc.; This results in problems as follows: First, most of the manufacturing is moderate in volume or for end route. Second, the exporting structure still narrows on the equipment or parts of computer. Finally, the consumption behavior of the consumers has changed and lastly lack of skillful workforce in the production of high level electronics in Thailand. On the part of effects on economics, uncertainty of Thailand laws and politics, the world economic recession, thus some large electronic companies in Thailand have adjusted their main strategy by moving the production base into neighbor countries who have an economic stimulating plan to support for a better growth and certainty in the national economy and stable politics as well as the chance of stepping up as future leader in AEC.

Thus, Thailand 4.0 and the Startup Project is another hope that government is now pushing and supporting to become the solution to the problems facing the Thailand electronics industry. The government is planning to establish the guideline to drive technology. The electronics industry is still ranked between 1 – 5 of the target group of industries that the government gives importance and continues to support. The government is making policies to stimulate and form confidence in investors as well as improve information technology infrastructure to support an efficient and effective product and service of manufacturing. Technology well managed shows that

information technology is a source of treasure that generates income and wisdom. If Thailand can manage information technology at global level, it would create an enormous income that would lead to national modernizing and advancement. However, information technology usage should be managed to suit the conditions of economic and politics.

In conclusion, the result from this study confirms that the status of Thailand electronics industry is influenced by environmental impact from business competition to significance of information technology investment. The environmental impact has also an influence on the operational performance and organizational productivity, effectiveness, market share and customer satisfaction through innovation capabilities and disruptive innovation management. The significance of this research is to understand the external environmental impact and the importance of IT investment. This enhances technology strategic planning in conformity with the recent and future changes of Thailand electronics industry.

5.6 Limitation of the Study

It is necessary to address the limitation of this study to help advance future research.

The first limitation involves the items used for each observed variable, despite the thorough review of the relevant literature, there might be chances that the factors selected and used in the data collection were few (only 5 factors).

Secondly, innovation integration is a multidimensional construct, which could consist of various components. In this study the relationship among selected variables may have positive and negative impact on organizational performance through mediator management.

Finally, the IT manager and director as target respondent were expected to represent an informant from each corresponding firm. However, the use of one informant from each responding company may lead to bias; future researcher might need to consider an average score from more than one respondent in the same responding company in order to render a more accurate information and reduce biases.

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5.7 Suggestions for Future Research

This study was grounded on PEST analysis and disruptive innovation of the innovation theory. There are numerous channels that future research can pursue. The results of this study support the literature review that an organization's competitiveness and superior performance can be achieved through the implementation of their internal capabilities, especially through the integration of innovation capabilities and disruptive innovation management. It would be interesting for future researchers to explore further into the effect of the factors on organizational performance through innovation capabilities and disruptive innovation management. This might provide different perspective, as well as, a cross-functional integration effects, the collaboration of organization's unique capabilities and the impact on organizational performance. The Future research might as well, extend the study to the mediating effect and the influences of the other capabilities.

In innovation, integration is multidimensional, future research could examine other dimensions of innovation integration and their influence on organizational performance. This may yield better understanding of the relationship with other innovation integration and organizational performance. It is also suggested to consider other industries, which might have same nature and characteristics.

Moreover, the theoretical contribution of empirical study can also be done with a more focus and with and in-depth qualitative research, this would provide different perspective from a more quantitative-based research.

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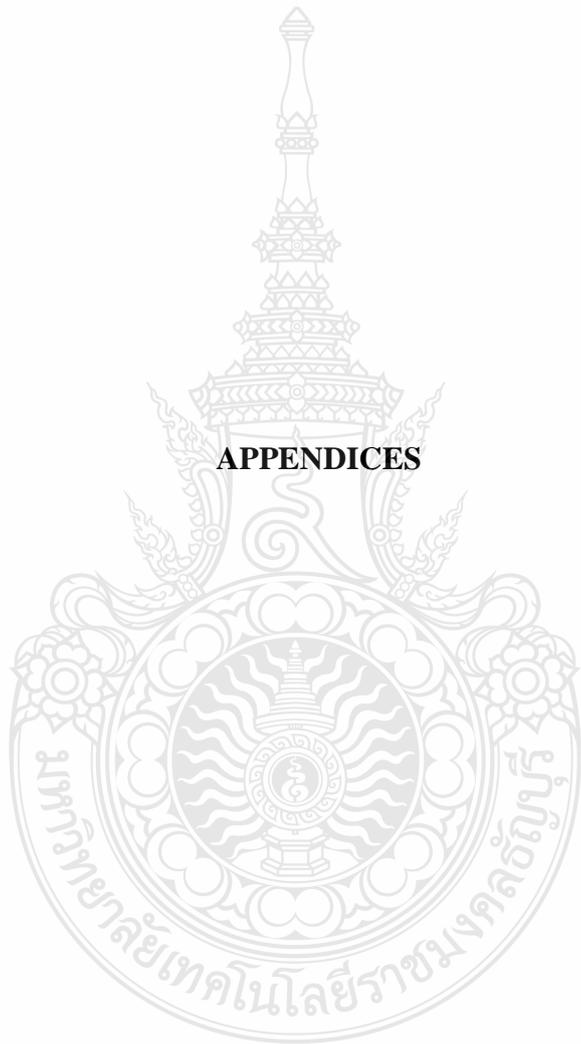
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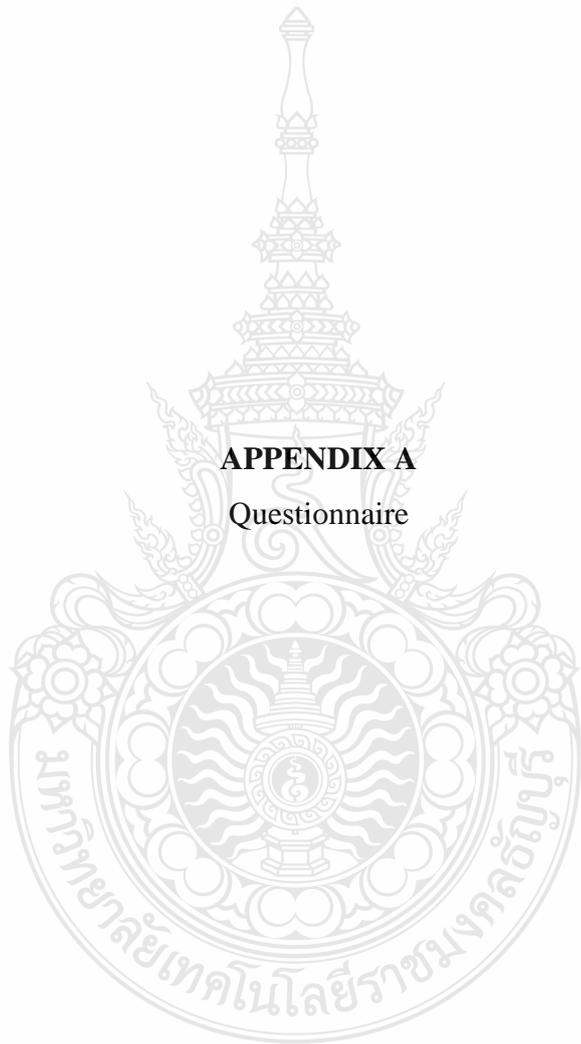
APPENDIX A

Questionnaire

Questionnaire survey on the opinion towards

Innovation capabilities, Disruptive innovation management and

Organization performance

Title: "The Effect of Environmental Factor and IT Investment on Organizational Performance through Innovation Capabilities and Disruptive Innovation Management in the Electronic Industry"

Direction: Please indicate your input in an appropriate box

Section 1: The importance of IT investment on the organization (IT Investment)

Please indicate your level of agreement with the following statements

1 = Strongly Disagree, 2 = Quite Disagree, 3 = Slightly Disagree, 4 = Neither Agree nor Disagree, 5 = Slightly Agree, 6 = Quite Agree, and 7 = Strongly Agree

The importance of IT investment on your organization with the following attributes:

Statement	Level of agreement						
	1	2	3	4	5	6	7
Innovation Investment							
1. Your company emphasizes on the importance of IT investment for Research and Development of innovation.	1	2	3	4	5	6	7
2. Your company emphasizes on the importance of IT investment for effective production process.	1	2	3	4	5	6	7
Infrastructure Investment							
3. Your company emphasizes on the importance of IT investment on infrastructure for effective operation.	1	2	3	4	5	6	7
4. Your company emphasizes on the importance of IT investment on infrastructure for data communication and security.	1	2	3	4	5	6	7
Management Investment							
5. Your company emphasizes on the importance of IT investment to support organizational management for business competition.	1	2	3	4	5	6	7

Statement	Level of agreement						
	1	2	3	4	5	6	7
6. Your company emphasizes on the importance of IT investment on management investment for CRM.	1	2	3	4	5	6	7
Automation Investment							
7. Your company emphasizes on the importance of IT investment to streamline the operation of the employee.	1	2	3	4	5	6	7
8. Your company emphasizes on the importance of IT investment to improve the efficiency for manufacturing process.	1	2	3	4	5	6	7

Section 2: The importance of Innovation Capabilities on the organization

Please indicate your level of agreement with the following statements

1 = Strongly Disagree, 2 = Quite Disagree, 3 = Slightly Disagree, 4 = Neither Agree nor Disagree, 5 = Slightly Agree, 6 = Quite Agree, and 7 = Strongly Agree

Importance of Innovation Capabilities on your organization with the following attributes:

Statement	Level of agreement						
	1	2	3	4	5	6	7
Product Capabilities							
9. Your company emphasizes on the encouragement to support product development.	1	2	3	4	5	6	7
10. Your company emphasizes on employees' capabilities development.	1	2	3	4	5	6	7
11. Your company has research and development unit for products and services.	1	2	3	4	5	6	7
Process Capabilities							
12. Your company emphasizes on operational process improvement.	1	2	3	4	5	6	7

Statement	Level of agreement						
	1	2	3	4	5	6	7
13. Your company emphasizes on manufacturing process time reduction.	1	2	3	4	5	6	7
14. Your company emphasizes on employees' involvement on manufacturing process	1	2	3	4	5	6	7

Section 3: Organizational Performance

Please indicate your level of agreement with the following statements

1 = Strongly Disagree, 2 = Quite Disagree, 3 = Slightly Disagree, 4 = Neither Agree nor Disagree, 5 = Slightly Agree, 6 = Quite Agree, and 7 = Strongly Agree

The Innovation Capability and Disruptive Innovation Management on Organizational Performance with the following attributes:

Statement	Level of agreement						
	1	2	3	4	5	6	7
Organizational Productivity							
15. Your company has achieved productivity according to planning and goal.	1	2	3	4	5	6	7
16. Your company has achieved productivity according to quality and efficiency aspect.	1	2	3	4	5	6	7
Organizational Effectiveness							
17. Your company has achieved set operational planning and goal.	1	2	3	4	5	6	7
18. Your company has the ability to adjust work process.	1	2	3	4	5	6	7
Market Share							
19. Your company has gained more market share over the past three years.	1	2	3	4	5	6	7
20. Your company has a better competitive position than those of your competitors in the same industry.	1	2	3	4	5	6	7

Statement	Level of agreement						
	1	2	3	4	5	6	7
Customer Satisfaction							
21. The customers are satisfied with your products and services	1	2	3	4	5	6	7
22. Your customer retention rate is better than those of you competitors in the same industry.	1	2	3	4	5	6	7

Section 4: The importance of Disruptive Innovation Management on the organization

Please indicate your level of agreement with the following statements

1 = Strongly Disagree, 2 = Quite Disagree, 3 = Slightly Disagree, 4 = Neither Agree nor Disagree, 5 = Slightly Agree, 6 = Quite Agree, and 7 = Strongly Agree
Importance of Disruptive Innovation Management on your organization with the following attributes:

Statement	Level of agreement						
	1	2	3	4	5	6	7
New-Market Disruptive Innovation							
23. Your company emphasizes on the importance of high performance new product development.	1	2	3	4	5	6	7
24. Your company has competitors analysis for product development.	1	2	3	4	5	6	7
25. Your company has comparative strategy with market leader for improvement of product quality.	1	2	3	4	5	6	7
26. Your company emphasizes on product manufacturing to become market leader.	1	2	3	4	5	6	7
Low-End Disruptive Innovation							
27. Your company emphasizes on the importance of the products to response for customer requirement.	1	2	3	4	5	6	7

Statement	Level of agreement						
	1	2	3	4	5	6	7
28. Your company emphasizes on the importance of the products with the focus on the basic technology requirement target group.	1	2	3	4	5	6	7
29. Your company emphasizes on product manufacturing with lower cost than competitive.	1	2	3	4	5	6	7
30. Your company emphasizes on products that easy for use.	1	2	3	4	5	6	7

Section 5: The impact of environmental factor on the organization (Environmental Factor)

Please indicate your level of agreement with the following statements

1 = Strongly Disagree, 2 = Quite Disagree, 3 = Slightly Disagree, 4 = Neither Agree nor Disagree, 5 = Slightly Agree, 6 = Quite Agree, and 7 = Strongly Agree

The impact of external environment on your organization with the following attributes:

Statement	Level of agreement						
	1	2	3	4	5	6	7
Competitive Pressure							
31. Your company has been impacted by business competitive pressure.	1	2	3	4	5	6	7
32. Your company has been impacted by cost of manufacturing and service.	1	2	3	4	5	6	7
Government Regulation							
33. Your company has been impacted by governmental policy, regulations and law.	1	2	3	4	5	6	7
34. Your company has been impacted by political violence and conflict.	1	2	3	4	5	6	7
Technology Support							
35. Your company has been impacted by technology rapid change.	1	2	3	4	5	6	7

Statement	Level of agreement						
	1	2	3	4	5	6	7
36. Your company has been impacted by outside information and communication technology infrastructure.	1	2	3	4	5	6	7
Industry Characteristics							
37. Your company has been impacted by competition of the similar products in the same industry.	1	2	3	4	5	6	7
38. Your company has been impacted by manufacturing supply chain practices.	1	2	3	4	5	6	7

Section 6: Demographic and background characteristics of the surveyed respondent

    39. Type of business registration

        ☐ Public Limited Company

        ☐ Limited Company

        ☐☐Partnership

        ☐☐Other/Please specify ……………………

    40. Nature of investment

        ☐☐ Thai Firms

        ☐☐ Joint Venture with Foreign/Please specifies the country………………….   ☐☐ Foreign Firms/Please specify the country……………………

    41. Type of manufacturing

        ☐☐ Manufactured products for internal use.

        ☐☐ Manufactured products as contract manufacturer.

        ☐☐ Manufactured products for both internal and contract manufacturers.

        ☐☐ Other/Please specify ……………………

    42. Number of employees

        ☐☐ Less than or 100 employees   ☐☐ 1-500 employees

        ☐☐ 501-1,000 employees   ☐☐ More than 1,000 employees

43 Size of registered capital (Baht)

     ☐Less than 10 million   ☐11 – 50 million

     ☐51-100 million   ☐More than 100 million

44. Number of years in operating

     ☐Less than 5 years   ☐5 – 10 years

     ☐11 – 15 years   ☐More than 15 years

-----Thank you for your kind participation-----
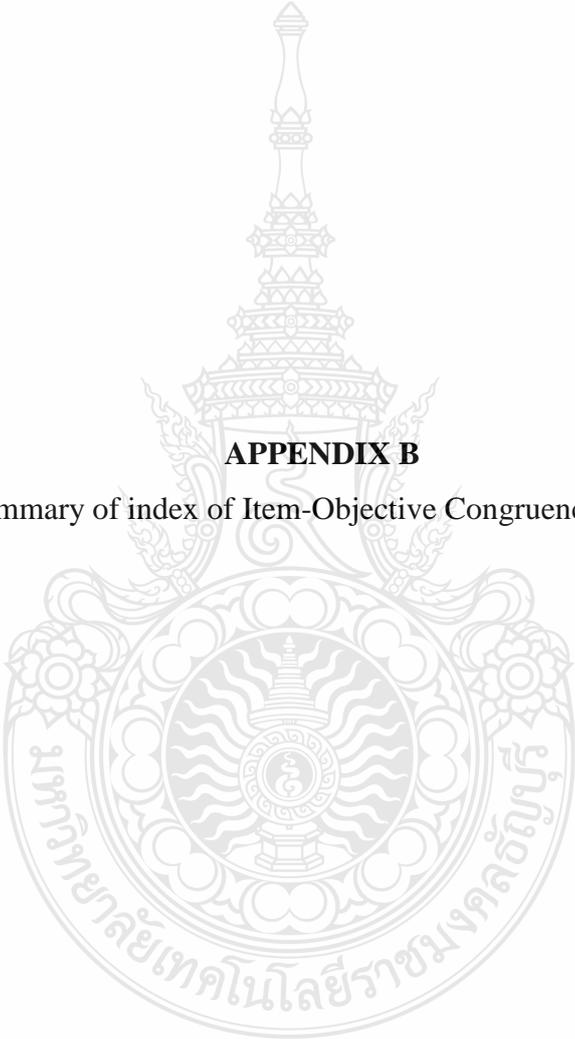
APPENDIX B

Summary of index of Item-Objective Congruence (IOC)

Index of Item-Objective Congruence (IOC)

P.1

Variable	Item	Subject-matter expert						Average	Total Average
		1	**2**	**3**	**4**	**5**	**6**		
Environmental Factor									
Competitive Pressure	COP1	+1	+1	+1	+1	+1	+1	1.00	0.84
	COP2	0	+1	+1	+1	+1	0	0.67	
Government Regulation	GOR1	+1	+1	+1	+1	+1	+1	1.00	0.75
	GOR2	+1	0	0	+1	+1	0	0.50	
Technology Support	TES1	+1	+1	+1	+1	+1	+1	1.00	1.00
	TES2	+1	+1	+1	+1	+1	+1	1.00	
Industry Characteristic	INC1	+1	0	+1	0	+1	+1	0.67	0.50
	INC2	0	+1	0	0	+1	0	0.33	
IT Investment									
Innovation Investment	INS1	+1	+1	+1	+1	+1	+1	1.00	1.00
	INS2	+1	+1	+1	+1	+1	+1	1.00	
Infrastructure	INF1	+1	+1	+1	+1	+1	+1	1.00	1.00
	INF2	+1	+1	+1	+1	+1	+1	1.00	
Management	MAS1	+1	+1	+1	+1	+1	+1	1.00	0.92
	MAS2	0	+1	+1	+1	+1	+1	0.83	
Automation	AUS1	+1	0	+1	+1	+1	+1	0.83	0.67
	AUS2	+1	0	+1	0	+1	0	0.50	
Innovation Capabilities									
Product Capabilities	PDC1	+1	+1	+1	+1	+1	+1	1.00	0.78
	PDC2	0	+1	+1	0	+1	+1	0.67	
	PDC3	+1	0	+1	0	+1	+1	0.67	
Process Capabilities	PCC1	+1	+1	+1	+1	+1	+1	1.00	0.89
	PCC2	+1	0	+1	+1	+1	+1	0.83	
	PCC3	+1	+1	0	+1	+1	+1	0.83	

Index of Item-Objective Congruence (IOC)
P.2

Variable	Item	Subject-matter expert						Average	Total
		1	**2**	**3**	**4**	**5**	**6**		**Average**
Disruptive Innovation									
New-Market	NED1	+1	+1	+1	+1	+1	+1	1.00	0.92
	NED2	+1	+1	+1	+1	+1	+1	1.00	
	NED3	+1	+1	+1	0	+1	+1	0.83	
	NED4	+1	+1	+1	+1	0	+1	0.83	
Low-end	LOD1	+1	+1	0	+1	+1	+1	0.83	0.79
	LOD2	+1	0	+1	0	+1	+1	0.67	
	LOD3	0	+1	+1	1+	+1	+1	0.83	
	LOD4	+1	+1	+1	0	+1	+1	0.83	
Organizational Performance									
Productivity	ORP1	+1	+1	+1	+1	+1	+1	1.00	0.92
	ORP2	+1	+1	+1	+1	0	+1	0.83	
Effectiveness	ORE1	+1	0	+1	0	+1	+1	0.66	0.83
	ORE2	+1	+1	+1	+1	+1	+1	1.00	
Market Share	MKS1	+1	+1	+1	+1	+1	0	0.83	0.83
	MKS2	+1	+1	+1	+1	0	+1	0.83	
Customer sat.	CUS1	+1	+1	0	+1	+1	0	0.67	0.59
	CUS2	+1	0	+1	0	+1	0	0.50	
Total IOC average score									**0.82**
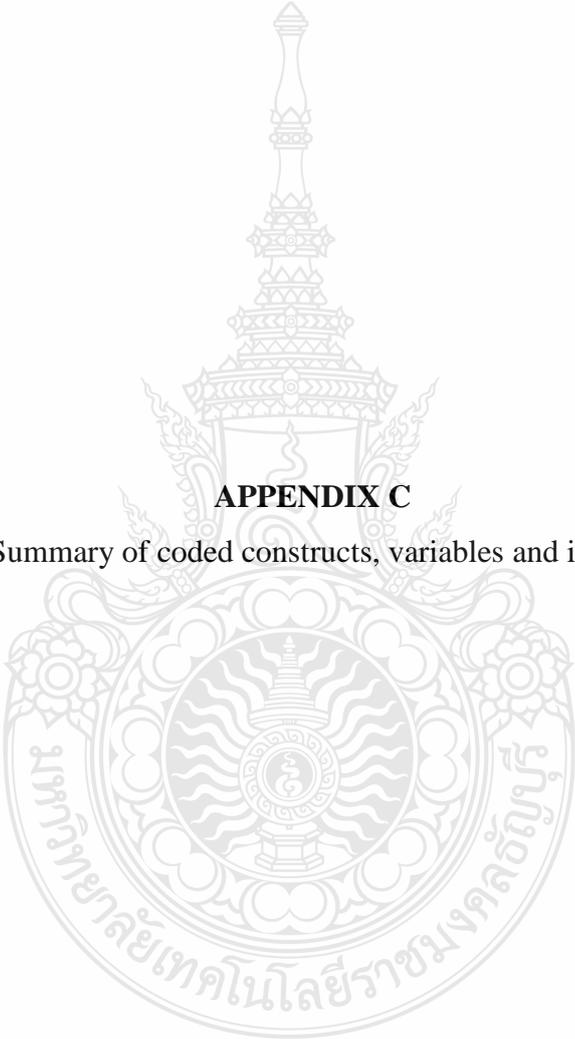
APPENDIX C

Summary of coded constructs, variables and items

Encoded constructs, variables and items

Abbreviations and symbols	Explanation
ENF	Environment Factor
ITI	Information Technology Investment
INC	Innovation Capabilities
DIM	Disruptive Innovation Management
ORP	Organization Performance
Environment Factor (ENF)	
COP	**Competitive Pressure**
COP1	Competitive Pressure Variable Number 1
COP2	Competitive Pressure Variable Number 2
COM Ave	Average all Competitive Pressure Variable
GOR	**Government Regulation**
GOR1	Government Regulation Variable Number 1
GOR2	Government Regulation Variable Number 2
GOR Ave	Average all Government Regulation Variable
TES	**Technology Support**
TES1	Technology Support Variable Number 1
TES2	Technology Support Variable Number 2
TES Ave	Average all Technology Support Variable
INC	**Industry Characteristics**
INC1	Industry Characteristics Variable Number 1
INC2	Industry Characteristics Variable Number 2
INC Ave	Average all Industry Characteristics Variable
Information Technology Investment (ITI)	
INS	**Innovation Support**
INS1	Innovation Support Variable Number 1
INS2	Innovation Support Variable Number 2
INS Ave	Average all Innovation Support Variable
INF	**Infrastructure**
INF1	Infrastructure Variable Number 1
INF2	Infrastructure Variable Number 2
INF Ave	Average all Infrastructure Variable
MAS	**Management Support**
MAS1	Management Support Variable Number 1
MAS2	Management Support Variable Number 2
MAS Ave	Average all Management Support Variable
AUS	**Automation Support**
AUS1	Automation Support Variable Number 1
AUS2	Automation Support Variable Number 2
AUS Ave	Average all Automation Support Variable

Abbreviations and symbols		Explanation
Innovation Capabilities (INC)		
PDC		**Product Innovation Capabilities**
	PDC1	Product Capabilities Variable Number 1
	PDC2	Product Capabilities Variable Number 2
	PDC3	Product Capabilities Variable Number 3
	PDC Ave	Average all Product Capabilities Variable
PCC		**Process Innovation Capabilities**
	PCC1	Process Capabilities Variable Number 1
	PCC2	Process Capabilities Variable Number 2
	PCC3	Process Capabilities Variable Number 3
	PCC Ave	Average all Process Innovation Variable
Disruptive Innovation Management (DIM)		
NED		**New-Market Disruptive**
	NED1	New-Market Disruptive Variable Number 1
	NED2	New-Market Disruptive Variable Number 2
	NED3	New-Market Disruptive Variable Number 3
	NED4	New-Market Disruptive Variable Number 4
	NED Ave	Average all New-Market Disruptive Variable
LOD		**Low-End Disruptive**
	LOD 1	Low-End Disruptive Variable Number 1
	LOD 2	Low-End Disruptive Variable Number 2
	LOD 3	Low-End Disruptive Variable Number 3
	LOD 4	Low-End Disruptive Variable Number 4
	LOD Ave	Average all Low-End Disruptive Variable
Organizational Performance (ORP)		
ORP		**Organizational Productivity**
	ORP1	Organizational Productivity Number 1
	ORP2	Organizational Productivity Number 2
	ORP Ave	Average all Organizational Productivity Variable
ORF		**Organizational Effectiveness**
	ORF1	Organizational Effectiveness Number 1
	ORF2	Organizational Effectiveness Number 2
	ORF Ave	Average all Organizational Effectiveness Variable
MAS		**Market Share**
	MAS1	Market Share 1
	MAS2	Market Share 2
	MAS Ave	Average all Market Share Variable
CUS		**Customer Satisfaction**
	CUS1	Customer Satisfaction 1
	CUS2	Customer Satisfaction 2

Abbreviations and symbols	Explanation
CUS Ave	Average all Customer Satisfaction Variable
%	Percentage
MIN	Minimum
MAX	Maximum
M	Mean
SD	Standard Deviation
VIF	Variance inflation factor
CFA	Confirm factor analysis
AVE	Average variance extracted
CR	Composite reliability
t	Criteria Ratio
R^2	R- Square
CMIN	Chi-Square
df	Degree of freedom
CMIN/df	Chi-Square / Degree of freedom
p-value	Probability value
GFI	Goodness of fit index
AGFI	Adjusted goodness of fit index
RMR	Root mean square residual
RMSEA	Root mean square error of approximation
NFI	Normed fit index
CFI	Comparative fit index
Holelter	Critical N for a significance level of .05 or .01
β	Beta
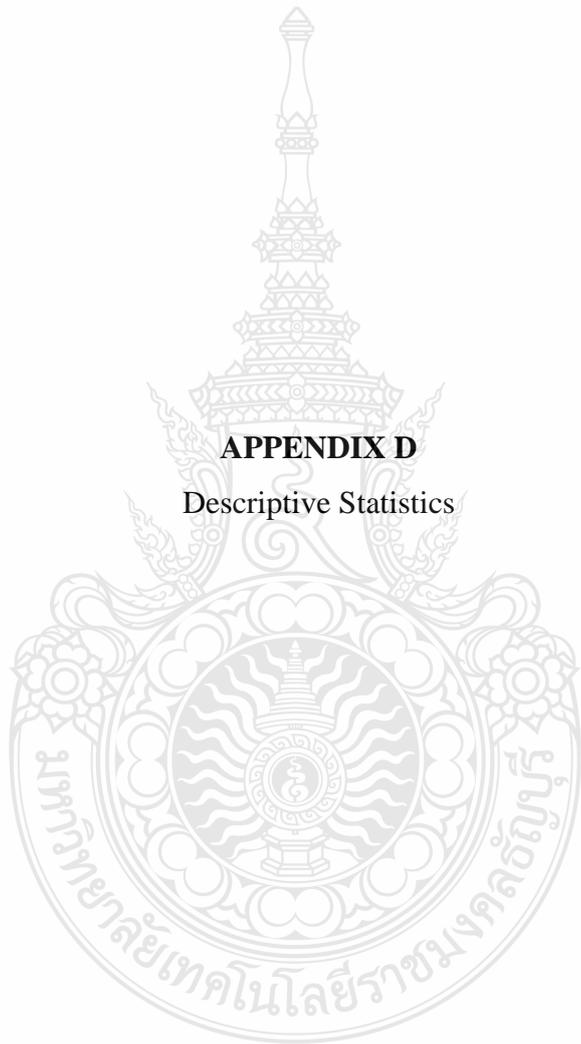
APPENDIX D

Descriptive Statistics

Table of descriptive statistics

| | N | Minimum | Maximum | Sum | Mean | | Std. Deviation | Skewness | | Kurtosis | |
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Std. Error	Statistic	Std. Error
COP1	255	1.00	7.00	1263.00	4.9529	.08441	1.34784	-.342	.153	-.387	.304
COP2	255	1.00	7.00	1278.00	5.0118	.07848	1.25329	-.518	.153	-.031	.304
GOR1	255	1.00	7.00	1171.00	4.5922	.08313	1.32746	-.307	.153	.102	.304
GOR2	255	1.00	7.00	1118.00	4.3843	.08467	1.35207	-.186	.153	-.026	.304
TES1	255	1.00	7.00	1152.00	4.5176	.07934	1.26689	-.145	.153	-.156	.304
TES2	255	1.00	7.00	1134.00	4.4471	.08120	1.29663	-.112	.153	-.272	.304
INC1	255	1.00	7.00	1133.00	4.4431	.07568	1.20844	-.149	.153	.313	.304
INC2	255	1.00	7.00	1111.00	4.3569	.07419	1.18475	-.235	.153	.428	.304
INS1	255	1.00	7.00	1098.00	4.3059	.09349	1.49295	.037	.153	-.647	.304
INS2	255	1.00	7.00	1193.00	4.6784	.08730	1.39407	-.254	.153	-.333	.304
INF1	255	1.00	7.00	1202.00	4.7137	.08168	1.30430	-.325	.153	-.269	.304
INF2	255	1.00	7.00	1254.00	4.9176	.08141	1.30002	-.290	.153	-.241	.304
MAS1	255	1.00	7.00	1214.00	4.7608	.08037	1.28346	-.209	.153	-.466	.304
MAS2	255	1.00	7.00	1215.00	4.7647	.08463	1.35141	-.279	.153	-.377	.304
AUS1	255	1.00	7.00	1269.00	4.9765	.08166	1.30393	-.482	.153	-.178	.304
AUS2	255	1.00	7.00	1287.00	5.0471	.08199	1.30932	-.374	.153	-.366	.304
PDC1	255	1.00	7.00	1253.00	4.9137	.07957	1.27066	-.301	.153	-.320	.304
PDC2	255	1.00	7.00	1254.00	4.9176	.08421	1.34468	-.485	.153	.185	.304
PDC3	255	1.00	7.00	1200.00	4.7059	.09037	1.44307	-.290	.153	-.310	.304
PCC1	255	2.00	7.00	1277.00	5.0078	.07455	1.19049	-.199	.153	-.406	.304
PCC2	255	1.00	7.00	1266.00	4.9647	.08434	1.34674	-.520	.153	.205	.304
PCC3	255	1.00	7.00	1275.00	5.0000	.08223	1.31317	-.379	.153	-.132	.304

	N	Minimum	Maximum	Sum	Mean		Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Std. Error	Statistic	Std. Error
NED1	255	1.00	7.00	1285.00	5.0392	.07991	1.27608	-.486	.153	.203	.304
NED2	255	1.00	7.00	1231.00	4.8275	.07542	1.20434	-.277	.153	-.005	.304
NED3	255	1.00	7.00	1240.00	4.8627	.07478	1.19414	-.306	.153	.061	.304
NED4	255	1.00	7.00	1290.00	5.0588	.07938	1.26758	-.684	.153	.473	.304
LOD1	255	2.00	7.00	1343.00	5.2667	.07158	1.14305	-.362	.153	-.248	.304
LOD2	255	1.00	7.00	1299.00	5.0941	.07473	1.19339	-.505	.153	.268	.304
LOD3	255	1.00	7.00	1280.00	5.0196	.07984	1.27499	-.485	.153	.241	.304
LOD4	255	1.00	7.00	1269.00	4.9765	.07286	1.16352	-.332	.153	.040	.304
ORP1	255	1.00	7.00	1308.00	5.1294	.07253	1.15821	-.531	.153	.482	.304
ORP2	255	2.00	7.00	1345.00	5.2745	.07401	1.18186	-.561	.153	.139	.304
ORE1	255	2.00	7.00	1321.00	5.1804	.07091	1.13238	-.672	.153	.444	.304
ORE2	255	2.00	7.00	1317.00	5.1647	.06886	1.09954	-.438	.153	.011	.304
MKS1	255	1.00	7.00	1176.00	4.6118	.07101	1.13388	.006	.153	.143	.304
MKS2	255	1.00	7.00	1168.00	4.5804	.07204	1.15032	-.112	.153	.348	.304
CUS1	255	2.00	7.00	1273.00	4.9922	.06851	1.09398	-.475	.153	.204	.304
CUS2	255	2.00	7.00	1303.00	5.1098	.07340	1.17206	-.378	.153	-.220	.304
Valid N (listwise)	255										

Table of descriptive statistics (Average)

Descriptive Statistics

	N	Minimum	Maximum	Sum	Mean		Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Std. Error	Statistic	Std. Error
COPAv	255	1.00	7.00	1270.50	4.9824	.07707	1.23063	-.489	.153	-.047	.304
GORAv	255	1.00	7.00	1144.50	4.4882	.07946	1.26890	-.255	.153	.102	.304
TESAv	255	1.00	7.00	1143.00	4.4824	.07707	1.23063	-.138	.153	-.203	.304
INCAv	255	1.00	7.00	1122.00	4.4000	.06937	1.10777	-.102	.153	.173	.304
INSAv	255	1.00	7.00	1145.50	4.4922	.08400	1.34132	-.092	.153	-.411	.304
INFAv	255	1.00	7.00	1228.00	4.8157	.07607	1.21480	-.354	.153	-.059	.304
MASAv	255	1.00	7.00	1214.50	4.7627	.07648	1.22136	-.180	.153	-.388	.304
AUSAv	255	1.50	7.00	1278.00	5.0118	.07704	1.23030	-.400	.153	-.272	.304
PDCAv	255	1.33	7.00	1235.67	4.8458	.07364	1.17598	-.296	.153	-.229	.304
PCCAv	255	2.00	7.00	1272.67	4.9908	.07194	1.14878	-.199	.153	-.483	.304
NEDAv	255	1.25	7.00	1261.50	4.9471	.06819	1.08888	-.420	.153	.232	.304
LODAv	255	2.00	7.00	1297.75	5.0892	.06398	1.02173	-.307	.153	-.163	.304
ORPAv	255	1.50	7.00	1326.50	5.2020	.06838	1.09193	-.590	.153	.502	.304
OREAv	255	2.00	7.00	1319.00	5.1725	.06638	1.06002	-.622	.153	.260	.304
MKSAv	255	1.00	7.00	1172.00	4.5961	.06497	1.03748	-.067	.153	.251	.304
CUSAv	255	2.00	7.00	1288.00	5.0510	.06585	1.05150	-.456	.153	-.010	.304
Valid N (listwise)	255										
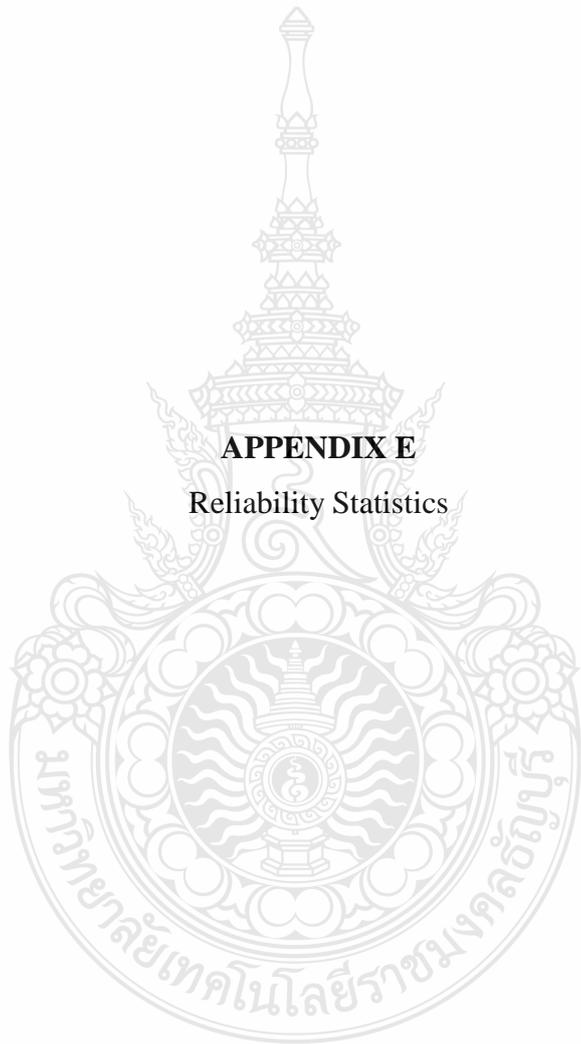
APPENDIX E

Reliability Statistics

Reliability
Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	255	100.0
	Excluded[a]	0	.0
	Total	255	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.956	.957	38

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	4.857	4.306	5.275	.969	1.225	.069	38

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
INS1	180.2627	822.675	.584	.661	.955
INS2	179.8902	827.130	.572	.721	.955
INF1	179.8549	823.652	.662	.776	.955
INF2	179.6510	826.252	.629	.688	.955
MAS1	179.8078	821.904	.698	.760	.954
MAS2	179.8039	822.213	.657	.671	.955
AUS1	179.5922	825.046	.643	.746	.955
AUS2	179.5216	823.896	.656	.728	.955
PDC1	179.6549	821.817	.707	.740	.954
PDC2	179.6510	820.456	.684	.728	.955
PDC3	179.8627	820.639	.631	.645	.955
PCC1	179.5608	829.539	.641	.724	.955
PCC2	179.6039	823.846	.637	.675	.955
PCC3	179.5686	821.120	.692	.751	.954
ORP1	179.4392	829.901	.655	.703	.955
ORP2	179.2941	826.374	.694	.733	.955
ORE1	179.3882	828.160	.698	.772	.955
ORE2	179.4039	830.809	.677	.737	.955
MKS1	179.9569	838.632	.533	.568	.955
MKS2	179.9882	835.539	.572	.631	.955
CUS1	179.5765	836.379	.590	.669	.955
CUS2	179.4588	831.698	.619	.707	.955
NED1	179.5294	822.841	.689	.715	.955
NED2	179.7412	826.476	.679	.718	.955
NED3	179.7059	824.177	.719	.765	.954
NED4	179.5098	818.668	.753	.777	.954
LOD1	179.3020	828.975	.678	.726	.955
LOD2	179.4745	832.290	.598	.620	.955
LOD3	179.5490	823.973	.674	.652	.955
LOD4	179.5922	830.494	.642	.699	.955
COP1	179.6157	841.836	.400	.726	.956
COP2	179.5569	842.208	.428	.719	.956
GOR1	179.9765	846.409	.346	.721	.957
GOR2	180.1843	851.954	.268	.742	.957
TES1	180.0510	846.466	.364	.809	.957
TES2	180.1216	845.572	.367	.806	.957
INC1	180.1255	845.016	.405	.688	.956
INC2	180.2118	842.483	.451	.627	.956
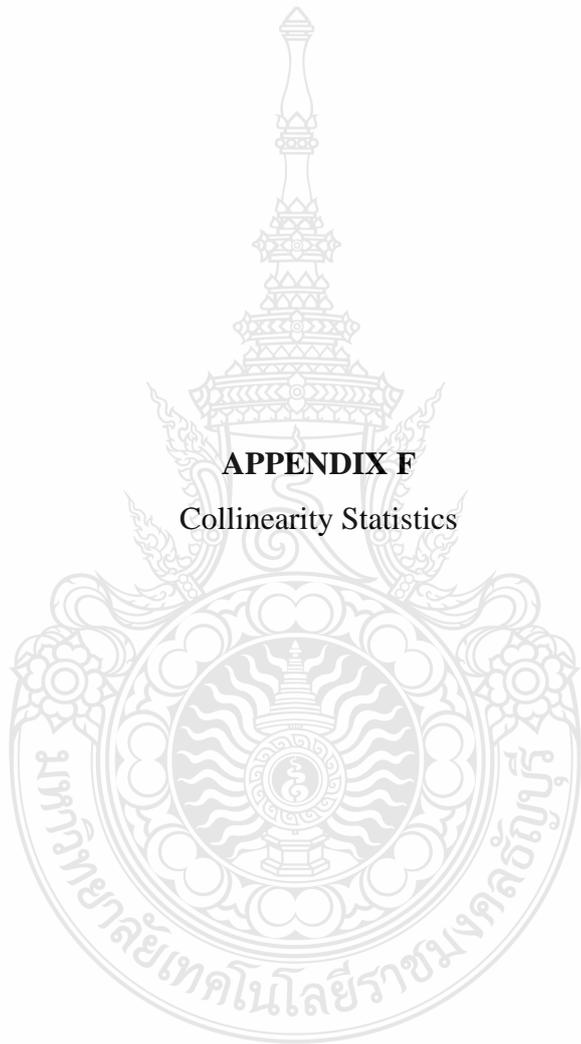
APPENDIX F

Collinearity Statistics

Descriptive Statistics

	Mean	Std. Deviation	N
COPAv	4.9824	1.23063	255
GORAv	4.4882	1.26890	255
TESAv	4.4824	1.23063	255
INCAv	4.4000	1.10777	255
INSAv	4.4922	1.34132	255
INFAv	4.8157	1.21480	255
MASAv	4.7627	1.22136	255
AUSAv	5.0118	1.23030	255
PDCAv	4.8458	1.17598	255
PCCAv	4.9908	1.14878	255
NEDAv	4.9471	1.08888	255
LODAv	5.0892	1.02173	255
ORPAv	5.2020	1.09193	255
OREAv	5.1725	1.06002	255
MKSAv	4.5961	1.03748	255
CUSAv	5.0510	1.05150	255

	Coefficients[a]						
Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**	**Collinearity Statistics**	
	B	**Std. Error**	**Beta**			**Tolerance**	**VIF**
(Constant)	.661	.361		1.829	.069		
GORAv	.210	.056	.217	3.747	.000	.557	1.794
TESAv	.280	.062	.280	4.496	.000	.481	2.078
INCAv	.269	.063	.242	4.275	.000	.581	1.721
INSAv	-.255	.062	-.277	-4.099	.000	.407	2.455
INFAv	.146	.081	.144	1.805	.072	.295	3.393
MASAv	.080	.076	.079	1.055	.292	.332	3.012
AUSAv	.070	.074	.070	.954	.341	.343	2.916
1 PDCAv	-.184	.087	-.176	-2.113	.036	.269	3.722
PCCAv	.036	.088	.033	.404	.687	.277	3.609
NEDAv	.224	.092	.198	2.446	.015	.284	3.525
LODAv	.035	.089	.029	.386	.700	.339	2.949
ORPAv	.095	.092	.084	1.035	.302	.280	3.568
OREAv	.051	.094	.044	.542	.588	.286	3.497
MKSAv	.043	.069	.036	.623	.534	.552	1.811
CUSAv	-.173	.083	-.148	-2.084	.038	.369	2.711

a. Dependent Variable: COPAv

Biography

Name-Surname   Mr. Wirat Butwapee

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Declaration

This work contains no material which has been accepted for the award of any other or diploma in any university or other tertiary institution and, to the best of my knowledge and beliefs, contains on material previously published or written by another person, except where due reference has been made in the text.

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