Entrepreneurial Orientation, Knowledge Absorptive Capacity and Firm Performance: An Empirical Study from the Medical Device Industry in Thailand

Chanarus Wongcharee

A Thesis Submitted in Partial Fulfillment of Requirements for
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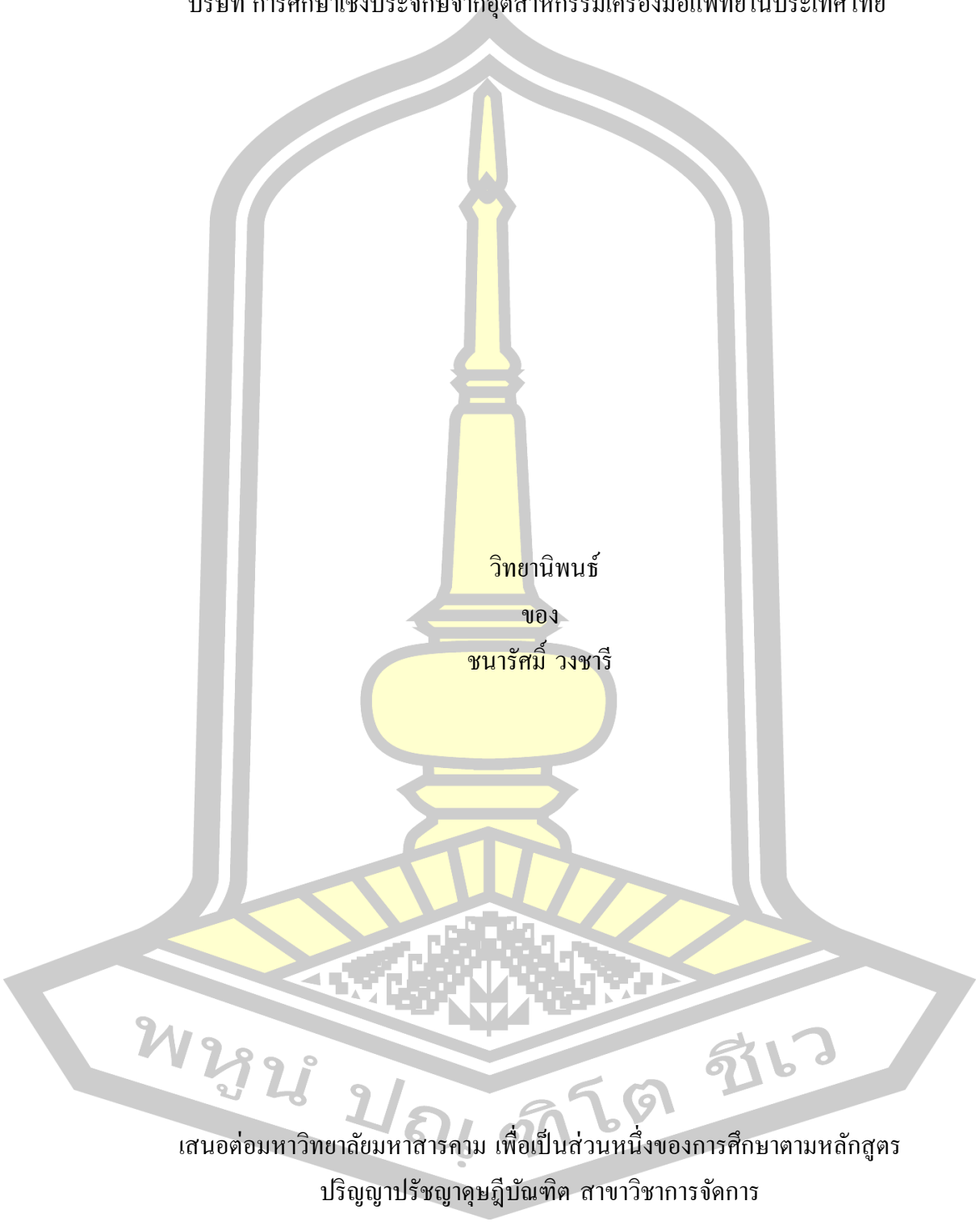

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The examining committee has unanimously approved this Thesis, submitted by Mrs. Chanarus Wongcharee , as a partial fulfillment of the requirements for the Doctor of Philosophy Management at Mahasarakham University

Examining Committee

.....Chairman
(Assoc. Prof. Chonlatis Darawong , Ph.D.)

.....Advisor
(Asst. Prof. Sujinda Popaitoon , Ph.D.)

.....Co-advisor
(Pakorn Sujchaphong , Ph.D.)

.....Committee
(Asst. Prof. Pornlapas Suwannarat , Ph.D.)

.....Committee
(Assoc. Prof. Karun Pratoom , Ph.D.)

Mahasarakham University has granted approval to accept this Thesis as a partial fulfillment of the requirements for the Doctor of Philosophy Management

.....
(Asst. Prof. Nitiphong Songsrirote , Ph.D.)
Dean of Mahasarakham Business School

.....
(Assoc. Prof. Krit Chaimoon , Ph.D.)
Dean of Graduate School

TITLE Entrepreneurial Orientation, Knowledge Absorptive Capacity and Firm Performance: An Empirical Study from the Medical Device Industry in Thailand

AUTHOR Chanarus Wongcharee

ADVISORS Assistant Professor Sujinda Popaitoon , Ph.D.
Pakorn Sujchaphong , Ph.D.

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ABSTRACT

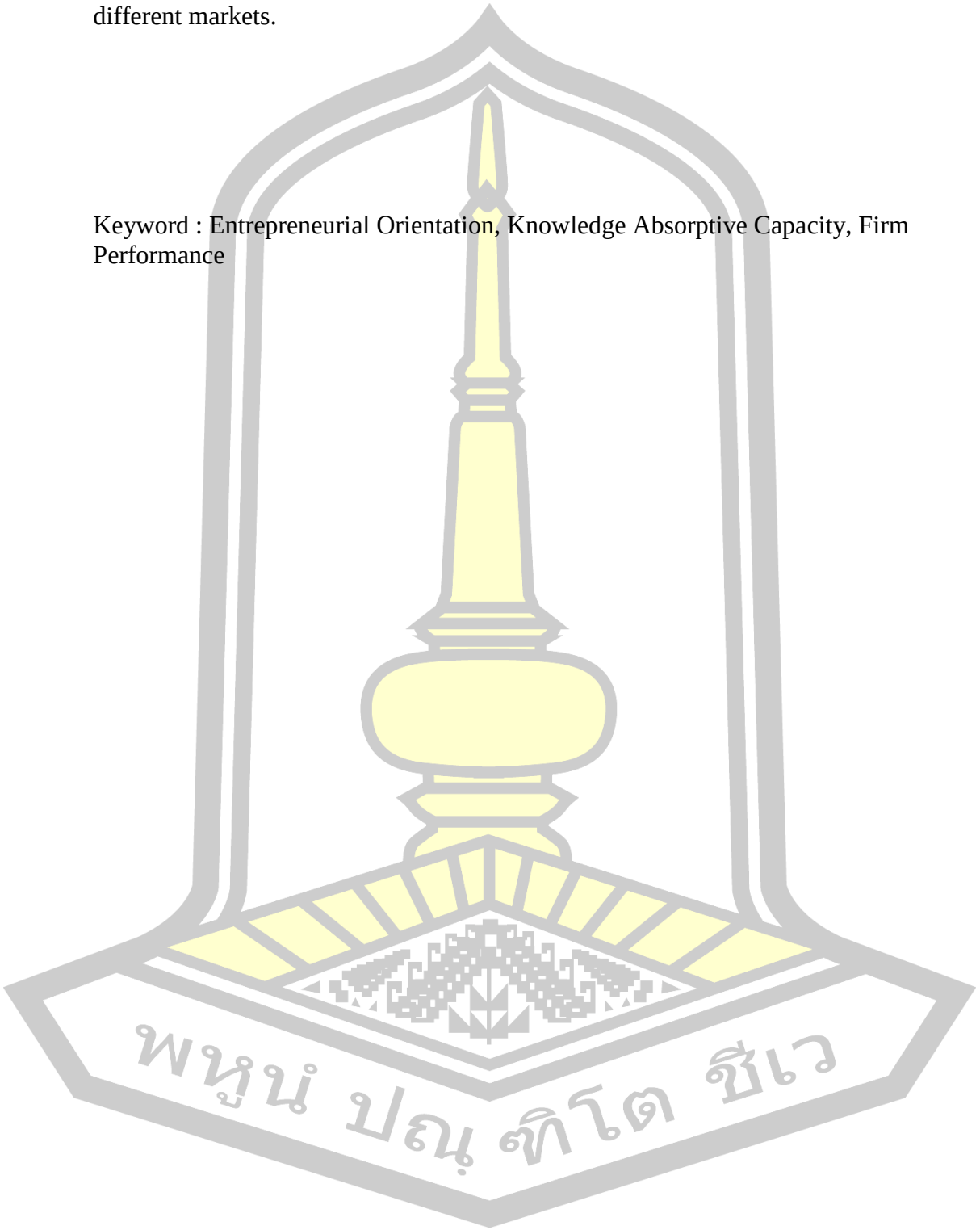
This research responds to calls for research exploring the relationships among entrepreneurial orientation (EO), knowledge absorptive capacity (ACAP) and firm performance particularly in the unexplored context of medical device industry. This research aims to answer research questions; *how and why* do key characteristics of EO contribute to firm performance in the medical device industry? *What* does the extent of the characteristics of EO influence firm performance; particularly, when investigated their knowledge ACAP as a moderating role. This research conducts mixed methods to answer these specific questions.

Based on case study research from five selected medical device companies, the crucial characteristics of EO are *proactiveness* and *competitive aggressiveness* that affect firm performance. In addition, for the survey data based on 74 medical device firms, the results indicate that the proactiveness of EO has a significant positive effect on firm performance while the EO competitive aggressiveness was no significance. Moreover, knowledge ACAP, as a moderator, plays a significantly negative effect on the relationship between the EO proactiveness and firm performance. To explain these phenomenon based on mixed methods, the findings show: (1) EO proactively find a new market through exporting in order to gain new sale by increasing the exploitation rate of firm's existing resources and avoiding making price war in the current market that can be destroyed their profitability in the near future, and (2) the characteristic of EO competitive aggressiveness totally differs from other hi-tech industries (e.g., slow rate of obsolescence products and incrementally changes of new product development).

This research contributes to the literature of EO and Knowledge ACAP particularly in the context of the medical device industry. This research points out the different roles of EO proactiveness and competitive aggressiveness on firm performance; when knowledge ACAP plays a moderator role. For managerial implication, entrepreneurs and managers in the medical device industry can boost their firm performance by developing their proactive skills such as participating in medical seminars domestically and internationally and exporting their products

overseas. In addition, medical device firms should better exploit external knowledge (e.g., R&D in overseas) to expand their potential sales and return on investments in different markets.

Keyword : Entrepreneurial Orientation, Knowledge Absorptive Capacity, Firm Performance



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Chanarus Wongcharee

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CHAPTER I

INTRODUCTION

1.1 Background and Rationale of the Study

Firm involvement in entrepreneurial activity represents one of the significant engines that enhance economic development (Lumpkin and Dess, 1996b). The Thai government encourages entrepreneurs in the medical device industry because the industry becomes the potential industry to grow the country's economy (National Science and Technology Development Agency (NSTDA), 2017). Therefore, Thailand aims to encourage medical device manufacturing firm performance by promoting the production capacity of medical devices themselves rather than importing from abroad. (Covin and Slevin, 1989a; Simsek, Ciaran, Veiga, and Souder, 2009) asserted that entrepreneurial orientation (EO) captures a firm's entrepreneurial activities, decision-making posture, strategic decisions, and managerial philosophies. Moreover, EO is a valuable characteristic to leave behind competitors and improve firm performance (Covin and Slevin, 1989a). As a result, EO is adopted as a useful construct to understand a firm's capability to maintain performance while the other fails (Covin and Lumpkin, 2011). For example, conservative firms tend to commit to the exploitation of existing opportunities (Covin, Green, and Slevin, 2006). In contrast, entrepreneurial firms emphasize exploratory behavior; they have reconfiguring capabilities that lead them into new areas of expertise (Jantunen, Puumalainen, Saarenketo, and Kyläheiko 2005), with higher learning efforts (Clercq, Sapienza, and

Crijns, 2005) that have a positively significant effect on performance (Dess and Lumpkin, 2005). However, even though some firms largely engage in EO, only a small number can achieve success (Dess and Lumpkin, 2005). Hence, EO scholars demonstrate how and why EO facilitates the outcome of firm performance (Lumpkin and Dess, 1996a; Lumpkin and Dess, 2001). as well as how the dimensions of EO influence performance independently (Casillas, Moreno, & Barbero, 2011).

In addition, medical device entrepreneurs face important issues concerning performance, including bringing production capacity to the commercial sectors (NSTDA, 2017). Commercial ends are critical for the production of medical devices. An excellent production process is meaningless if products are unable to commercially succeed in the market (Lane and Lubatkin, 1998). So the ability to utilize commercials ends reflects a successful firm's performance outcomes (Stock, Greis, and Fischer, 2001). Chatterji, Fabrizio, Mitchell, and Schulman (2008) suggested that the key challenges to developing new medical devices are acquiring new ideas, expecting market demand, product development projects, gaining regulatory approval, and encouraging the adoption of new technologies and new generations of existing technologies. Moreover, a firm must satisfy the need of users (physicians). As a result, medical device manufacturers must be confident that their devices will serve a real need in the market (Ackerly, Valverde, Diener, Dossary, and Schulman, 2009). Knowledge absorptive capacity (knowledge ACAP) refers to the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends (Cohen and Levinthal, 1990). Hence, knowledge ACAP improves the internal learning system, increases innovation capacity (Patel,

Kohtamäki, Parida, and Wincent, 2015; (Tsai, Academy, & Journal, 2001) and facilitate social process (Wiklund, 1999; Wiklund and Shepherd, 2003).

Taken together, prior studies showed that increasing EO efficiency is largely a function of knowledge ACAP. Wiklund (1999) asserted that EO can be described as a resource-intense strategic behavior. As a result, scholars have asserted that knowledge ACAP affects to EO. For example, Fang, Yuli, and Hongzhi (2008) asserted that firms' capability in identifying and using external opportunities show significant differences in EO. Cepeda-Carrion, Cegarra-Navarro, and Jimenez-Jimenez (2012) showed that ACAP is an imperative determinant for developing innovativeness. Hence, both EO and knowledge ACAP are significant to firm performance. Yet it has been largely unclear how and why do EO and knowledge ACAP affect firm performance. Moreover, how can ACAP stimulate EO for better performance? (Sciascia, D'Oria, Bruni, and Larrañeta, 2014; Wales, Parida, and Patel, 2013). Moreover, how can ACAP stimulate the EO to create a better firm performance?

In addition, several studies in various settings found the importance of EO and knowledge ACAP to firm performance (Wang, 2008; Wales et al., 2013; Engelen, Kube, Schmidt, and Flatten, 2014; Engelen, Gupta, Strenger, and Brettel, 2015; Hernández-Perlines and Xu, 2018). Scholars such as Sciascia et al. (2014) and Hernandez-Perlines, (2018) found that knowledge ACAP positively supports the EO–performance relationship but in different contexts. Wales et al. (2013) studied 285 technology-based small and medium enterprises, while Hernández-Perlines and Xu (2018) studied 218 family firms. Sciascia et al. (2014) studied low- and medium-tech industries and found that lower levels of ACAP affect higher firm performance. Based

on these results, it could be concluded that context might provide inconsistent findings among studies. Firms' capability to manage uncertain situations by engaging in new knowledge is a major challenge to how well firms implement entrepreneurial activities (Lumpkin and Dess, 1996a). Hence, ACAP is a set of a firm's strategic postures which represent a set of resources and capabilities that facilitate firm performance (Wales et al., 2013). In summary, as literature on EO and knowledge ACAP in the medical device industry is still rudimentary, this research aims to understand the multidimensional characteristics of EO, the importance of knowledge ACAP within the medical device industry, and how EO and knowledge ACAP can be complementary within the medical device industry.

1.2 Problem Statement

As discussed in the previous section, this study describes phenomena from the lens of firm performance, EO, and firm's knowledge ACAP in the medical device industry.

First, entrepreneurship scholars have developed alternative perspectives to describe entrepreneurship. EO characteristics have been debated among EO scholars. EO research has adopted two principal approaches corresponding to unidimensional and multidimensional conceptualizations (Covin and Lumpkin, 2011). The unidimensional approach is based on Miller (1983) and Covin and Slevin, (1989a) research. They posited that entrepreneurship is represented by proactive manners, risk-taking, and innovativeness, and its dimensions are co-varying. They highlighted the covariance among the dimensions of EO that represent firm-level entrepreneurial processes (Stetz, Howell, Stewart, Blair, and Fottler, 2000; Stetz et al., 2000).

Regarding the multidimensional approach, Lumpkin and Dess (1996a) postulated that EO is represented by five characteristics: proactiveness, competitive aggressiveness, risk-taking, innovativeness, and autonomy. Some scholars suggest that EO dimensions are dependent on each other (e.g., Covin and Slevin, 1989a). Moreover, multidimensional constructs could be conceptualized in two forms: aggregate and superordinate (Edwards, 2001).

Each firm can be represents by one or more dimension of EO. Thus, the difference among firms in terms of internal resources and external environment affect the variation of the set of entrepreneurial processes among firms (Engelen et al., 2014a). Hence, entrepreneurial firms might focus on particular dimensions of EO (Lumpkin & Dess, 1996a). In other words, the specific entrepreneurial actions of each firm vary depending on their firm's EO characteristics, such as external knowledge acquisition behavior and utilization of knowledge. Hence, the variation on firms' entrepreneurial characteristics makes comparisons among entrepreneurship levels across firms difficult (Rauch, Wiklund, Lumpkin, & Frese, 2009). As the medical device industry is an unexplored context, this research aims to investigate how and why key characteristics of EO contribute to firm performance within the medical device industry.

Second, for medical device firms, varying types of knowledge force medical firms to rely on their prior knowledge and path dependence because of the variety of knowledge those firms have to capture, including those from scientists, engineers, physicians, and patients. This knowledge allows technologies applied to new products to be more suitable, and new products can reach the market more quickly (Davey,

Brennan, Meenan, and McAdam, 2011). In contrast, if firms lack customer familiarity, they cannot recognize customer needs and serve market needs and provide knowledge on how to serve the market (Shane and Venkataraman, 2000; Shane and Venkataraman, 2007). The firm formulates an effective marketing strategy to introduce and sell a new product/service. As a result, persistent accumulation of new external knowledge or ability to absorb knowledge is essential for successful exploitation (Mowery, Oxley, and Silverman, 1996). As a result, persistent accumulation of new external knowledge or ability to absorb knowledge is essential for successful exploitation. Scholars highlight that how well firms exploit external knowledge relies on its level of prior related knowledge. This points out the importance of ACAP as a context- and path-dependent capability and should not be separate from its context (Lane, Koka, and Pathak, 2006; Flatten, Greve, and Brettel, 2011).

Prior study showed knowledge ACAP influences the efficiency of EO (Engelen et al., 2014; Sciascia et al., 2014). Knowledge ACAP develops innovativeness of firm (Cepeda-Carrion et al., 2012) through acquiring and learning from new sources of knowledge (Sun and Anderson, 2010). In other word, knowledge ACAP stimulates the effectiveness of entrepreneurial processes in term of new product and service development and finally firm performance improvement (Cohen and Levinthal, 1990; Lane, Salk, and Lyles, 2001). EO allows firms to address market needs by introducing and selling a new and good service (Shane and Venkataraman, 2000).

In the context of the manufacturing sector, scholars also paid attention on how and why ACAP stimulates EO effectiveness on firm performance in various contexts

(e.g., De Clercq, Dimov, and Thongpapanl, 2010; Dimitratos, Lioukas, and Carter, 2004; Engelen et al., 2015; Engelen et al., 2015; Engelen, Neumann, and Schmidt, 2016; Lee, Lee, and Pennings, 2001) except medical device industry. Based on the above discussion, medical device manufacturing firms can better recognize end exploit new information relevant to their particular products by developing knowledge ACAP. Hence, the importance of knowledge ACAP within the medical device industry was raised as a research question in this present study. This research answers this question by investigating the importance of knowledge ACAP on EO and why it contributes to firm performance within the medical device industry.

Third, as multidimensional of EO affect to firm performance separately (Lumpkin and Dess, 2001; Casillas et al., 2011; Hernandez-Perlines, 2018), knowledge ACAP might have a different effect on multidimensional EO and avenues to firm success (Sciascia et al., 2014; Hernandez-Perlines, 2018). Interdependence among the five EO dimensions stimulates key debates in the literature concerning the relationship between EO and firm performance. To explain the nature of the entrepreneurial process and firm performance more precisely, scholars also proved how and why dimensions of EO affect firm performance separately. (Lumpkin and Dess, 2001; Casillas et al., 2011; Hernandez-Perlines, 2018). Moreover, Covin et al. (2006) note that advancement in the EO literature is based on how scholars define the determinants and the outcomes of EO and the appropriate ways of conceptualizing it. In addition, the variation in the relationship between EO and firm performance among various studies provides conflicting viewpoints among EO scholars. Lumpkin and Dess (2001) suggested that entrepreneurial processes may not be associated with strong performance, as these processes involve complex phenomena. Empirical

evidence supports this viewpoint (Lumpkin and Dess (2001). Positive association between EO and firm performance are observed (Wiklund, 1999; Zahra and Covin, 1995; Wiklund and Shepherd, 2003), but negative associations have been observed as well. Dess, Lumpkin, and Covin (1997) observed individual bias toward the value of entrepreneurship. Therefore, EO scholars need to provide specific rationale on why EO has positive or negative effects on performance in different contexts of study (Rauch et al., 2009).

In addition, comparing results among studies could not be possible even for scholars in the same context but with different approaches in defining the meaning of EO (Rauch et al., 2009). Hence, the extent to which independence and several multidimensions of EO are applied in studies varies depending on the context, and a challenge to conducting EO research is basically an understanding of each context of study. It will help scholars choose which EO conceptualization is more suitable. Through survey research, this study fills this gap by investigating the extent to which prominent dimensions of EO, proactiveness and competitive aggressiveness, influence firm performance.

Fourth, the literature on the relationship between EO and knowledge ACAP and its effect on firm performance have grown. (Wales et al., 2013; Sciascia et al., 2014; Hernandez-Perlines, 2018). However, the link between multiple dimensions of EO and knowledge ACAP is still overlooked. Scholars adopted a contingency approach to test the EO–performance relationship (Lumpkin and Dess, 1996a; Covin and Lumpkin, 2011; Zellweger and Sieger, 2012). Hence, this research aims to fill the theoretical gap and answer two questions: How and why does knowledge absorptive capacity contribute to firm performance in a medical device industry context? How

and why do EOs and knowledge absorptive capacity contribute to firm performance, and to what extent does knowledge ACAP moderate the effects of the link between multidimensional EO and firm performance? To address these questions, this research employs a case study approach to study the characteristic of knowledge ACAP. Moreover, partial least-square analysis tests knowledge ACAP as a moderator between a relationship with proactiveness and competitive aggressiveness.

1.3 Research Questions

As addressed in the above statements, this research adopted two research methods to answer specific questions:

(1) How and why do key characteristics of EO contribute to firm performance in the medical device industry?

(2) How important is knowledge ACAP on EO and why does it contribute to firm performance in the medical device industry?

Then, the questions for the quantitative research are as follows:

(3) To what extent does proactiveness influence firm performance?

(4) To what extent does competitive aggressiveness influence firm performance?

(5) To what extent does knowledge ACAP moderate the relationship between proactiveness and firm performance?

(6) To what extent does knowledge ACAP moderate the relationship between competitive aggressiveness and firm performance?

1.4 Objectives of the Study

The specific research objectives of the study are

(1) To understand what and how EO and knowledge absorptive capacity contribute to firm performance in the medical device industry context.

(2) To explore the effect of proactiveness on firm performance.

(3) To explore the effect of competitive aggressiveness on firm performance.

(4) To explore the moderating effect of absorptive capacity on the relationship between proactiveness and firm performance.

(5) To investigate the moderating effect of absorptive capacity on the relationship between competitive aggressiveness and firm performance.

1.5 Significance of the Study

This research contributes to the understanding of the substantial body of knowledge on entrepreneurship that explains the roles of multidimensional EO as entrepreneurial processes that determine firm performance under the context of the medical device industry in Thailand. Moreover, this research also investigates the link between multidimensional EO, knowledge ACAP, and firm performance. (Wales et al., 2013; Sciascia et al., 2014; Hernandez-Perlines, 2018), qualitative analysis (Rauch et al., 2009). This research provides insights that contribute in many aspects and theoretical and managerial implications.

First, it provides insights into the nature of multidimensional EO and firm performance in the context of the medical device industry in Thailand to provide rationale for the question on how and why entrepreneurial processes contribute to firm performance. Previous theoretical discussions about the nature of multidimensional EO have inconclusive results because they might vary depending on different contexts and affect firm performance. This research will provide a clear chain of evidence through case study research. It responds to the call for quantitative analysis of EO research in the case of new context studied(Rauch et al., 2009).

Second, scholars call for a study of the independent effect of multidimensional EO on firm performance (Covin et al., 2006; Hughes and Morgan, 2007; Lumpkin and Dess, 2001) because it influences performance differently. It facilitates insight in terms of explaining why inconsistent results of EO have appeared in prior studies, which responds to scholarly calls to investigate how and why multiple dimensions of EO affect firm performance separately (Lumpkin and Dess, 2001; Casillas et al., 2011; Hernandez-Perlines, 2018).

Third, this study discusses knowledge ACAP's role as a contingency factor often associated with the EO–performance relationship. It has been rarely investigated in previous studies (Hughes and Morgan, 2007; Wales et al., 2013; Sciascia et al., 2014; Hernandez-Perlines, 2018). It enhances the understanding of multiple dimensions of EO and knowledge ACAP and why they are crucial to firm performance. In addition, this research will raise two prominent EO dimensions, proactiveness and competitive aggressiveness, which will be part of a set of hypotheses. In particular, this study focuses on the role of knowledge ACAP in

stimulating proactiveness and competitive aggressiveness and its effects on firm performance (Lumpkin ans Dess, 2001). This study sheds light on to the role of knowledge ACAP as a moderator in firm performance management under the medical device industry context, which is rarely investigated.

On managerial implication, this research responds to academic debates by providing findings with theoretical contributions to the field and a range of managerial implications, particularly for executives, business managers and business advisors, and policymakers in the medical device industry. The findings offer important managerial implications. First, the result underlines the role of proactive behavior in enhancing a firm's performance in the medical device industry. To sustain proactiveness effectiveness on firm performance, managers should explicitly consider a strategy to manage optimum-level knowledge ACAP. Based on the research results, a lower level of knowledge ACAP gives a more effective strategy to increase firm performance than a higher level. Managers should pay attention on how to accumulate prior stock of medical knowledge. This strategy might not only prevent Not Invent Here Syndrome (NIH syndrome) but also enhance the firm's knowledge ACAP to accumulate their prior related knowledge for future product development projects. In addition, managers of medical device firms should be aware of the cost to acquire new external knowledge as well. Second, policymakers should support medical device industry in order to stimulate medical device knowledge through the incubation center of medical innovation. Additionally, policymakers must enhance the success rate of technology transfer from medical research projects into medical products available in the market, which play a crucial role for medical device entrepreneurs.

1.6 Scope of the Research

In essence, the scope of this study is at the unit level of the firm in a medical device firm in Thailand. The key informants are the CEO, the manager, and the department manager, who have understood the characteristics of the firm's EO and knowledge ACAP. The medical device industry in Thailand was selected as the target group for data investigation. The unexplored context of medical devices stimulates the researcher to take both an inductive and deductive approach to guide the research design and the method for data collection. For the inductive approach, five cases of a manufacturing medical device firm are selected as a sample to gain data. The researcher adopted an in-depth interview method to gain insightful data related to the main key variables: EO and knowledge ACAP. The researcher relied on both within- and cross-case analyses. Analyzing the differences and similarities among the five cases provides rationale on the characteristics of EO and knowledge ACAP related to firm performance. Moreover, deeply understanding the phenomena enhances one's understanding of the similarities and the differences between real-world context and literature review.

For the deductive approach, the participants were selected from the database of the Department of Business Development, comprising a total 313 firms as of April 24, 2018. This research investigated how two different approaches to entrepreneurial decision-making may have different effects on firm performance, which are proactiveness and competitive aggressiveness. Moreover, the moderating effect of knowledge ACAP on the relationship between proactiveness and competitive aggressiveness and firm performance will be explored. The data were collected using

a questionnaire mailed to each firm. To ascertain the quality of the questionnaire, validity and reliability were tested using factor analysis and Cronbach's alpha. In this research, PLS-SEM was employed as the main statistical technique to test the effects between constructs. Furthermore, descriptive analysis, variance inflation factors, and correlation analyses are employed to test the basic assumption of PLS-SEM.

1.7 Organization of the Dissertation

This dissertation is divided into five chapters as follows:

Chapter 1 provides the introduction of the study. It presents the background and rationale, problem statement, research questions and research objectives, significance, and scope of the study.

Chapter 2 provides the literature review. It is divided into four sections. These include reviewing the relevant literature for its main constructs and relationships. The literature was reviewed intensively and extensively in the following areas: (1) overview of the medical device industry in Thailand, (2) performance of medical firms, (3) EO and firm performance, (4) knowledge ACAP, EO and firm performance, and (5) research questions.

Chapter 3 explains the empirical examination of the research methods. This research adopts both the inductive and the deductive approach to guide the research design and the method for data collection. For the inductive approach, the research method is a case study. The researcher relied on both within- and cross-case analyses. Next, the researcher looked for within-case and cross-case similarities and differences

to gain insightful knowledge from research objectives. In terms of the quantitative approach, there will be a clear research framework. The final section proposes a research framework that will guide the quantitative research.

Chapter 4, based on the case study results, this study has hypotheses to guide the quantitative research including the main effect of profound EO characteristics (proactiveness and competitive aggressiveness) on firm performance. Additionally, the moderating role of knowledge ACAP on the relationship between proactiveness, competitive aggressiveness, and firm performance are proposed as well. The deductive approach consists of sample selection and data collection, variable measurements of each construct, reliability and validity testing of the survey instrument, statistics to test the hypotheses, and Tables summarizing the definitions and operation variables of the construct.

Chapter 5 presents the conclusion and discussion of this research. It then presents theoretical contributions, implications of the findings for managerial practices, and future research agenda.

CHAPTER II

LITERATURE REVIEW

The research objectives of this research are as followed, 1) to understand what and how EO and knowledge ACAP contribute to firm performance in medical device industry context, 2) to explore the effect of proactiveness to firm performance. 3) to explore the effect of competitive aggressiveness to firm performance, 4) to explore the moderating effect of knowledge ACAP in the relationship between proactiveness and firm performance, and 5) to investigate the moderating effect of knowledge ACAP in the relationship between competitive aggressiveness and firm performance. This chapter presents the qualitative research method relevant literature concerning the three main areas of body of knowledge. First, overview of medical device industry in Thailand is showed. Second, the literature on firm performance is reviewed with respect to of medical device firm. Third, present literature review of the relationship between EO and firm performance. Fourth, knowledge ACAP has been described with the notion of entrepreneurial orientation and firm performance.

2.1 Overview of the Medical Device Industry in Thailand

2.2.1 Overview

According to the National Science and Technology Development Agency (NSTDA) report (2017), the medical device industry has been dubbed the “medical

hub of Asia." According to the Medical Device Intelligence Unit of Thailand, the medical device industry plays a vital role in the economy of Thailand as it has a positive contribution to the exports of the country. According to NSTDA (2017), exporting medical devices is valued at 85,173.99 million baht with an average annual growth rate of 3.2 percent. Figure 1 shows the export value of the medical device industry; it has grown continuously from 2012 to 2016. As a result, Thailand focuses on the development of medical device manufacturers because they have a potential for growth.

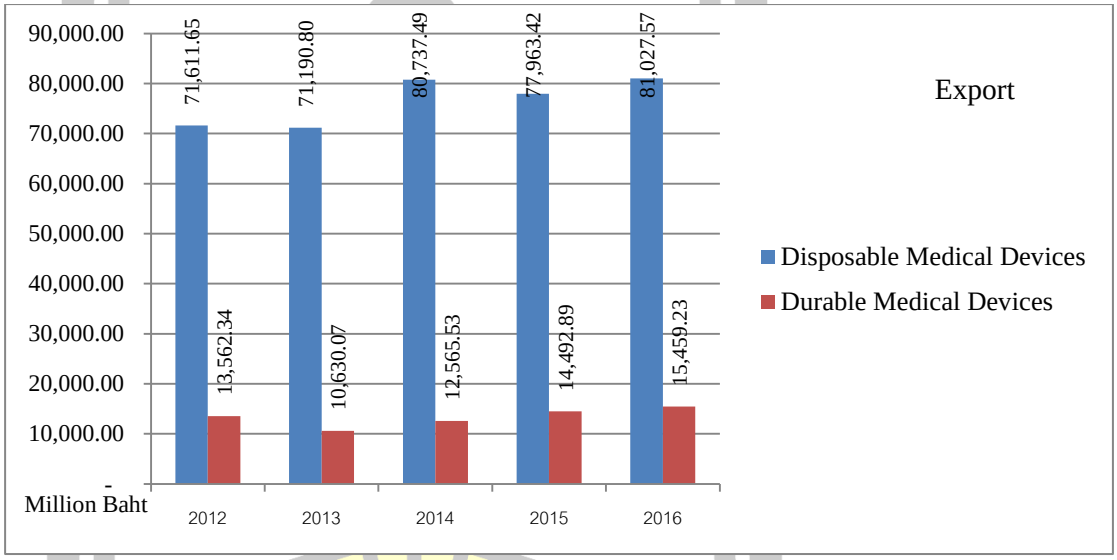


Figure 1 The Export Value of Medical Device Industry During 2012-2016

In Thailand, the challenge of the medical device manufacturing industry is to drive R&D projects to commercialize the Thai government, which provides support to R&D projects for medical devices through private R&D agencies, universities, and specialized research centers (NSTDA, 2017). As a result, firm success depends on external collaboration with external sources (Caloghirou, Kastelli, and Tsakanikas, 2004). Davey, Brennan, Meenana, and McAdam (2011) concluded that if medical

device firms can capture scientists' multifaceted ideas, physicians, engineers, clinicians, and patients. They allow technologies to spread to the market more quickly. Successful external knowledge exploitation develops a firm's ability to absorb knowledge (Chen, 2004). Hence, a firm's ability to exploit commercial benefits from external sources of knowledge is critical. Gray (2006) found significant differences between manufacturing and nonmanufacturing SMEs. In thos research, knowledge absorptive capacity (knowledge ACAP) refers to the ability to assimilate and replicate new knowledge gained from external sources (Cohen and Levinthal, 1990). As a result, manufacturing firms need knowledge ACAP to exploit commercial benefits from external knowledge from various sources.

Lumpkin and Dess, (1996a) suggested that to contribute to further EO conversations, scholars should extend their study into neglected areas. In addition, Wales (2016) called for qualitative research to clarify the essentially unanswered research questions. Hence, to understand EO within the unexplored context, medical device firms, this study aims to adopt multiple case study research to gain insightful data to clarify a set of research questions derived from the theory of EO and knowledge ACAP that affect firm performance. This includes the EO conceptualization approach and the inconsistency of multiple dimensions of EO in studies. Depending on the context of the study, two EO conceptualization approaches (Lumpkin and Dess, 1996a), and inconsistence of a multidimensional of EO among studies. Unidimensional and multidimensional, stimulate inconclusive results in EO literature (Covin and Slevin, 1989a; Lumpkin and Dess, 1996a) stimulate inconclusive results in EO literature. For the unidimensional method, EO is

characterized by three dimensions, proactiveness, innovativeness, and risk-taking, and is concerned with how firms manage these (Miller, 1983a). Three dimensions of entrepreneurial posture should co-vary (Corvin and Slevin, 1991). For the multidimensional approach, EO is characterized by five dimensions which vary independently and may not be equally valuable across performance (Lumpkin and Dess, 1996a).

Moreover, scholars pay unequal attention the dimensions of the EO constructs. (Rauch et al., 2009) suggested that competitive aggressiveness and autonomy may produce different relationships with performance. In addition, as the dynamics of competition increase, external knowledge plays an important role to reconfigure a firm's resources (Zahra and Georgre, 2002), and scholars have studied how and why knowledge ACAP relates to EO and firm performance.

Hence, it can be seen that performance of medical device firms has the potential to increase yearly and appears to have a prominent economic effect in the future. Although the EO construct has been investigated by scholars over the past 20 years (Runyan, Droge, and Swinney, 2008; Richard, Wu, and Chadwick, 2009; (Dai, Maksimov, Gilbert, & Fernhaber, 2014), there are still some areas which are underdeveloped; little attention was paid to EO in the context of the medical device industry. However, literature on EO in the medical industry is missing, highlighting the need to explore EO characteristics in these settings. As a result, some questions have not been explored, such as the EO nature of the medical device industry, EO's effect on firm performance, and the factors stimulating the EO–firm performance relationship.

2.2 Firm Performance of Medical Firm

Performance measures various aspects of firm, and characterized as a multidimensional concept (Chakravarthy, 1986). Chakravarthy (1986) identified key indicators to measure excellent firms. Excellent performance requires more than a single criterion (Bagozzi and Phillips, 1982). Moreover, most existing indicators basically capture historical trends or past performance (Chakravarthy, 1986).

Strategic performance is defined as the quality of long-term adaptation to the environment. Based on Chakravarthy (1986) there are three types of measurement. (1) Traditional measurement measures firm's profitability e.g., returns on investment (ROI), return on sales (ROS) and market share. (2) The quality of a firm's transformation is classified as adaptive specialization and adaptive generalization (Chakravarthy, 1982). Adaptive specialization mainly focuses on short term profitability (Chakravarthy, 1982). Adaptive generalization focuses on long-term survival e.g., firm's R&D spending and (3) stakeholder's satisfaction.

Firm performance is defined as indicators to measure a firm's incremental growth and captures different aspects (Chakravarthy, 1986; Murphy, Trailer, and Hill, 1996). Scholars recommended using multiple indicators to measure firm performance because multiple measurement focuses on the achievement of continuous incremental growth and capturing different aspects of firm performance in various business goals (Cameron, 1978; Venkatraman and Ramanujam, 1986; Murphy et al., 1996). Venkatraman and Ramanujam (1986) cautioned that financial indicators with opposite directions should not be combined to form a composite dimension because they reflect distinct aspects.

Financial indicators reflect success in terms of the economic goals of the firm (Venkatraman and Ramanujam, 1986). According to Murphy et al. (1996), financial performance is an imperative indicator of firm effectiveness. ROI, ROE, and market-to-book ratio (M/B ratio) are necessary conditions for differentiating excellent firms from bad ones because it is not sufficient to explain a variation of the firm's effectiveness (Chakravarthy, 1986). Hence, firm performance indicators must capture various aspects of the firm, including growth, efficiency, and profit (Murphy et al., 1996).

Table 1Comparing the Indicators Measuring Firm Performance

Author(s) (Year)	**Firm type**	**Firm Performance Indicators**			
		Growth	**Sales**	**Profitability**	**Efficiency**
Lee (2018)	Medical device firm		√		√
Kim and Kim (2018)	Healthcare IT SMEs		√		
Brännback et al. (2009)	Life Science firms	√		√	
Chakravarthy (1986)	Computer business			√	√
Murphy et al. (1996)	Integrative the indicators from Entrepreneurship literature			√	√

Performance measurement is critical in entrepreneurship research (Murphy et al., 1996). The relationship between EO and performance may depend upon the accuracy and appropriateness of indicators used to assess performance (Lumpkin and Dess, 1996a). Many EO studies use financial performance as an outcome metric (Dai et al., 2014). Table 1 shows firm performance indicators of the medical device firm. It

can be measured by multiple indicators. For example, Lee (2018) adopted profitability indicators (gross margins, sales revenue and earnings), and efficiency indicators (ROE, ROA) to reflex the degree of firm performance. A study by Kim and Kim (2018) adopted sales to measure firm performance to capture its ability to commercialize in healthcare IT SMEs. In conclusion, EO studies employ both financial and nonfinancial indicators as outcome metrics (Dai et al., 2014) to measure overall firm performance. This research adopts six indicators to capture three aspects of firm performance—efficiency, profitability, and growth (Murphy et al., 1996; Brännback et al., 2009) because of their broader perspective to capture various dimensions of firm performance. For efficiency indicators, this study measures ROI. For profitability, this study measures sales and net profit. For growth, this study measures three items: sale growth, net profit growth, and market share growth (Murphy et al., 1996).

2.3 Entrepreneurial Orientation and Firm Performance

2.3.1 Entrepreneurial Orientation

Entrepreneurship is characterized by high-performing firms. According to Lumpkin and Dess (2001), EO refers to the strategic processes and styles of firms that engage in entrepreneurial activities (Miller and Friesen, 1982) suggested that when an entrepreneurial firm engages in product market innovation, risk encounter and proactiveness are critical processes to defeat rivals. Hence, Miller (1983b) adopted innovativeness, risk-taking, and proactiveness to characterize entrepreneurship. Based

on Miller, (1983b) original conceptualization, numerous scholars have adopted this approach. For example, Covin and Slevin (1989a) investigated the performance in hostile and benign environments using innovative, risk taking, and proactive to measure entrepreneurial strategic posture. (Covin and Slevin, 1993) asserted that there are two paths of EO conceptualizations corresponding the unidimensional and multidimensional conceptualizations.

First, the unidimensional dimension approach is presented by Covin and Slevin (1989). They defined the characteristics of EO as "the entrepreneurial process as an overall strategic posture concerning how the firm should operate on specific behavioral dimensions." Moreover, dimensions of entrepreneurial posture should co-vary. Scholars have repeatedly studied three core dimensions; risk-taking, innovativeness, and proactiveness e.g.; Covin and Slevin (1989), Naman and Slevin, (1993), Wiklund and Shepherd (2003b) and Wiklund and Shepherd (2005).

Second, the multidimensional approach that presented by Lumpkin and Dess (1996a). Lumpkin and Dess (1996a) defined an EO as "the decision-making styles, processes, and methods that inform a firm's entrepreneurial activities." EO is characterized by five dimensions: proactiveness, competitive, aggressiveness, risk-taking, innovativeness, and autonomy. Multidimensional EO varies independently and may not be equally present in different conditions, such as the firm's stages. Scholars repeatedly sought to prove that EO carries value in terms of firm performance e.g., Wiklund and Shepherd (2003b) and Zahra and Covin (1995). However, EO may not permanently improve firm performance. Table 2 provides the details of empirical studies that the five dimension of EO according to Lumpkin and Dess (1996a).

As illustrated in Table 2 scholars adopting the unidimensional approach of EO have to determine how to use the EO construct. Hughes and Morgan (2007) some studies ignored the individual influence of each dimension and combine them into one single construct e.g., Lee et al., 2001; Wiklund and Shepherd, 2003b; Wang, 2008; De Clercq et al., 2010). Some studies interpreted results according to the dimension of the variable (e.g., Dai et al., 2014; Rauch et al., 2009; Richard, Barnett, Dwyer, and Chadwick, 2004). These concerns act as key debate points of the multidimensionality of the EO approach. Edwards (2001) suggested that multidimensional constructs have two forms: aggregate and superordinate. For the aggregate construct, the relationships flow from the dimensions to the construct (Edwards, 2001). The aggregate construct combines all dimensions into one general concept. Therefore, different approaches influence firm performance in various ways, and the relationship between dimensional EO and firm performance may be inconsistent. (Covin et al., 2006; Hughes, Ireland, and Morgan, 2007; Lumpkin and Dess, 2001).

The same problem explained in the unidimensional construct was found when researchers adopted the multidimensional approach as well. As the EO construct defines five independent dimensions (Edwards, 2001), all dimensions range from low to high according of the context of study. Hence, inconsistent results across studies were observed. The neglected area of EO research in medical device manufacturing firms with a limited amount of empirical evidence has captured the EO characteristics of these firms This research adopted the multidimensional approach of EO by Lumpkin and Dess (2001) to understand the EO construct by resolving these omissions and responding to the following research question: what are the characteristics of EO in the context of medical device firms?

Table 2 Dimensions of EO Construct Adopted in Past Research

Author(s) (Year)	Sample Group	Measure		Sub-dimensional				
		Unidimensional	Multidimensional	Risk-taking	Proactiveness	Competitive Aggressiveness	Innovativeness	Autonomy
Zahra & Covin (1995)	Medium-size manufacturing firm	√		√	√		√	
Stetz et al. (2000)	Health care industry		√	√	√			
Slater and Narver (2000)	Variety of industry	√		√		√	√	
Harms and Ehrmann (2009)	German firm	√		√			√	
Lumpkin and Dess (2001)	Different industries		√		√	√		
Morgan and Strong (2003)	Medium and large, high technology and industrial manufacturing firms	√		√	√	√		
Wiklund and Shepherd (2003b)	SMEs		√	√	√		√	
Richard, Barnett, Dwyer and Chadwick (2004)	Banks	√		√			√	
Hughes and Morgan (2007)	Young high-technology firms		√	√	√	√	√	√
Naldi, Nordqvist, Sjöberg, and Wiklund (2007)	Family firm		√	√	√			
Fang et al. (2008)	New ventures		√	√	√			
Wang (2008)	Medium to large firm		√	√	√	√		
Runyan et al. (2008)	Small business	√		√	√		√	
De Clercq et al. (2010)	Canadian- based firm	√		√	√		√	
Pérez-Luño, Wiklund, and Cabrera (2011)	Innovating firm	√		√	√			
Zellweger and Sieger (2012)	Family firm		√	√	√	√	√	√

Table 2 (Contd.)

Author(s) (Year)	Sample Group	Measure		Sub-dimensional				
		Unidimensional	Multidimensional	Risk-taking	Proactiveness	Competitive Aggressiveness	Innovativeness	Autonomy
Dai et al. (2014)	SMEs		√	√	√		√	
Craig, Pohjola, Kraus, and Jensen (2014)	Family firm	√		√	√			

Table 3 illustrates the empirical research in Thailand which related to knowledge ACAP and performance. It shows that prior research related to EO, knowledge ACAP in the same study in the context of Thailand is rarely seen. For example, Popaitoon and Siengthai, 2014) studied EO, ACAP, and team performance. Moreover, Darawong (2015) studied absorptive capacity, new product development team, and Tanimkarn and Kuntonbutr (2014) studied EO, and firm financial.

Therefore, this research aims to investigate variables that have not been studied before particularly in the medical device context. With the limited number of studies on medical devices in Thailand, researchers are aware of the differences between the theoretical variable and the actual context. For example, what type of EO is appropriate? Does each dimension of EO suit the context of study?

Table 3 The Empirical Research of EO, Knowledge ACAP in Thailand

No	Author(s), year	Main Content	Variables
1	Jiraphanumes, Aujirapongpan, & Chamchang (2011)	Innovativeness and Performance	Entrepreneurial and strategic orientation, innovativeness and performance
2	Lekmat, (2012)	Firm performance	Entrepreneurial Orientation and SME Performance
3	Popaitoon and Siengthai (2014)	International human resource management practice	Human resource management practice and project performance
4	Atawongsa (2014)	Business growth	Entrepreneurial orientation and SME growth
5	Tanimkarn and Kuntonbutr (2014)	Firm financial performance	Entrepreneurial orientation and financial performance
6	Darawong (2015)	New product development	Knowledge ACAP and new product development team
7	Sudaporn Kuntonbutr (2016)	International intelligence	Entrepreneurial orientation and the capability of international operation
8	Wongmuek (2018)	Entrepreneurial orientation in fashion industry	Entrepreneurial orientation of fashion design

The next section describes how the five dimensions of EO relate to firm performance based on the empirical evidence.

2.3.2 Entrepreneurial Orientation and Firm Performance

Besides the understanding of the EO characteristic with the five dimensions of Lumpkin and Dess (1996), Table 4 provides the details of empirical studies on the composition and effectiveness of EO on firm performance. In this study, EO is defined based on the definition by Corvin and Slevin (1991) and Lumpkin and Dess (2001) as "strategic making processes and styles of firms that engage in entrepreneurial activities represented by autonomy, innovativeness, proactiveness, competitive aggressiveness, and risk taking."

Prior evidence shows that all dimensions exhibit relations with firm performance. Moreover, there are widespread reports of a positive relationship between EO and performance e.g., Wiklund and Shepherd (2003b). However, some findings found little or no association between EO and firm performance while some also reported a negative relationship (e.g., Morgan and Strong, 2003; Smart and Conant, 2011). Tang, Tang, Marino, Zhang, and Li (2008) found an inverted U-shaped relationship between EO and firm performance, as expressed in both perceptual and objective performance, in Chinese firms. Yet it is largely unclear how these five dimensions independently affect firm performance. The next section is the literature review about the five dimensions of EO.

Empirical evidence shows two possible causes that may affect the extent of the relationship between EO and firm performance. It would appear that EO sometimes, but not always, contributes to improved business performance.

Proactiveness refers to how firms relate to market opportunities by seizing initiatives in the marketplace (Lumpkin and Dess, 1996). A firm needs to continuously pursue new opportunities (Hamel, 2000; Wiklund and Shepherd, 2005) to explore resources and gain benefits from a first-mover advantage (Zahra and Covin, 1995; Birnbaum, Christensen, Christensen, and Raynor, 2005), seeking an attractive niche market by exploring new opportunities for growth (March, 1991), and also introducing new products and new technologies faster than rivals (Miller and Friesen, 1978).

Although many scholars found evidence that firm proactive behavior supports firm performance (Lumpkin and Dess, 2001; Wiklund and Shepherd, 2003), there are also theoretical discussions in the opposite direction. Lumpkin and Dess (2001) asserted that firm context, in which firm processes play as contingent factors to determine the extent of entrepreneurial process, will affect firm performance. First, in the early stages of industry development, performance is related to a firm's proactive strategy because the first-mover advantage gains benefits from dominating distribution channels, establishing brand recognition, and occupying premium market segments. Second, regarding the environmental factor, proactiveness will encourage firm performance in the early stages of an industry's life cycle, but firm performance will diminish when industry matures (Lumpkin and Dess, 2001).

Table 4 The Empirical Research of EO, Knowledge ACAP

No.	Author(s) (Year)	EO Definition	Research Objective	Sample	Results
1	Wiklund and Shepherd (2003)	"A combination of three dimensions: innovativeness, proactiveness, and risk-taking"	Examine the moderating effect of EO between knowledge-based resources and performance.	225 Swedish SME	"Knowledge-based resources (applicable to discovery and exploitation of opportunities) are positively related to firm performance and that EO enhances this relationship."
2	Richard, Barnett, Dwyer and Chadwick (2004)	"Propensity to act autonomously, innovate, take risks, and act proactively when confronted with market opportunities (Lumpkin & Dess, 1996)."	Evaluated relationships between cultural diversity and firm performance within the context of firm-level entrepreneurial orientation.	535 banks	"Innovativeness positively and risk taking negatively moderated nonlinear relationship patterns for both racial and gender heterogeneity."
3	Naldi, Nordqvist, Sjöberg and Wiklund (2007)	"Organizational processes, methods and style of firm use to act entrepreneurially (lumpkin and Dess,1996)"	Evaluate of risk taking and its impact in family firms.	696 Swedish family firm	"Risk taking in family firm was negatively related to firm performance, while proactiveness and innovativeness were negatively related to firm performance."

Table 4 (Contd.)

No.	Author(s) (Year)	EO Definition	Research Objective	Sample	Results
4	Wang (2008)	"The processes, practices, and decision making activities that leads to new entry (Lumpkin and Dess, 1996)."	Evaluate the EO , learning orientation and performance relationship	213 medium to large UK firms	"LO mediates the EO-performance relationship, and the EO-LO-performance link is stronger for prospectors than analyzers. The findings indicate that LO must be in place to maximize the effect of EO on performance, and that LO"
5	Hughes,and Morgan (2007)	"The decision-making styles, processes, and methods that inform a firm's entrepreneurial activities"	Examine the effect of risk-taking, innovativeness, and proactiveness on business performance.	211 young high-technology firms at an embryonic stage of development.	"Only proactiveness and innovativeness have a positive influence on business performance while risk-taking has a negative relationship. Competitive aggressiveness and autonomy appear to hold no business performance value at this stage of firm growth."
6	Runyan, Droge, and Swinney (2008)	"A strategic choice which describe individual business-related decisions as interactive and interdependent, perhaps forming a "pattern" reflecting strategic stance (Galbraith and Schendel, 1983)"	Examines the constructs of entrepreneurial orientation (EO) versus small business orientation (SBO), their impact on small business performance, and whether these effects are moderated by business life cycle.	267 small business owners from 11 small medium downtowns	"For the younger group (<11 years), only EO significantly predicts performance while for the older group (>11 years), only SBO significantly predicts performance."

Table 4 (contd.)

No.	Author(s) (Year)	EO Definition	Research objective	Sample	Results
7	Rauch, Wiklund, Lumpkin and Frese (2009).	"The methods, practices, and decision-making styles managers use to act entrepreneurially and can be thought of as a type of strategic orientation insofar as it captures how a firm intends to compete."	Analyze the effect of EO on business performance.	211 young high-technology firms	"Only proactiveness and innovativeness have a positive influence on business performance while risk-taking has a negative relationship. Competitive aggressiveness and autonomy appear to hold no business performance value at this stage of firm growth."
8	De Clercq, Dimov, and Thongpapanl (2010)	"Strategic posture to be innovative, proactive, and risk taking takes on instrumental importance (Covin and Slevin, 1991)."	Examines the roles of social relationships between functional managers and their commitment in shaping the entrepreneurial orientation (EO)-performance relationship.	232 Canadian-based firms	"The EO and performance link is stronger for higher levels of procedural justice, trust, and organizational commitment."
9	Dai, Maksimov, Gilbert, and Fernhaber (2014)	"Firm's innovativeness, proactiveness, and willingness to undertake risks (Lumpkin and Dess, 1996)"	Examining the independent influences of innovativeness, proactiveness, and risk-taking on the ability of a firm tobroaden its scope across international markets.	500 SMEs spanning 10 industries,	"The results reflect the consequences of being "stuck in the middle" with respect to their strategic posture on innovativeness and proactiveness, but reveal a nuanced role for risk-taking behavior."

In contrast, proactiveness lowers firm performance in hostile environments (Lumpkin and Dess, 2001). It can be seen that the theoretical evidence is split into two approaches from various industries except the medical device industry. How does proactiveness affect a firm's performance?

Innovativeness refers to the willingness to support creativity and experimentation in introducing new products/services and novelty, technological leadership, and R&D in developing new processes (Lumpkin and Dess, 1996). The positive effect and the moderating effect between innovativeness and firm performance are well established. Empirical evidence shows that innovativeness has a direct effect on firm performance and has a moderating effect between firm strategy and firm performance (Lechner and Gudmundsson, 2014). For the direct effect, Hatak, Kautonen, Fink, and Kansikas (2016) innovativeness affects firm performance positively when the owners make commitment, show consistency, and stick to their decisions in business alternatives.

Factors enhancing innovativeness and firm performance include competitive strategy (Lechner and Gudmundsson, 2014), management team characteristics (Richard et al., 2004), and knowledge base on firm performance is stronger (Wiklund and Shepperd, 2003). For the moderating effect, when innovativeness is high, the effect of competitive strategy, management team characteristics, and the knowledge base to firm performance are stronger. For example, Lechner and Gudmundsson (2014) found that innovativeness is highly moderate the effect between differentiation strategy and small firm performance. Richard et al., (2004) found that firm's innovativeness benefits to firm performance in case of firm constitute heterogeneity of management team such as race diversity. However, theoretical evidence shows that

innovativeness has a positive effect on firm performance, but the Thai medical device industry encounters the challenge of driving R&D projects toward commercialization. Therefore, can innovativeness create commercial benefits? According to Lumpkin and Dess (1996), R&D is one of the characteristics reflect to firm's innovativeness. R&D is a characteristic reflecting a firm's innovativeness. However, mere innovativeness may not be able to improve firm performance in the medical industry.

Risk taking is the tendency to take bold actions such as venturing into unknown new markets, committing a large portion of resources to ventures with uncertain outcomes, and/or borrowing heavily (Lumpkin and Dess, 1996). Miller and Friesen (1982) stated that a risk-taker firm has a tendency to withdraw resources from existing products and apply resources to new products and processes to exploit market opportunities. Zahra and Garvis, (2000). . Characteristics of high risk-taking are as follows: investing in internal R&D which enhances the capability to respond to customer demand and avoiding delays in making strategic commitments (Birnbaum, Christensen, Christensen, and Raynor, 2005), dominating distribution channels, establishing brand recognition, and occupying premium market segments (Lumpkin and Dess, 1996). Risk-taking firms usually exploit new opportunities by committing firm resources before clearly understanding situations (Covin and Slevin, 1988) and while payoff is still uncertain. However, risk would not be taken by a firm member called "individually risk-averse."

Lumpkin and Dess (1996) described "risk-averse" as a firm member's aversion to a new venture opportunity. Risk-averse individuals will carefully study or have confidence in a good idea. As a result, firms will not take new opportunities

when risk-averse firm members refuse it (Lumpkin and Dess, 1996). This kind of firm could be called conservative firms, which are characterized by "the top management style of risk-averse and no innovative." (Covin and Slevin, 1988). Scholars have found ambiguous relationships between risk-taking and performance (e.g., Begley and Boyd, 1987).

Prior research reported that a family firm takes risks less than normal firms while engaged in entrepreneurial activities and found a negative relation between risk-taking and firm performance (Naldi et al., 2007). A bundle of knowledge-based resources coupled with risk-taking behavior will increase firm performance. Wiklund and Shepherd (2003) investigated risk-taking as a moderator, and they found that small and medium-size firms' willingness toward greater risks increase the relationship between their bundle of knowledge-based resources and performance. Hence, to make risk-taking behavior positively affect performance, knowledge needs to alter the risk and maximize firm performance.

Competitive aggressiveness reflects the intensity of a firm's efforts to outperform industry rivals, characterized by a combative posture and a forceful response to a competitor's actions (Lumpkin and Dess, 1996). Scholars agreed that competitive aggressiveness benefits firm performance in hostile environments. Scholars agreed that competitive aggressiveness benefits firm performance in hostile environments (Dess and Dess, 1996). Competitive aggressiveness indicates efforts of a firm to outperform rivals within the industry (Lechner and Gudmundssun, 2014). Scholars provided the rationale on why firms are required to compete heavily with competitors, including product life cycle, margin constraints (Dess and Lumpkin,

2005), new market entry (MacMillan and Day, 1987), firm strategy (Miller and Dess, 1993) , and market leader position(McGee and Dowling, 1994) . As demonstrated in Table 2.3 scholar paid little attention on this dimension on empirical evidences research, and its consequence of this dimension to firm performance is not consistence among the studies.

Empirical evidence showed conflicting relationships between competitive aggressiveness and firm performance. Lumpkin and Dess (2001) found that in hostile environments, a competitively aggressive posture would enhance performance. Moreover, Covin and Slevin (1990) also found that, under hostile environments, high-performing firms often exhibit an aggressively competitive orientation. However, a study by Lechner and Gudmundsson (2014) found that competitive aggressiveness is negatively related with cost-leadership and differentiation strategies, and both strategies are positively related to small firms' performance. Hence, under different conditions, the relationship between competitive aggressiveness and firm performance varies.

Autonomy is defined as independent action by an individual or team aimed at bringing forth a business concept or vision and carrying it through to completion (Lumpkin and Dess, 1996). It allows firms quicker and relies on self-decisions to serve novel products or services in new markets (Lumpkin and Dess, 1996). In other words, autonomy is a firm's willingness to pursue new market opportunities.(Li, Liu, Wang, and Li, 2009). In entrepreneurial firms, practices aim to foster autonomy (Lumpkin, Cogliser, and Schneider, 2009) for example, advantage-seeking behaviors, opportunity-seeking (Ireland, Hitt, and Sirmon, 2003), transform firm's strategic posture and strategic renewal (Burgelman, 1983). Although Lumpkin and Dess (1996)

highlighted autonomy as a key dimension of EO, however; as illustrated in Table 2.4, empirical studies of autonomy are limited.

In line of this reasoning, this research puts forward the following research question:

Research question1: What are the key characteristics of EO within the medical device industry?

Scholars highlight the role of contingency factor on the EO–firm performance relationship (e.g., Covin and Slevin 1991; Karagozoglu and Brown, 1988). For the mediating roles, Wiklund and Shepherd (2003) and Wiklund and Shepherd (2005) studied resource availability, (Ruiz-Ortega, Parra-Requena, Rodrigo-Alarcón, and García-Villaverde, 2013) studied marketing capabilities strategy formation process, Covin et al. (2006) studied internal social context. For moderating roles, environmental hostility, turbulence, and dynamism, industry life-cycle and external networks had been studied (Dess et al., 1997; Lee et al., 2001; Lumpkin and Dess, 2001; Namen and Slevin, 1993; Stam and Elfring, 2008; Wiklund and Shepherd, 2005). Moreover, EO scholars have studied internal and external moderators in three-way interactions, including configurational models (e.g. Lumpkin and Dess, 1996). As shown in Table 5 scholars have been studied of EO and performance relationship.

Studies showed that increasing the efficiency of EO is largely a function of knowledge ACAP (Sciascia et al., 2014; Engelen et al., 2014). Knowledge ACAP allows firms to gain new external knowledge (Camisón and Forés, 2011). EO is a strategic orientation requiring resources (Wiklund, 1999). As a result, knowledge

ACAP facilitates the success of resource consumption by providing new knowledge to consume existing firm resources. This research suggested that knowledge ACAP stimulates the effect of EO on firm performance by improving firm learning capacity to utilize the value of new external knowledge. Therefore, what conditions will enhance the association between EO and firm performance?

2.4 Knowledge Absorptive Capacity, Entrepreneurial Orientation and Firm Performance

2.4.1 Knowledge ACAP

This study adopts Cohen and Levinthal's (1990) definition at the firm level. Knowledge ACAP is defined as "the ability of a firm to recognize the value of new external information, assimilate it and apply it to commercial ends." ACAP refers not only to the

Table 5 EO and Firm Performance Relationship

Author(s) (Year)	Independent Variables	Contingency Variable	Dependent Variables	Research Results
Covin and Slevin, (1988)	EO	Organizational structure	Firm performance	EO top management style positively affects performance of organically structured firms.
Covin and Slevin, (1989a)	Strategic posture and organization structure	Environmental hostility	Firm performance	-In hostile environment, firms' performance benefits from an entrepreneurial strategic posture. -In benign environments, firms' performance benefits from a conservative strategic posture.
Covin and Slevin, (1990)	Strategic posture and organization structure	Stage of industry life cycle	Firm performance	-Industry life cycle moderates the relationship between strategic posture and performance.
Covin, Slevin, and Schultz (1994)	Strategic posture, organizational structure and competitive marketing tactics	Strategic mission	Firm performance	-Strategic mission moderates the relationship between management decisions and firm performance. -Entrepreneurial strategic postures are greater for more build-oriented strategic missions than for less build-oriented strategic missions.
Becherer and Maurer (1998)	EO, marketing orientation	Environmental turbulence and environmental hostility	Firm performance	-EO positively impacts firm performance. -Environmental turbulence and hostility quasi-moderate the relationship between marketing orientation and EO.
Barrett and Weinstein, (1998)	-EO, firm flexibility and market orientation		Firm performance	-EO, flexibility, and market orientation are all positively correlated with each other and with firm performance.

Note * based on Engelen, Kube, Schmidt and Flatten (2014)

Table 5 (contd.)

Author(s) (Year)	Independent Variables	Contingency Variable	Dependent Variables	Research Results
Zahra and Garvis, (2000)	International corporate entrepreneurship (ICE)	Environmental hostility	Firm performance	-There is a positive relationship between EO and firm performance. -Environmental hostility has a curvilinear moderating effect on the ICE and performance relationship.
Lee, Lee and Pennings (2001)*	EO, technological capabilities, social capital and financial resources	External networks	Firm performance	-EO positively affects to firm performance
Lumpkin and Dess (2001)	Proactiveness and competitive aggressiveness	Environmental dynamism, environmental hostility and stage of industry life cycle	Firm performance	-Proactiveness is positively related to performance in dynamic environment. -Competitive aggressiveness is poorly related to performance in the mature stages of an industry.
Wiklund and Shepherd (2003)	Knowledge-based resources	EO	Firm performance	-EO enhances the positive relationship between knowledge-based resources and firm performance. -EO positively affects firm performance.

Note * based on Engelen, Kube, Schmidt and Flatten (2014)

Table 5 (contd.)

Author(s) (Year)	Independent Variables	Contingency Variable	Dependent Variables	Research Results
Dimitratos et al., (2004)	EO	Domestic environment and foreign environment	International performance	There is a positive relationship between entrepreneurship and international performance that is positively moderated by the level of uncertainty in the domestic country.
Richard, Barnett, Dwyer and Chadwick (2004)	Cultural diversity (race and gender)	EO	Firm performance	Innovativeness positively and risk-taking negatively moderate the nonlinear relationship patterns between racial and gender heterogeneity and firm performance.
Wiklund and Shepherd (2005)	EO	-Environmental dynamism and access to financial capital	Firm performance	-EO positively influences firm performance. -EO positively influences firm performance when companies face severe constraints like limited financial resources and a sTable environment.
Lumpkin, Wales, and Ensley (2006)	EO .	Firm age	Revenue and employee growth	-Age negatively moderates the relationship between risk-taking and performance. -Age positively moderates the relationship between competitive aggressiveness and proactiveness and between aggressiveness and performance

Note * based on Engelen, Kube, Schmidt and Flatten (2014)

Table 5 (contd.)

Author(s) (Year)	Independent Variables	Contingency Variable	Dependent Variables	Research Results
Covin, Green and Slevin (2006)	EO	-Participation in strategic decision-making, mode of strategy formation And strategic learning from failure	Firm performance	-The EO–performance relationship is more positive when firms employ autocratic decision-making and exhibit an emergent strategy-formation process. -The EO–performance relationship is positive.
Walter, Auer, and Ritter (2006)	EO	Network capabilities	Firm performance	-A spin-off's EO fosters competitive advantages. -Network capabilities strengthen the relationship between EO and spin-off performance.
Runyan et al. (2008)	-EO -Small business orientation	-Longevity	Firm performance	-EO and small business orientation are unique constructs. -EO is positively associated to the firm performance of only younger firms. -Longevity moderates the relationships of EO and of SBO to small business performance.
Stam and Elfring (2008)	EO	-Intra-industry social capital -Extra-industry social capital	Firm performance	-Bridging ties positively moderates the EO–performance relationship. -For firms with high levels of bridging ties, the EO–performance relationship is stronger when network centrality is high.

Note * based on Engelen, Kube, Schmidt and Flatten (2014)

Table 5 (contd.)

Author(s) (Year)	Independent Variables	Contingency Variable	Dependent Variables	Research Results
Moreno and Casillas, (2008)	EO	-Environmental dynamism -Environmental hostility -Expansion based on new products and technology -Availability of resources	Firm growth strategy	-There is no significant relationship between EO and firm growth. -Greater EO favors the use of expansion strategies.
Richard et al., (2009)	EO	-CEO's position tenure -CEO's industry tenure	Firm performance	-EO positively affects firm performance. -CEO's industry tenure positively and CEO's position tenure negatively moderate this relationship
De Clercq, Dimov and Thongpapanl, (2010)	EO	Firm performance	-Internal social exchange processes	-EO is positively linked to firm performance. -The EO–performance link is stronger for higher levels of procedural justice, trust, and organizational commitment and when the organization's social context comes closer to an "ideal."
Su, Xie, andLi, (2011)	EO	-Firm type (new venture vs. established firm)	Firm performance	The EO–performance relationship has an inverse U shape in new ventures but is positive in established firms.
Chirico, Sirmon, Sciascia, and Mazzola, (2011)	EO	-General involvement -Participative strategy	Firm performance	-EO and participative strategy have positive effects on performance. -EO and generational involvement interact to affect performance negatively.

Table 5 (contd.)

Author(s) (Year)	Independent Variables	Contingency Variable	Dependent Variables	Research Results
Kraus, Rigtering, Hughes, and Hosman, (2012)	EO	Market turbulence	SME business performance	-Only proactiveness has a direct impact on performance. -The interaction of innovativeness with turbulence is significantly positive. -The interaction of risk taking with turbulence is significantly negative.
Anderson and Eshima, (2013)	EO	-Firm age -Intangible resources	SME firm growth	-The relationship between EO and firm growth is strongest among younger SMEs. -Higher levels of intangible resources relative to industry rivals positively strengthen the EO–performance relationship. -The relationship between EO and firm growth is strongest among younger SMEs that have higher levels of intangible resources than their peers.
Engelen, Gupta, Strenger and Brettel (2015)	EO	Transformational leadership behavior	Firm performance	-EO is positively associated with firm performance. -This relationship is positively moderated by four transformational behaviors, regardless of national setting. -The higher top management scores on all transformational leadership behaviors, the greater EO's performance consequences

acquisition or assimilation of new knowledge to the firm but also to the firm's ability to exploit and apply commercial ends. ACAP is a dynamic (Van den Bosch, Volberda, and de Boer, 1999; Floyd and Lane, 2000; Zahra and Georgre, 2002) that acts mostly relevant to EO. Gaining new knowledge enhances firms engaging in various types of entrepreneurial activities and then allow them to successfully exploit new opportunities in markets differently. To implement uncertain entrepreneurial activities, renewing a firm's resources and capabilities maximizes their full potential for EO (Eisenhardt and Martin, 2000; Engelen, Kube, Schmidt, and Flatten, 2014b).

Since the publication of Cohen and Levinthal (1989) work on knowledge , empirical studies have analyzed firms' capacity to absorb knowledge in different units of analysis as shown in Table 6. For example, firm level (Gold, Malhotra, and Segars, 2001; Caloghirou et al., 2004; Liao, Fei, and Chen, 2007; Delmas, Hoffmann, and Kuss, 2011; unit level (Tsai, 2001) and dyadic level (Lane et al., 2001; Chen, 2004). Moreover, and in a variety of research fields such as innovation management (Liao et al., 2007; Kostopoulos, Papalexandris, Papachroni, and Ioannou, 2011; Moilanen, Østbye, and Woll, 2014), organizational learning (Lane, Salk and Lyles, 2001; Tsai; 2001), knowledge management Gold et al., 2001; Caloghirou et al., 2004), and strategic management (Chen 2004; Delmas et al., 2011; Flatten et al., 2011)

Using Cohen and Levinthal (1990) original definition, Zahra and George (2002) provided a distinction between potential and realized absorptive capacity. The term *potential absorptive capacity* (PACAP) refers to the capacity to acquire and assimilate knowledge. PACAP encompasses deriving new insights and consequences from the combination of existing and newly acquired knowledge and incorporating

transformed knowledge into operations (Zahra and Georgre, 2002). Realized absorptive capacity (RACAP) involves the transformation and exploitation of capabilities. Therefore, a firm's knowledge ACAP does not simply depend on the ability to interface with the external new knowledge from the environment only, but ACAP also depends on transfers of knowledge across and within subunits (Cohen and Leventhal, 1990), and firms can exploit it and apply it for commercial benefits. Thus, the definition of Cohen and Leventhal, (1990) is a context-specific concept that explains why knowledge ACAP enhances entrepreneurial processes to increase firm performance.

Comparing between knowledge ACAP literature and medical device evidence, this research found that scholars investigated the extent to which acquiring new knowledge enhances innovation capability. Based on knowledge ACAP literature, firms with a high level of knowledge ACAP are likely to have a better understanding of the new knowledge and to harness new knowledge from other firms to help their innovative activities (Tsai, 2001; Makhija and Ganesh, 1997). Without such capacity, firms are hardly able to learn or transfer knowledge from outside. On the other hand, firms can assimilate new knowledge more effectively if they possess a high level of knowledge ACAP (Chen, 2004). Based on the medical device evidences, Caloghirou et al. (2004) found that seeking new ideas from scientific or business

Table 6 Knowledge ACAP and Firm Performance Relationship

Authors (Year)	Level of Analysis	Research Objectives	Samples/Methods	Performance Outcomes
Lane et al., (2001)	Dyadic (IJVs)	To propose and test a model of IJV learning and performance that segments ACAP into the three components originally proposed by Cohen and Levinthal (1990).	Resurveying the IJVs studied by Lyles and Salk (1996) 3 years later (47 IJVs).	The results suggest that. trust and management support from foreign parents are associated with IJV performance but not learning
Gold et al., 2001)	Firm	To examine the issue of effective knowledge management from the perspective of organizational capability.	Over 300 senior executives.	ACAP as a set of (acquisition, conversion, application) and protection are “precondition” for effective knowledge management.
Tsai (2001)	Business unit	To determine the effectiveness of interunit learning and knowledge transfer	60 business units	They find that the interaction between absorptive capacity and network position has significant, positive effects on business unit innovation and performance.

Table 6 (Contd.)

Authors (Year)	Level of Analysis	Research Objectives	Samples/Methods	Performance Outcomes
Caloghirou et al., (2004)	Firm	To investigate the extent of existing internal capabilities of firms and their interaction with external sources of knowledge affect their level of innovativeness.	558 manufacture firm in seven countries.	They find the importance of the capability of the firm to recognize, assess and exploit information and knowledge outside its boundaries in the generation of innovation.
Chen (2004)	Strategic Unit	To examine the effects of knowledge attribute, alliance characteristics, and firm's absorptive capacity on the performance of knowledge transfer.	137 alliance cases.	They find that knowledge transfer performance is positively affected by the explicitness of knowledge and firm's absorptive capacity; that equity-based alliance will transfer tacit knowledge more effectively while contract-base alliance is more effective for the transfer of explicit knowledge.

Table 6 (Contd.)

Authors (Year)	Level of Analysis	Research Objectives	Samples/ Methods	Performance Outcomes
Liao et al., (2007)	Firm	Investigates the relationships between knowledge sharing, absorptive capacity, and innovation capability	170 Taiwanese knowledge intensive firms	They find that absorptive capacity is the intervening factor between knowledge sharing and innovation capability. It also shows that knowledge sharing has a positive effect on absorptive capacity, and that a completely mediating model exhibits both model generalization and extension characteristics through multiple model comparison in different industry population samples.
Delmas et al., (2011)	Firm	To analyze the organizational capabilities that underlie a firm'sability to generate competitive advantage from the adoption of proactive environmental strategies.	157 German chemical firms	Knowledge ACAP was a link between proactive environmental strategies to corporate performance.

Table 6 (Contd.)

Authors (Year)	Level of Analysis	Research Objectives	Samples/Methods	Performance Outcomes
Flatten, Greve and Brettel (2011)	Firm	To investigate the relationship between ACAP and firm performance in small and medium-sized enterprises (SMEs) is mediated by strategic alliances	345 research-intensive Firm of the German	They find that strategic alliances of SMEs mediate both the relationship between ACAP and firm performance and the relationship between each dimension of ACAP and firm performance.
Kostopoulos et al., (2011)	Firm	To examines the role of absorptive capacity as both a mechanism to identify and translate external knowledge to achieving superior innovation and time-lagged financial performance.	461 Greek enterprises	They find that external knowledge inflows are directly related to absorptive capacity and indirectly related to innovation. Absorptive capacity contributes, directly and indirectly, to innovation and financial performance

Table 6 (Contd.)

Authors (Year)	Level of Analysis	Research Objectives	Samples/Methods	Performance Outcomes
Moilanen et al., (2014)	Firm	To investigate the relationship between external knowledge, absorptive capacity (AC) and innovative performance for small and medium-sized enterprises(SMEs)	552 Norway firm	They find that external knowledge inflows have a much stronger direct effect on innovation performance for non-R&D firms and leave a weak mediating effect of AC.

journals retain a positive relationship in innovation. They argued that publications in journals constitute a mechanism of knowledge diffusion. Additionally, knowledge ACAP enhances commercialization success when firms know how to diffuse new knowledge throughout the firm. Prior literature showed that path dependence and prior related knowledge act as critical criteria on firm success in innovation. Cohen and Levinthal (1990) argued that the ability of a firm to recognize the value of new, external information, to assimilate it, and to apply it to commercial ends is critical to its innovation capabilities. They have suggested that knowledge ACAP is mainly a function of prior related knowledge and intensive efforts. In turn, the development of ACAP and innovation performance is path-dependent, that is, cumulative knowledge from previous R&D. Accordingly, the lack of investment in an area of expertise early on may lead to NIH syndrome or may stop the invention a technical capability in that area. Hence, knowledge-based resources play an essential role in the firm's ability to be entrepreneurial (Galunic and Eisenhardt, 1994). However, the linking chain between knowledge ACAP and firm performance is not clear within the medical device context.

In line of this reasoning, this research puts forward the following research question:

Research question 2: How important is knowledge ACAP within the medical device industry?

2.4.2 The Knowledge ACAP, EO, and Firm Performance

EO and performance need knowledge ACAP. Scholars have discussed how and why knowledge ACAP influences firm entrepreneurial action differently and whether EO and ACAP have a complementary effect on firm performance in the medical device industry.

The knowledge-based view considers firms (Kogut and Zander, 1992) as elements characterized by knowledge as the main determinant of success.(Spender, 1996; Grant, 1996). Knowledge determines a firm's capacity to conceive new ideas, configure resources differently, and develop innovative strategies and effective product offerings. Entrepreneurship is mostly seen as a process recombination of resources and knowledge flows allowing an individual or an organization to meet a market need by introducing and selling a new good, new service, raw material, or organizing method delivering superior value (Ardichvili, Cardozo, and Ray, 2003; Shane and Venkataraman, 2000; Sciascia et al., 2014). Entrepreneurial opportunities are seen as a collective of individuals' beliefs about the relative value of resources and the potential to transform them into a different state (Sciascia et al., 2014). In turn, these different beliefs depend on information asymmetries and differences in the ability to recognize the value of new knowledge to be acquired, assimilated, transformed, and applied to commercial ends.

Asymmetry of information owned among firms affects differences in the firm's ability to recognize the value of new knowledge to be acquired, assimilated, transformed, and applied to commercial ends (Alvarez and Busenitz, 2007; Sciascia et

al., 2014) or knowledge ACAP. Firm's knowledge ACAP may influence the quality of entrepreneurial behavior (Sciascia et al., 2014). However, entrepreneurial behavior may not be transformed into high performance if the access to external knowledge cannot be compatible with firms' prior related knowledge, lack of ability to utilize external knowledge, and appropriability conditions.

For prior related knowledge, (Cohen and Levinthal (1990) suggested that the degree of external knowledge specialization determines the extent of a firm's absorption and assimilation. The firm must have the same expertise or prior related knowledge as the specialized knowledge that the firm needs to absorb (Jansen, Van Den Bosch, and Volberda, 2005). The complexity of the knowledge to be assimilated and the degree of the firm's concerns of outside knowledge determine the degree of similarity of the firm's prior related knowledge and diversity of background. For example, external scientific and technological knowledge require specific characteristics of prior and diverse knowledge within the firm to absorb and share this external knowledge throughout the firm (Liao et al., 2007). Hence, the degree of external knowledge absorption and assimilation determines the degree of cumulative knowledge ACAP. As such, if external knowledge is far from a firm's knowledge base, the firm might resist absorbing the new external knowledge.

The "not invented here" (NIH) syndrome is defined as firms' resistance to accepting innovative ideas from the environment (Cohen and Levinthal, 1990) greater attention to external sources may result in internal resistance from at least some of the company's technical staff (Laursen and Salter, 2006). Moreover, a firm's ability to assimilate and exploit existing knowledge from the external environment increases its ability to imitate new processes or product innovations and increase its ability to

exploit firm existing or internal R&D capacity. Hence, does NIH syndrome affect entrepreneurial firm performance? As a result, prior related knowledge and NIH syndrome provide a rational on why its entrepreneurial behavior may not be transformed to high performance.

Knowledge ACAP not only has a function on acquiring new external knowledge effectively but also depends on transfers and integration between new knowledge and existing knowledge among subunits within a firm. Thus, high levels of ACAP do not guarantee a firm's performance success because of the distinctiveness of a knowledge-intensive firm (Cohen and Levinthal, 1990). A medical device manufacturing firm relies on a firm's prior knowledge and path dependence because it affects the acquisition of medical-related knowledge and the assimilating process of new external knowledge (Cohen and Levinthal, 1990) to create commercial benefits. This points out the importance of ACAP as a context- and path-dependent capability that should not be separated from its context (Lane et al., 2006).

Table 7 demonstrates that scholars provide the rational on knowledge ACAP influences the dimensional of EO (Engelen et al., 2014b; Sciascia et al., 2014; Hernández-Perlines and Xu, 2018). New external knowledge acquiring and assimilating of the knowledge through a firm influence the quality of the entrepreneurial behavior (Sciascia et al., 2014). Firm may be proactive, innovative, and risk-taking although the amount and quality of the external knowledge will be acquired and assimilated. However, entrepreneurial behavior may not be converted into high firm performance if the external knowledge is limited, especially for the available innovative external knowledge (Grimpe and Sofka, 2016). Specialization of knowledge external knowledge (Karim and Mitchell, 2000), make product launched

without carefully identified an understanding of the market conditions may result in an unsuccessful project (Sciascia et al., 2014).

In other words, taking risks without quickly interpreting industry conditions can result in failure particularly in a sTable industry whose conditions can easily be understood by competitors (Sciascia et al., 2014). As a result, being proactive without accurately understanding the competitive situation may make a firm react inappropriately (Engelen, Kube, Schmidt and Flatten, 2014). As a result, firm planning aiming to improve external knowledge acquisition and assimilation will improve a firm's ability to identify successful entrepreneurial opportunities (Sciascia et al., 2014; Hernández-Perlines and Xu, 2018).

Empirical evidence has provided rationale on the knowledge ACAP–EO relationship. Scholars such as Sciascia et al. (2014) and Hernández-Perlines and Xu (2018) found that ACAP strengthens the EO-performance relationship. However, Wales et al., (2013) found that ACAP enhances financial gains at lower levels of ACAP and mitigating the decline in financial performance at higher levels of ACAP. Wiklund (1999) suggested that EO characteristics such as proactive behavior provides firms the ability to present new products/services to the market ahead of competitors, which also gives them a competitive advantage that leads to improved financial results. The aggressiveness to compete with competitors might not improve financial performance in the case of resource constraints because it prevents small firms from pursuing cost leadership or differentiation strategies (Porter, 1985). Evidence of both EO and knowledge ACP provides rationales on why knowledge ACAP.

Table 7 Empirical Studies of EO, Knowledge ACAP and Firm Performance

Author(s) (Year)	Independent Variables	Dependent Variables	Contingency Variable	Research Results
Wales et al., (2013)	Knowledge ACAP	Firm performance	EO	-An inverted-U shaped relationship between ACAP and financial performance. -EO moderates the ACAP-performance relationship, enhancing financial gains at lower levels of ACAP and mitigating the decline in financial performance at higher levels of ACAP.
Sciascia et al., (2014)	EO	Firm performance	Knowledge ACAP	EO has a positive effect on firm performance when coupled with high levels of both Potential and Realized Absorptive Capacity
Engelen et al., (2016)	EO	Firm performance	CEO narcissism	-EO is positively associated with firm performance. -This relationship is weakened when the CEO has narcissistic traits.
Hernández-Perlines and Xu, 2018)	EO	International performance	Knowledge ACAP	-International performance of family businesses is determined, to a great extent, by the entrepreneurial orientation. In addition, this effect is reinforced by the absorption capacity, exerting a positive moderating role.

stimulates entrepreneurial actions and firm performance; however, there are some theoretical gaps to pursue

According to Lumpkin and Dess (1996), five multidimensional of EO have an independence effects on performance. Moreover, Rauch et al. (2009) asserted that entrepreneurship should investigate additional dimensions suggested in the literature, such as competitive aggressiveness and autonomy, because they may produce different relationships with performance. Hughes and Morgan (2007) found that competitive aggressiveness and autonomy appear to hold no business performance value at this stage of firm growth. Moreover, Hughes and Morgan (2007) called for an investigation on what and how the extent of competitive aggressiveness and autonomy hold firm performance value. Lumpkin and Dess (1996) highlighted that very young firms might exhibit dependency on innovativeness and risk-taking, for example, more than older and larger firms which may require greater autonomy to achieve improved performance. Thus, some dimensions such as autonomy are being investigated. In addition, comparison among studies could not be possible, as scholars study in the same context but have different approaches to define the meaning of EO (Engelen et al., 2014a). Hence, the extent to which independence and several dimensions of EO are applied in the studies varies depending on the context. Taken together, based on the context of the medical device industry, existing evidence is scarce and might not accurately provide a theoretical explanation on how to improve firm performance through entrepreneurial actions and knowledge ACAP.

In line of this reasoning, this research puts forward the following research question:

Research question3: How are EO and knowledge ACAP complementary within the medical device industry?

According to Figure 2 shows that the relationship between variables has no clear boundaries about how each variable in this context is related under unexplored context; medical device industry.

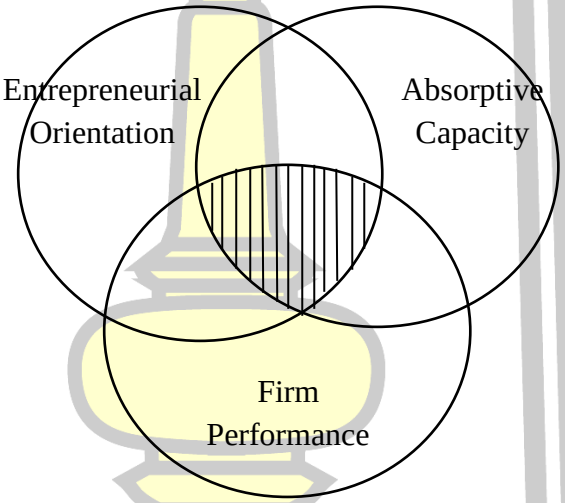


Figure 2 Unclear Boundaries under Unexplored Context

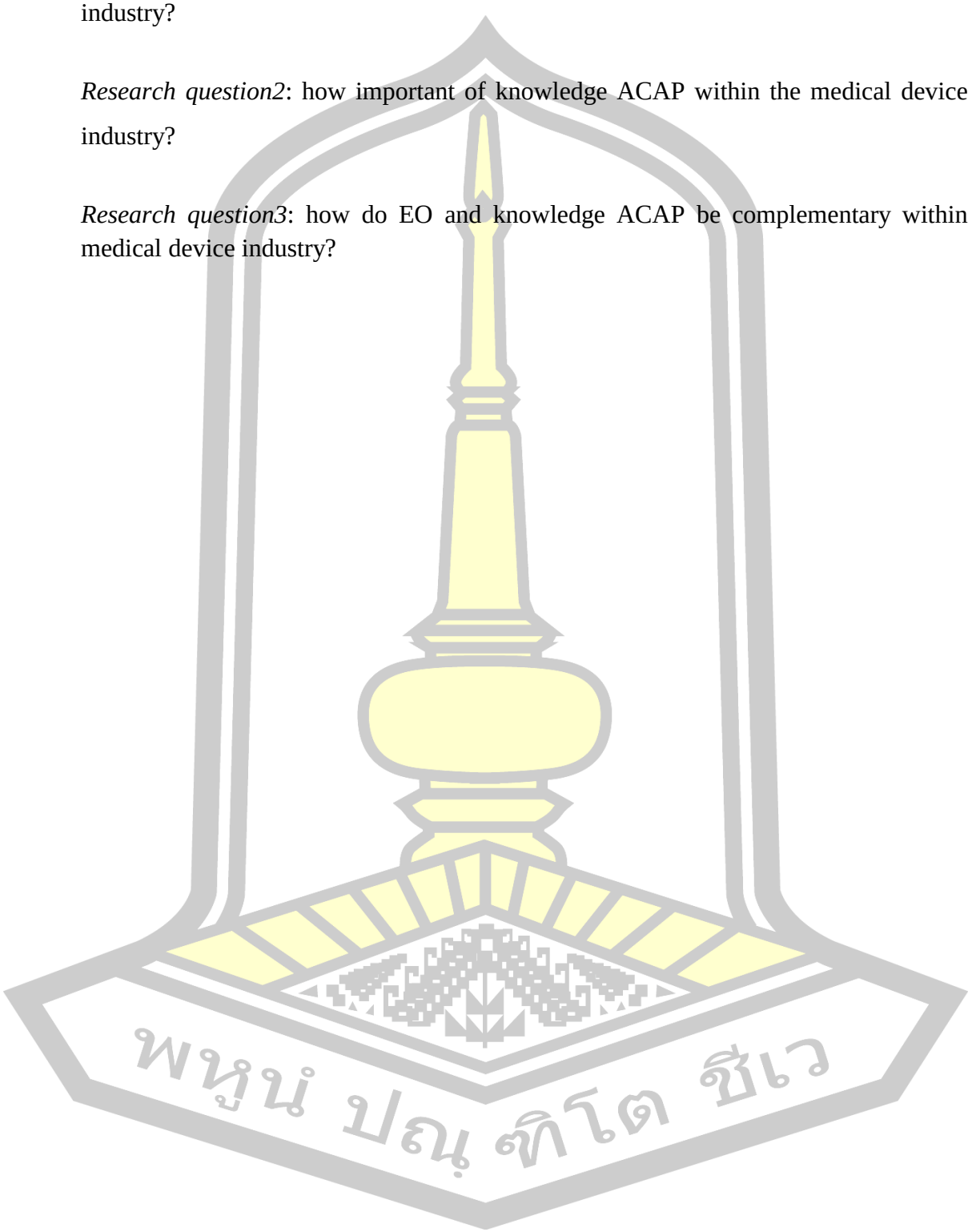
2.5 Research Questions

Based on the literature review, it was found that prior evidences have not been provided clear research model to support the relationship among variables studied in the context of the medical device industry. Broad research questions as followed helps to guides to hypothesis setting in chapter 4. Below are research questions in summary:

Research question1: what is a key characteristic of EO within the medical device industry?

Research question2: how important of knowledge ACAP within the medical device industry?

Research question3: how do EO and knowledge ACAP be complementary within medical device industry?



CHAPTER III

RESEARCH METHODOLOGYS

The previous chapter discusses the literature relevant to the conceptualizations of entrepreneurial orientation, knowledge ACAP and the related constructs. This chapter presents the way in which research was operationalized. This study concerns about the context of studies in EO research. Hence, this research takes both inductive and deductive approach to guide the research design and the method for data collection. Hence, research takes a constructivist paradigm and positivism, whereby an inductive approach and a qualitative research approach are adopted to guide the research hypotheses.

Figure 3 shows the mixed method research design of this study.

3.1 Research Paradigm

Denzin and Lincoln (2011) have claimed that all research is directed by a set of beliefs and feelings about the world that determine what the inquiry is and how the research is practiced. These references groom a paradigm, an interpretive framework. This point is relevant to Guba (1990) stated that ‘ research is a basic set of beliefs that guide action’. In other words, the chosen paradigm has impacted on the researchers according to what should be done, how research should be delineated, and how results should be analyzed and interpreted (Brymman and Bell, 2007).

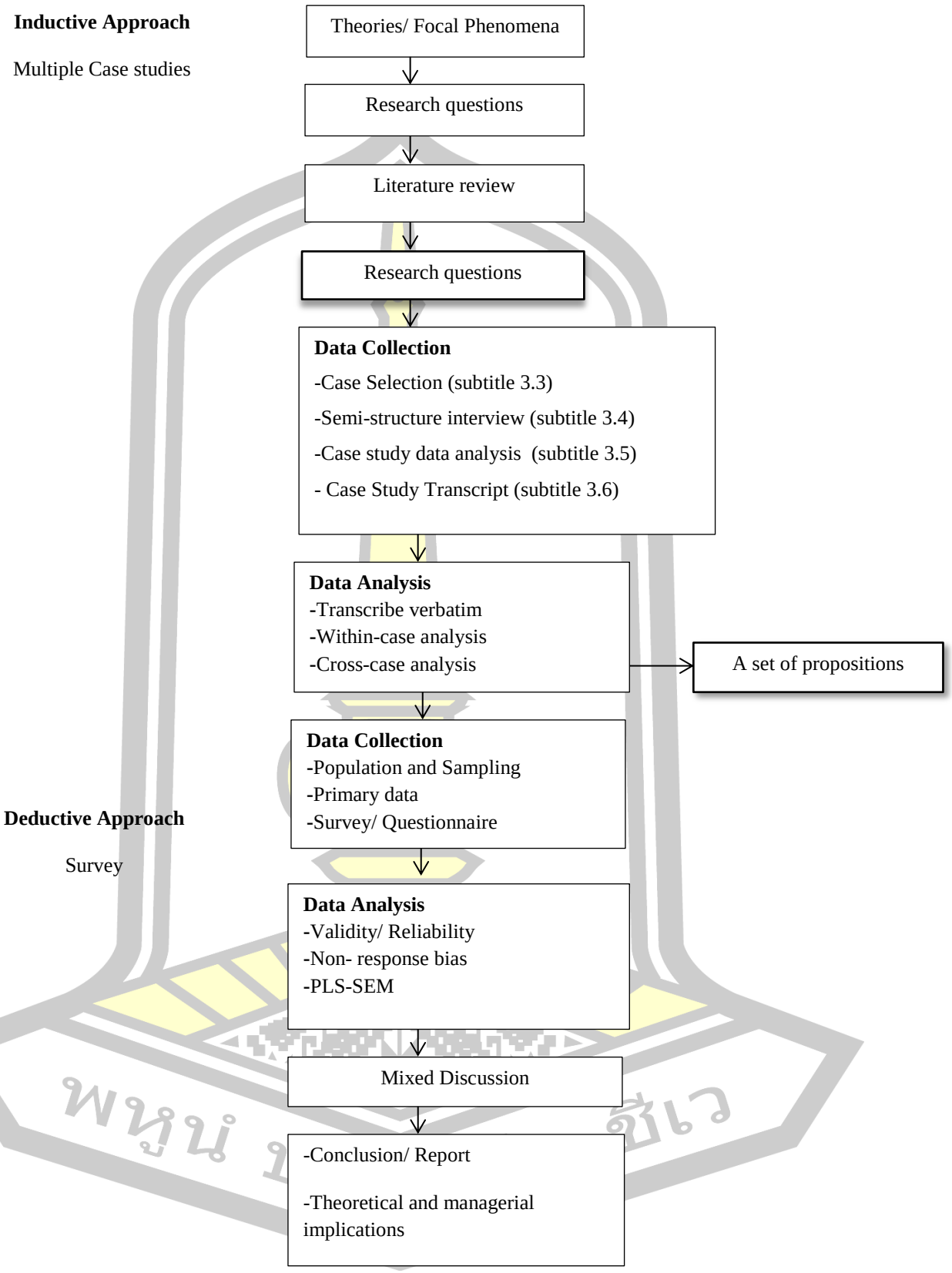


Figure 3 Research Design

The three main principles of paradigm distinctiveness are composed of ontology, epistemology, and methodology. Ontology, the philosophical study of the nature of being, existence, or reality and their relations, is the stance towards reality. Epistemology is the philosophy of knowledge or of how we come to know the relationship between the researcher and what is being researched. Lastly, methodology is concerned with how we come to know, but is much more practical in nature. Accordingly, methodology is focused on the specific ways of the research process, the methods, for gathering knowledge about the world. Epistemology and methodology are closely related: one involves the philosophy of how we come to know the world and the other involves the practice.

The research paradigm begins with two contrary philosophical positions namely positivism and social constructionism (Brymman and Bell, 2007). Positivism is a philosophy of science underlying the perspective that in the social as well as a natural science, information derived from sensory experience, logical and mathematical treatments of such data are together the exclusive sources of all authoritative knowledge. In other words, positivism assumes that there is a reality out there to be studied, captured and understood. That is, ontologically, the reality of positivism research is external and objective while the epistemological assumption of the positivistic research is that "knowledge is only of significance if it is based on observations of this external reality" (Easterby-Smith and Thorpe, 2002). In other words, the positivistic researcher assumes the role of an objective analyst, making detached interpretations about the data independent of informants. Hence, a deductive approach to measuring the concept being studied by quantitative data is emphasized and verification of hypotheses are subjected to empirical tests, in order to prove or

disprove the hypotheses under carefully controlled conditions (Easterby-Smith and Thorpe, 2002; Guba, 1990). In contrast, the ontological assumption concerning categories of being assumed in social constructionism is that “reality is not objective and exterior, but is socially constructed and given meaning by people” (Easterby-Smith and Thorpe, 2002). Thus, epistemologically, the social reality within this paradigm is identified by the social actors referring to individuals that their actions or reactions take into account rather than objective and external factors. In other word, exponents of the constructivist paradigm subsume that there are multiple realities, which are dependent for the form and content on the persons who hold them. Thus, the inductive approach to understanding what the actors are thinking and feeling and feeling regarding the research focus is emphasized.

3.1.1 Social Constructionism and Positivism

As discussed in the previous section, the research paradigm begins with two contrary philosophical positions namely positivism and social constructionism (Brymman and Bell, 2007; Easterby-Smith and Thorpe, 2002; Guba, 1990). Positivism is a philosophy of science underlying the perspective that in the social as well as a natural science, information derived from sensory experience, and logical and mathematical treatments of such data, are together the exclusive source of all authoritative knowledge. In other words, positivism assumes that there is valid knowledge (truth) merely in scientific inquiry. Accordingly, the positivist paradigm is assumed that there is a reality out there to be studied, captured and understood. That is, ontologically, the reality of positivistic research is external and objective while the

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taken part in what is being studied and the interpretations of the observations emerge from the actors themselves.

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3.1.2 The Constructionism Paradigm and Research Strategy

Guba (1990) argued that the paradigms of the positivism and social constructionism are not in the competition each other, but rather provide their specific characteristics to research and that the choice of the research paradigm should belong to the questions that are to be studied. Therefore, a proof of the hypothesis and generalizations is attributed to positivistic paradigm research and an explanation of how and why the relationships are developed and evolved, is generated from the constructivism paradigm, and as such, both are valid forms of inquiry. To address the research questions in this study rather than to investigate the subjective meaning of emerging inter-relationships among variables, a positivistic paradigm was assumed so as to undertake a deductive approach to test the hypothesized relationships underlying the linkages between entrepreneurial orientation, knowledge absorptive capacity and firm performance. Several research designs have been identified as being appropriate for use in quantitative or qualitative research, including: (a) survey research, (b)

experimental design and (c) the case study (Brymman and Bell, 2007; Easterby-Smith and Thorpe, 2002) and each of these is discussed below.

First, survey research is widely employed in social science studies, and its successful use depends on a highly structured approach to data gathering (Bryman, 2004). It works best if the researchers know what kind of information is needed for providing the explanation according to the phenomena of interest and if the provisional questions can be standardized so as to assure that questions convey the same meaning for the different respondents (Bryman, 2004). Thus, consistency in terms of the reliability of the measure, and measurement validity that has been created for a concept really does reflect the concept that it is supposed to be denoting, are major challenges for the researcher when drawing any conclusions from the study (Bryman, 2004; Brymman and Bell, 2007). Consistently, researcher's needs to have a clear understanding of the measurements associated with the issues of interest and are created to choose well-tested measures to improve the measure validity. Furthermore, carrying out a pilot survey, gaining access to a large sample size in relation to the target population and deploying an appropriates sampling method, are crucial for improving the stability of the measure and for raising the levels of confidence with which the researcher can generalize study outcomes to a wider population (Brymman and Bell, 2007). In addition, the category survey research can be divided into cross-sectional and longitudinal designs, with the one referring to a survey in which the collection of all the data in connection with the study occurs at a single point of time, whereas the other involves a process whereby the sample is surveyed and then surveyed again on at least one further occasion (Brymman and Bell, 2007). Consequently, using cross-sectional survey data it is only possible to examine the

pattern of association among the studied variables, whereas extending the research to make the data longitudinal allows for observation of changes and causal influences regarding the variables over time. To this end, it was not the objective of this study to investigate the linkages of those constructs using sample taken.

Second, the purpose of experimental design research is to examine the experimental manipulation of an independent variable by comparing two samples, one receiving the treatment (the experimental group) and the other not receiving the treatment (the control). The dependent variable is measured before and after the experimental manipulation and any different variable. The presence of a control, coupled with a random process of assignment to the experimental and control groups enhances the internal validity of the research so that conclusions regarding a causal relation existing between the independent and dependent variables can be drawn more confidently. In addition, experimental design is most appropriate when a test of single or few treatments are applied in the manipulation process, regarding the independent variables, in order to elicit the link between this treatment/s and the dependent variable. Accordingly, the experimental approach appeared not to offer an effective choice of research design for application in this investigation.

Third, the case study approach is similar to survey research, but differs in its focus (Brymman and Bell, 2007). Case study research approach is one of several form of social science research. Doing case study research would be the preferred method, compared to the others, in situations when (1) the main research questions are “how” or “why” questions; (2) a researcher has little or no control over behavioral events; and (3) the focus of study is a contemporary phenomenon. As discussed, a case study

investigates a contemporary phenomenon (the “case”) in its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident. In addition, case study design and data collection features, such as how data do triangulation; help to address the distinctive technical condition whereby a case study will have more variables of interest than data points (Yin, 2013). With the case study, the case, either in the form of an organization, event, people or location, is the object of interest or researchers taking this approach normally emphasize to provide an in-depth illustration of the unique features of the case. Whereas the main focus of the survey research approach is to examine the pattern or causal relationships of the study variables (Denzin and Lincoln 2011). In summarize, Table 8 provides the importance of each selected research method and form of research question.

Table 8 Different Research Methods with Different Forms of Research Questions

Method	Form of research question	Requires control of behavioral events?	Focuses on contemporary events?
Survey	Who, what, where, how many, how much?	No	Yes
Experiment	How, why?	Yes	Yes
Case study	How, why?	No	Yes

Note: Adapted from Yin (2013)

To address three research questions in the present research; how and why do entrepreneurial orientations and knowledge absorptive capacity contribute to firm performance. Hence, this research deems it most appropriate to adopt the case study research design, Based on (Yin, 2013) , “how” and “why” are more explanatory and

likely to lead to the use of case study as the preferred research method. This is because such questions deal with operational links needing to be traced overtime, rather than mere frequencies or incidence. Hence, this research method is relevant to research question (1) In addition, if research questions focus mainly on “what” questions, either of two possible methods such as survey and experiment) arises. Yin, (2013) suggests that some types of “what” questions are exploratory, for example “what can be learned from a study of startup business?” This type of question is a justifiable rationale for conducting an exploratory study, the objective being to develop pertinent hypotheses and research methods for further inquiry. Accordingly, researcher has adopted the case study research design to answer research question (2) and then developed theoretical hypotheses for future research agenda.

In summary, the most important condition for differentiating among the various research methods is to classify the type of research question being asked. This research deemed it most appropriate to adopt the case study research design. For research question (1), “How” question is likely to favor using a case study as discusses; research question “why” question, in this research, can be used exploratory case study research as explained.

3.2 Case Study Research

The nature of case study research comprises comprise two-fold Yin (2013) (1) a case study is an empirical inquiry that investigates a contemporary phenomenon (the “case”) in-depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident; and (2) a case study

inquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result. Case study relies on multiple sources of evidence, with data needing to converge in triangulate fashion, and as another result. In essence, the twofold definition-covering the scope and features of a case study- shows how case study research comprises an all-encompassing method-covering the logic of design, data collection techniques, and approaches to data analysis.

This research adopts multiple-case study research based on Yin (2013) that suits for this research to gain insight knowledge and deep understandings especially on the entrepreneurial orientation and absorptive capacity on medical manufacturing firm. In a multiple case study, researchers are examining several cases to understand the similarities and difference between cases. Yin (1993) describes how multiple case studies can be used to either, "(a) predicts similar results (a literal replication) or (b) predicts contrasting results but for predictable reasons (a theoretical replication)" (p.47). A qualitative method can be used to obtain the intricate details and deep understandings about a phenomenon and human perspectives such as feelings, emotions, thought processes (Strauss and Corbin, 1990). In addition, a semi-structured interview, within-case and cross-case analysis are the two best possible methods used for data collection, inquiry analysis, and the creation of knowledge.

3.2.1 Different types of case study research

To answer the research questions, qualitative case study research is best answered. Hence, the case and its boundaries have been considered what type of case study will be conducted. Based on Baxter and Jack, (2008)'s study, the authors

describe a variety of case studies that Yin (1993) and Johnson and Stake (1996) use different terms. On the one hand, Yin (2013) categorized case studies as explanatory, or descriptive that also differentiates between single, holistic case studies and multiple- case studies. On the other hand, Johnson and Stake (1996) identifies case studies as intrinsic, instrumental, or collective. Baxter and Jack, (2008) provide the definitions of these case study methods and published examples of these types of case study research as shown in Table 9.

This research adopted multiple-case study research based on Yin (2013) that suits for this research to gain insight knowledge and deep understandings on the entrepreneurial orientation, knowledge ACAP, and performance of the medical device industry in Thailand. In multiple case studies, researcher is examining several cases to understand the similarities and differences between cases.

Yin (1993) describes how multiple case studies can be used to either, "9a) predicts similar results (a literal replication) or (b) predicts contrasting results but for predictable reasons (a theoretical replication). Yin (1993) proposed the case study is a method of choices for investigating a complex interaction a phenomenon and a context. Qualitative method can be used to obtain the intricate details and deep understandings about phenomenon and human perspectives such as feelings, emotions, through process (Strauss and Corbin, 1990). In addition, a-semi structured interview and within-case and cross-case analysis are the two best possible methods used for data collection, inquiry analysis, and the creation of knowledge.

Table 9 Types of Case Study Research and Examples

Case study type	Definition and Published
Explanatory	According to (Joia, 2002), if researcher were seeking to answer a question that sought to explain the presumed causal links in real-life interventions that are too complex for the survey or experimental strategies. For example, to evaluate language, the explanations would link program implementation with program effects (Yin, 2013).
Exploratory	According to Jozkar and Boottorff (2001), exploratory case study is used to explore those situations in which the intervention being evaluated has no clear, single set of outcome.
Descriptive	According to Campbell and Ahrens (1998), a multiple case study enabler the researcher to explore differences within and between cases. The objective is to replicate findings across cases. It is imperative that the cases are chosen carefully so that the researcher can predict similar results across cases, or predict contrasting results based on the theory.
Multiple-case studies	According to (Hellström, Nolan, and Lundh, 2005), Stake (1995) uses the term intrinsic to suggested researchers who have a genuine interest in the case. They should use this approach when the intent is to better understand the case. The purpose is not to come to understand some abstract construct or generic phenomenon. The purpose is not to build theory (although that is an option; Stake, 1995).
Intrinsic	According to Hellström et al. (2005), Stake, (1995) uses the term intrinsic to suggest researchers who have a genuine interest in the case. They should use this approach when the intent is to better understand the case. The purpose is not to come to understand some abstract construct or generic phenomenon. The purpose is not to build theory (Stake, 1995).

Table 9 (Contd.)

Case study type	Definition and Published
Instrumental	According to (Luck, Jackson, and Usher, 2007) it is used to accomplish something other than understanding a particular situation. The case is of secondary interest; it plays a supportive role, facilitating our understanding of something else. The cis often looked at in depth, its contexts scrutinized, its ordinary activities detailed, and because it helps the researcher pursue the external interest (Stake, 1995)
Collective	According to (Scheib, 2003) collective case studies are similar in nature and description to multiple case studies (Yin, 1993).

3.2.2 Research Design

Case study method explains the belief that there are multiple reality cases in the social world, where the participant/ key informant is a knower creating an understanding of a specific inquiry in the natural world. In doing so, the researcher remained aware of the potential drawbacks of taking this approach, particularly regarding the reliability and validity of the measures. However, most of the concepts referred to in this study have well-established measures that have been studied in previous research (e.g., Eisenhardt and Graebner, 2007; Larsson, 1993; Yin, 2013). So many issues regarding the validity of these could be ruled out.

Based on Yin (2013), four tests namely construct validity; internal validity, external validity, and reliability have been commonly used to establish the quality of any empirical social research. The details are as below.

1. Construct validity: identifying correct operational measures for the concepts being studied.
2. Internal validity: seeking to establish a causal relationship, whereby certain conditions are believed to lead to other conditions, as distinguished from spurious relationships.
3. External Validity: defining the domain to which a study's findings can be generalized.
4. Reliability: demonstrating that the operations of a study such as the data collection procedures can be repeated with the same results.

For this case study research, these tests should be applied throughout the subsequent conduct of a case study at its beginning. Table 10 provides how to test.

Table 10 Validity and Reliability Testing for Case Study Research

Test	**Validity and Reliability Testing**
Construct validity	- Use multiple sources of evidence - Establish chain of evidence - Key informants review draft case study report
Internal validity	- Do pattern matching - Do explanation building - Use logic model
External validity	- Use theory in single-case studies - Use replication logic in multiple-case studies
Reliability	- Use case study protocol

3.2.3 Techniques to identify themes

According to (Ryan and Bernard, 2003), theme identification is one of the most fundamental tasks in qualitative research. Explicit descriptions of theme discovery are rarely found in articles and reports, and when they are, they are often relegated to appendices or footnotes. Based on Ryan and Bernard (2003), analyzing text involves several tasks: (1) discovering themes and subthemes, (2) winnowing themes to a manageable few (deciding which themes are important in any project), (3) building hierarchies of themes or code books, and (4) linking themes into theoretical models. This study focuses on the first task: discovering themes and subthemes in texts.

The techniques to identify theme and subthemes range from simple word counts on labor-intensive, line-by-line analyses that, computer record, and only humans can do (Ryan and Bernard, 2003). Scholars described the theme analysis in various manners.

(Opler, 1945) saw the identification of themes as a key step in analyzing cultures, established three principles for thematic analysis. First, he observed that themes are only visible (and thus discoverable) through an expressions in data. Second, some expressions of a theme are obvious and culturally agreed on, while others are subtler, symbolic, and even idiosyncratic. Third, cultural systems comprise sets of interrelated themes. The importance of any theme, he said, is related to (1) how often it appears, (2) how pervasive it is across different types of cultural ideas and practices, (3) how people react when the theme is violated, and (4) the degree to which the number, force,

Strauss and Corbin (2008) suggested that, themes or categories are the classification of more discrete concepts. This classification is discovered when concepts are compared one against another and appear to pertain to a similar phenomenon. The links between expressions and themes are “conceptual labels placed on discrete happenings, events. Thus, the concepts are grouped together under a higher order, more abstract concept called a category.

This study searches themes that appear in texts and refer to particular instances as expressions, behaviors, processes regarding to entrepreneurial orientation, knowledge absorptive capacity, and firm performance. In selecting one set of terms over others, we surely ignore subtle differences, but the basic ideas are just as useful under many glosses.

3.2.4 Identifying key characteristics of dimensionally EO constructs

This study has collected various characteristics. Of EO, and knowledge ACAP to guide in-depth interviews conversation and basically ways to create a theme for analyzing data as well. This study adopted five dimensions according from Lumpkin and Dess (1996) study as an initial to identify the characteristics of five dimensional EO for data analysis. Table 11 – 16 provides the samples of how this present research identifies that proactiveness, risk-taking, competitive aggressiveness, innovativeness, and autonomy. Additional identifying the characteristics of five dimensional EO are provided in appendix A.

3.3 Case Selection

In this study, the researcher relied on both within-case and cross-case analyses. Next, the researcher looked for within-case and cross-case similarities and differences to gain insightful knowledge from research objectives.

Table 11 A Sample of Identifying the Characteristics of Proactiveness

Proactiveness Characteristics	**Author (s)**				
	Wiklund and Shepherd, (2005)	Zahra and Covin, (1995)	Birnbaum, Christensen, and Raynor (2010)	Lumpkin and Dess, (2001)	Rauch et al. (2009)
Involve in new ideas, new products				√	
Take initiative in situations				√	√
Committing to large resources	√	√	√		

Table 12 A Sample of Identifying the Characteristics of Innovativeness

Innovativeness Characteristics	**Author (s)**		
	Rauch et al. (2009)	Hughes and Morgan, (2007)	Dai et al., (2014)
Introduce improvements innovations	√	√	
Creativity in its methods of operation	√	√	
New process and service development			√

Table 13 A Sample of Identifying the Characteristics of Risk-Taking

Risk-taking Characteristics	**Author (s)**				
	Zahra and Covin, (1995)	Miller and Friesen, (1982)	Covin and Slevin, (1988)	Rauch et al. (2009)	Hughes and Morgan, (2007)
Take calculated risks with new ideas		√	√	√	
Seeks out new ways to do things	√				
creative in its methods of operation	√				

Table 14 A Sample of Identifying the Characteristics of Competitive Aggressiveness

Competitive Aggressiveness Characteristics	**Author (s)**		
	Lumpkin and Dess, (2001)	Rauch et al. (2009)	Hughes and Morgan, (2007)
Aggressiveness and intensely competitive	√	√	√
Undo competitor	√	√	√
Bold and aggressiveness to compete		√	√

Table 15 A Sample of Identifying the Characteristics of Autonomy

Autonomy Characteristics	**Author (s)**		
	Rauch et al. (2009)	Hughes and Morgan, (2007)	Lumpkin et al., (2009)
Make and instigate changes	√	√	√
Act and think without interference	√	√	√
Independence to decide on work Lumpkin,	√	√	√

Table 16 A Sample of Identifying the Characteristics of Knowledge ACAP

Knowledge ACAP Characteristics	**Author (s)**	
	Su, Ahlstrom, Li, and Cheng, (2013)	(Liao et al. (2007)
Identifying new and useful knowledge	√	√
Understanding new and useful knowledge	√	√
Valuing new and useful knowledge	√	

The results were demonstrated via narrative scripts from the interviews and compared with the theory(Schuler et al., 2004) and opportunities of gaining potentially new insights emerging from the relationship among EO, absorptive capacity, and firm performance. Two selection criteria were selected: nationality and capital investment. Therefore, five firms were selected in this research.

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1. A medical device manufacturer whose ownership is 100 percent Thai with 100 million baht of capital investment.
2. A medical device manufacturer jointly owned by Thai and foreign firms with 200 million baht of capital investment.
3. A medical device manufacturer whose ownership is 100 percent Thai with 200 million baht of capital investment.
4. A foreign medical device manufacturer whose manufacturing facilities are outside Thailand with over 1,000 million baht of capital investment.
5. A foreign medical device manufacturer whose manufacturing facilities are outside Thailand with over 2,000 million dollars of capital investment.

3.3.1 Case A: Thai manufacturer which produces renal dialysis sterilization machines.

"Case A" sold diagnostic kits and devices for both private and public hospitals in Thailand and abroad. Case A imports goods from overseas and operates as a manufacturer. For manufacturers, the firm primarily focuses on the production of renal dialysis sterilization machines. This machine won the best innovation award in 2013. Nowadays, the firm occupies a 90 percent market share and acts as a market leader in the renal dialysis sterilization machine market. In 1995, case A first imported kidney-related medical equipment from overseas, for example, kidney dialysis machines and kidney dialysis filters. In that time, the firm's maintenance engineer saw that nurses took a very long time to clean kidney dialysis filters for repeated use. Most hospitals do not have an automated wash-and-dry machine to

sterilize kidney dialysis filters because of their high price. Maintenance engineers have been aware of this problem. They consulted the firm's owner, and the owner offered an investment to start the production of reusable kidney cleaners. The first-generation machine took some hardware concepts from machines sold in the market, however; case A developed software through their engineers. Case A has been developing machines with compact design and software development to facilitate a faster clean-and-dry cycle. As a result, nurses can serve patients more quickly and safely. Currently, case A has developed three generations. Development comes from the feedback from their customers and technology change, such as the use of sensor technology to reduce the number of hoses in the machine; as a result, the size is smaller and easy to maintain relative to the previous generation. In 2013, the National Innovation Agency of Thailand awarded case A "The Best Innovation" for its reusable kidney cleaners because it can wash two cylinders simultaneously. It separates the hydraulic system 100 percent with a mixing tank and a filtered fiber volume separator. Therefore, it can reduce the contamination of blood between patients. This machine has a 90 percent market share because it is easy to use and affordable.

3.3.2 Case B: Thai manufacturer of in-vitro diagnostic rapid test kit.

Be ethical, moral, honest, and develop our products and services to the best quality possible" is case B's philosophy. The firm's mission is "to be a leader in medical diagnostic by providing fast and efficient medical results. We promise to

maintain a high standard in every process of production to satisfy our customers." Case B is a company that manufactures and sells diagnostic rapid test kits, both imported and contracted for more than 10 years. Case B aims to be a leader in medical diagnostics by providing fast and efficient medical results. The founder of case B worked as a researcher in a state hospital and saw a problem with radioimmunoassay. Radioimmunoassay analysis needs skilled people, higher cost, and takes longer to get results. The founder saw a business opportunity and started her business with three staff members. They provide RIA analysis service with rapid analysis and lower price. Their way to create business starts from import the diagnostic test kits from abroad and then replacing imports. Quality and cheap price are inspirations and starting points to produce diagnostic kits to sell worldwide.

Table 17 Diagnostic Products Kits Developed From External Research of Case B

Product categories	**Product lists**
Brucellosis disease test kit	Brucella IgG 96T/Kit Brucella IgM 96T/Kit
Dengue test kit	Dengue IgG Indirect 96T/Kit Dengue IgM Capture 96T/Kit Dengue DUO IgM & IgG Capture 192T/Kit JE-Dengue IgM Combo
Human herpesvirus-infected disease test kit	Human Herpesvirus 6 IgG 96T/Kit Human Herpesvirus 6 IgM 96T/Kit
Leptospirosis test kit	Leptospira IgM 96T/Kit
West Nile Virus disease test kit	West Nile Virus IgM Capture 96T/Kit West Nile Virus IgG Capture 96T/Kit

Case B produced the first HIV kit but was unsuccessful because there was no buyer until the U.S. Food and Drug Administration (FDA) saw its quality and registered it with the WHO. Then HIV kits were distributed to Africa. Now, case B produces HIV tests but changed to newer and faster technologies. New kits can detect HIV infections from saliva. Case B is now listed on the U.S. Stock Exchange. Today, case B develops the dengue test kit and sells it worldwide.

3.3.3 Case C: Medical device manufacturer jointly owned by Thai and foreign firms which produces rapid diagnostics test kits in Thailand.

“Case C” is a leading provider of bio-medical business in Thailand with in-vitro diagnostics, life sciences and healthcare products. Case C was established since 2001. Firm's main business is the manufacture of medical diagnostic kits, also known as "rapid diagnostic test". The test kit uses a chromatographic immunoassay technique to detect antibodies or antigens in humans, animals, plants or some components of the substance. In addition, case C also has a manufacturing plant located in the industrial estate, which is an industrial estate that has been awarded the ISO 14001 environmental management standard. The building has been specifically designed for the manufacture and assembly of test kits. Temperature controlled It also has standards, guidelines and procedures for the manufacture of medical devices (GMP for medical devices) and has certified quality management systems for medical devices. Moreover, case C develops application software for hospitals, health centers and hospitals to serve patients in the front office of the hospital. The application has been recognized and widely used by more than 60 hospitals in Thailand.

Case C develops its product with through a network of research center for examples, NSTDA, National Center for Genetic Engineering and Biotechnology and the Thailand Research Fund. The researchers are a professor at the university who received a research grant. When research succeeds, case C has been granted their patents to produce goods for commercials. Case C focuses on the creation of medical products from Thai researchers. This will reduce the importing of foreign medical products. Moreover, the kits are made by Thai researchers are cheap, easy to detect, and required no additional devices when operate.

3.3.4 Case D: Chinese manufacturer of genomic analyzers and set a production in China

"Case D" is genomics provides a wide range of the next generation sequencing services and a broad portfolio of genetic tests for medical institutions, research institutions, and other public and private partners. Case D's mission is to leverage its genomics expertise in order to advance life science research and improve human health for the benefit of mankind. Case D has particular strengths in prenatal screening, hereditary cancer screening, testing for rare disease and in aiding precision medicine research and initiatives. Numerous scientific partners, healthcare providers, and pharmaceutical companies have come to rely on case D's world-leading bio-informatics research and development, large-scale computing infrastructure for data output and storage, and proprietary sequencing platforms. Case D has headquartered in Shenzhen, China, with branches and medical laboratories in major cities including

Beijing, Tianjin, Wuhan, Shanghai, and Guangzhou. Case D also has offices and laboratories located in Europe, North America and the Asia Pacific region. Case D currently operates in more than 100 countries and regions and works with more than 3000 medical institutions and more than 300 hospitals. To learn more about our company history, services, and product portfolio, watch our short animated video!

Overall employees are more than 8,000 people and their headquarters locates in Hercules, California. Case D focuses on life science research and clinical Diagnostics. Case D provides a wide range of next-generation sequencing services and a broad portfolio of genetic tests for medical institutions, research institutions, and other public and private partners. Firm's mission is to leverage its genomics expertise in order to advance life science research and improve human health for the benefit of mankind. Case D has particular strengths in prenatal screening, hereditary cancer screening, testing for rare disease and in aiding precision medicine research and initiatives. Numerous scientific partners, healthcare providers, and pharmaceutical companies have come to rely on case D's world-leading bio-informatics research and development, large-scale computing infrastructure for data output and storage, and proprietary sequencing platforms. A number of products are more than 10,000 items. Revenues exceeded $2.1 billion in 2017.

Case D's customers are vary includes university and research institutions, hospitals, public health, and commercial laboratories, biotechnology, pharmaceutical, as well as applied research laboratories that include food safety and environmental quality testing. Case D has built long-lasting customer relationships that help advance our research and development efforts in the introduction of new products and

solutions. Case D runs its business by using the capital from America's stock market. Firm use acquisition strategy to acquire competitors' technology and new product. In August 2012, case D launches biology center to develop products for the research and diagnostics markets based on the company's own technology. Nowadays, case D has some production plant in Thailand.

3.3.5 Case E: American manufacturer of a wide range of medical products and set a production in United State

"Case E" was founded in 1952. Their mission is "to provide useful, high-quality products and services that advance scientific discovery and improve healthcare." Their annual sales exceeded $2.1 billion in 2017. Case E is in the business segments of life science research and clinical diagnostics. It has more than 10,000 products, and its customers are university and research institutions, hospitals, public health, commercial laboratories, biotechnology, pharmaceutical, as well as applied research laboratories including food safety and environmental quality testing. Case E has 8,000 employees, and its headquarters is located in Hercules, California.

Their net sales for 2017 totaled $2.160 billion, an increase of 3.5 percent on a currency-neutral basis over the prior year. Their life science business, focusing on academic and biopharmaceutical research, did especially well. This segment of the business grew by 6.8 percent. In the new markets area, case E has been building a portfolio of products in the area of cell biology. Researchers are increasingly looking for information derived at the cellular level to round out data obtained at the DNA and

protein levels. Case E has also been investing in new geographic markets not only in the fast-growing markets of Asia and others but also in established markets such as the United States. For example, case E has a leadership position in blood typing around the world, with the exception of North America. For several years, case E has worked to obtain U.S. FDA approval for their flagship platform. This blood typing platform offers high-volume laboratory automation and walk-away autonomy to improve overall efficiency.

The second area of investment is the “DNA analyzer.” It leveraged its leadership position in DNA amplification; a few years ago, case E entered a new area with an acquisition. To date, case E has been very pleased with the results of the digital innovation, which has proven itself in the market by one measure. Today, there are more than 2,500 peer-reviewed publications enumerating applications of the technology for basic research as well as in the area of diagnostics.

Their multiplex capabilities have also received FDA clearances for assays products. In 2017, case E also reevaluated certain R&D projects and made some tough decisions. A few years ago, case E acquired an early-stage technology which offered promise in the growing area of cancer diagnosis; however, the realization of this application proved more difficult than expected, and case E was determined to apply for other opportunities with higher potential. Similarly, case E decided to discontinue blood virus testing, reapplying their investments into projects that case E believed will provide better outcomes in the market because they are best for the long-term prospects of the company.

3.4 Data Sources of Case Study

Case study research is characterized by the analysis of various sources of both primary and secondary data that help develop a theory (Yin, 1993). The main source of empirical data in this research was semi-structured interviews with the sale manager, R&D manager, production manager, and the firm's owner. To supplement, support, and verify the interviews, a secondary source of data for a considerable amount of archival data related to EO behavior, absorptive capacity, and the firm's decision-making was also investigated. This methodology constituted an appropriate method for ensuring data triangulation (Eisenhardt, 1989).

Table 18 Stage 1 One on One Interview

Case A	**Case B**	**Case C**	**Case D**	**Case E**
Sales manager (1 round)	CEO (1 round)	Plant Manager (1 round)	Territory account manager (1 round)	Sales Manager (1 round)
R&D manager (1 round)				

The guideline of a semi-structured interview was adopted from Schuler et al. (2004). It follows key variables in this study such as EO and knowledge ACAP.

3.5 Semi-Structural Interview

A semi-structured interview is appropriate for exploring the issue of complexity, procedural by nature, personal, or controversial and generally researchers use this method to gain detailed information of a respondent's beliefs about, or perceptions or accounts of, that particular topic (Smith, 1995). It contains a list of open-ended questions to be asked with follow-up questions promoting if particular responses are offered. The open-ended interview also allows participants to raise other important issues not contained in the guide and in fact no fixed sequence of questions is suitable to all participants (Denzin, 1970 cited by Silverman, 1993). It allows more flexibility for both the interviewer and interviewee to further explore some insights or interesting points emerging in interview, or for interviewer to probe for details where necessary. The questions, however, should be set in the logical order and those with sensitive areas should be left later interview when the interviewee is more relaxed and comfortable speaking to the interview (Smith, 1995).

The following shows the semi-structured interview questions regarding EO, knowledge ACAP, and firm performance. Additionally, there are other questions about medical innovation to grow a deep understanding of an interview on the nature of medical devices.

Entrepreneurial Orientation (EO)

1. How does the firm invest in new business opportunities? Does your firm take a risk when it finds new opportunities?

2. How does the firm respond when competitors offer new products on the market?
3. Please give your opinion on a competitive position of your firm relative to your competitors in your industry.
4. Are employees in your firm free to think and decide on their own work?
5. Please provide your opinions on the firm's ability to create innovative products.

Knowledge Absorptive Capacity (knowledge ACAP)

1. What are the external sources of new knowledge to develop new products?
2. How does the firm use new external knowledge for the innovative outcome of new product development?
3. What are your opinions on how the firm develops new product between improving from an existing product or introducing new knowledge and technology into a new product?

Medical innovation characteristics and firm performance

1. In your opinion, what is a medical device innovation? Would you give me a definition of medical device innovation and disruptive innovation?
2. Please provide comments on your sales performance over the past 3–5 years relative to your firm's goals and compared with competitors in the market.

3.4.1 Expert Interviews

This research held an in-depth interview with the experts. An in-depth interview refers to an informal one-to-one interview conducted by a trained interviewer who asks a set of semi-structured questions in a face-to-face setting (Smith, 1995; Yin, 1993). For qualifications of the expert for this study, the selected experts are a sales manager, a research and development manager, and a production manager. Those experts are involved in firm policy, decision-making process, and product development. Before conducting the first round of interviews, the researcher sent the semi-structured questions via e-mail and shared the research objectives by telephone. Each expert identified the time and place of the interview. Case A is organized at the firm. For the other firms, a sales manager would find it convenient to be interviewed outside the firms while a production manager would be comfortable at the factory. The one-to-one in-depth interviews are conducted with six key experts as follows: one CEO (case B), two sales managers (case A and case E), one R&D manager, and one sales manager (case E). Each interview took 45–60 minutes per round. Ten semi-structured questions served as guidelines to interview 10 key informants. All the experts allowed the researcher to tape-record the interviews. The researcher spent four days interviewing all the experts.

3.6 Case Study Data Analysis

The data analysis employed here approaches common to qualitative, inductive research studies (Yin, 1993). The following steps used to analyze the narrative transcripts, which are adapted from the work of Potter and (Wetherell, 1998).

Step 1: Reading the transcripts. This allows the researcher to experience as a reader and also become aware of "what a text is doing".

Step 2: Coding through reading the transcripts repeatedly by identifying all instance of reference to the discursive object which for this study is "stress causal relationship". This step is to ensure all material which is potentially relevant is included.

Step 3: Categorizing codes through rereading transcripts repetitively, looking for patterns both the features shared by accounts and the differences in the content and form of accounts, theme, etc.

Step 4: Identifying a discursive strategy, for example, disclaiming, footing, metaphors, analogies, etc. and subject positions by looking into the rhetorical context or argumentative organization of talk.

Step 5: Forming, refining and validating how these effects coherently fit together in explaining or supporting the findings.

Step 6: Reporting the conclusion, validation procedures, and specific parts or aspects of the extracts so that the reader can assess the researcher's interpretations.

In this research, the researcher has relied on both within-case and cross-case analyses. The researcher looked for within-case and cross-case similarities and differences to gain insightful knowledge research objectives. The following section has demonstrated the results by narrative scripts from the interview to compare with the theory (Schuler et al., 2004) and to take opportunities of gaining potentially new insights from the interviews.

3.7 Case Study Transcript

The transcripts from six experts show in Appendix B.

3.8 Coding Through Reading

Regarding to theme identification from Table 11- Table (p.78 – p.80), this research adopted themes to be categorized into codes. The researcher reread transcripts repetitively, looking for patterns shared by accounts and differences in content and themes. The following is an example from the in-depth interview data of six experts. All categorized codes shown below are seen in Thai medical device manufacturing firms (case A, B, C).

Proactiveness is categorized into four codes: involvement in new ideas, new products, taking initiative in situations, committing to large resources, and identifying new opportunities. *Risk-taking* is categorized into five codes: taking calculated risks with new ideas, seeking out new ways to do things, being creative in methods of operation, first-mover advantage, and emphasis on both exploration and experimentation. *Competitive aggressiveness* is categorized into one code: undoing competitors. *Innovativeness* is categorized into two codes: introducing improvement innovations and tried-and-tested practices, and equipment and products or services**.** *Autonomy* is categorized into two codes: communicating freely and acting and thinking without interference. *Knowledge ACAP* is categorized into six codes: identifying new and useful knowledge, understanding new and useful knowledge, valuing new and useful knowledge, assimilating new and useful knowledge, applying

new and useful knowledge, and exploiting new and useful knowledge. All categorized coding of proactiveness, innovativeness, risk-taking, competitive aggressiveness and autonomy behavior are coded of case A to case D are showed in Appendix C.

3.9 Within Case and Cross Case Analysis

Based on the research question presented in chapter 1, first question aims to describe the key characteristics of EO within the medical device industry? The following results integrated from the respondent's interviewing results.

Table 19 Summary of Characteristics of Dimensional EO

Case	Proactiveness	Competitive Aggressiveness	Risk-Taking	Innovativeness	Autonomy
A	√	×	×	×	×
B	√	√	×	×	×
C	√	√	×	×	×
D	√	√	×	√	×
E	√	√	×	√	×

3.8.1 Key Characteristics of EO within the Medical Device Industry

According to Lumpkin and Dess (2001), the dimensions of EO often vary independently rather than co-vary. as EO is not an isolated phenomenon (Naldi et al., 2007). Table 19 is a summary of salient dimension of EO that describes a key characteristic of EO based on the medical device context. This section adopted two criteria in selecting a dimension of EO: (1) variables that affect firm performance and (2) variables with differences between real context and literature review.

For the first criteria, based on the literature review, proactiveness and competitive aggressiveness were selected for investigation in quantitative research. The effect of proactiveness and competitive aggressiveness on firm performance has differed in many contexts of study, so it is unclear. Thus, generalizing the characteristics of EO from other findings was a challenge. Lumpkin and Dess, (2001) found that proactiveness and competitive aggressiveness may have different effects on firm performance. These differences were particularly apparent in the way firms relate to their external environment.

Proactiveness

Based on case studies, proactiveness is mainly characterized by involvement in new ideas, new products, and identifying and pursuing new opportunities, for example, pursuing new medical trends and incorporating new technology to improve a product's features. For these cases, to increase firm performance, most firms expand their market abroad with varying degrees of exporting capability; for example, case A and case C export their product to a regional market such as Southeast Asia while case B aims to export their products worldwide. Medical device firms in Thailand are not true leaders because some medical products are copied from foreign products; for example, case B initiated the import of medical devices from abroad first and then developed their own product later. However, some firms with medical knowledge and enough market experience can produce their own products, such as case B and case C, which produce HIV diagnostic test kits and thalassemia test kits. As a result, they can

be leaders of a domestic product's origin, but the volume of imported products is larger than that of domestic products.

Based on literature, proactiveness refers to a market leader's perspective seeking and exploits new markets looking for future demand compared to competitors (Lumpkin and Dess, 1996a). Proactive response to opportunities is appropriate for firms in dynamic environments or in growth-stage industries where conditions rapidly change and opportunities for advancement are numerous. But such environments may not favor the kind of combative posturing typical of competitive aggressiveness. Firms in hostile environments or in mature industries, where competition for customers and resources is intense, are more likely to benefit from competitive aggressiveness as a response to threats. Empirical evidence shows a positive relationship between proactiveness and firm performance under various contexts. In international markets, proactive behavior influences success of a firm's pursuit of opportunities.(Dai et al., 2014). However, the family firm context showed that proactiveness is negatively related to firm performance (Naldi et al., 2007).

For these cases, it could be argued that in other industries, it may be necessary to prioritize volume and aim to increase return on scale and lower prices, but for the medical device market, which is unique, customer drive is the first priority. Target customers for medical devices are healthcare professionals such as doctors and nurses, medical technologists, and other medical specialists in various sections in hospitals. Each medical product serves a special need in each particular medical practice. Hence, firms are proactive in expanding their products into the same customer segment but in different areas, for example, firms engaging in exporting their products

abroad. As a result, proactive behavior in the medical context might be explained as different from literature.

Hypothesis 1: Proactiveness positively relates to firm performance.

Competitive aggressiveness

Based on case studies, firms exhibit competitive aggressiveness because they have to compete in their market boundary which continuously grows ever the years. In case a competitor firm offers a new imported product with more features, Thai medical device manufacturers do not focus on head-to-head competition by lowering prices to compete and gain market share.

Case C showed that if a competitor's new product affects sales, staff members try to find information related to the competitor's products. Case C uses their product's strengths to counter these situations, such as offering cheaper price but the same quality as that of imported products and adjusting features according to additional customer needs. For example, case C's thalassemia test kits are comparable with foreign products; moreover, they are easy to use, with no required expensive tools. Meanwhile, foreign manufacturing firms compete with competitors by offering new products more quickly. Foreign manufacturers are more competitive than Thai manufacturers because foreign manufacturers initiate actions which competitors respond to and commit to large resources because of their higher capital readiness.

Table 20 Within Case and Cross Case Analysis among Case A, B, C, D and E of Proacctiveness and Competitive Aggressiveness

EO	Case	√ / ×	Code
Proactiveness	Case A	×	Respond when competitors are moving.
	Case B	√	Expand the market wildly and monitor new medical trend.
	Case C	√	Expand market both domestic and abroad
	Case D	√	Emphasis specialized services to focus group of customers both domestic and abroad.
	Case E	√	Actively enter new market to expand the customer through various markets.
Competitive Aggressiveness	Case A	√	-Compete in existing market. -Growth by the growth of the existing market. -Export in South East Asia countries.
	Case B	√	Produce new products to maintain and expand the market wildly.
	Case C	√	Offer cheaper, easier to detect, less expensive relative to imported products.
	Case D	√	Offer new products quickly than competitors.
	Case E	√	Offer new products quickly than competitors. Reliable products quality with premium price and high reputation in medical market.

For example, case C and case D have investment capitals of 1,000 million baht and 2,000 million dollars, respectively.

Accordingly, the R&D manager of case C said that medical devices have a long product life cycle. Therefore, firms do not usually lower prices to compete because each firm often has loyal customers. Customers are always familiar with the devices they use. More sophisticated technology leads to longer time learning how to

use the devices. It makes changing the brand even more difficult. Moreover, a particular technology has a patent or copyright in production, discouraging customers to change brands. As a result, price reduction is not a solution to compete in the medical device industry. Accordingly, prior studies show both positive and negative relationships between competitive aggressiveness and firm performance. In contrast, foreigner manufacturing uses leading volume-driven sales from global markets. The firms benefit from receiving investment capital from the government's acquisition of production technology. As a result, the firm has a competitive advantage through lower cost of production

In the literature, competitive aggressiveness refers to market efforts to outperform competitors. It is characterized by an aggressive response aimed to improve competitive positions or overcome threats in the market (Lumpkin and Dess, 1996a; Dess and Lumpkin, 2005). According to Dess and Lumpkin (2001), the shortening of product life cycles forces firms to use price competition to gain market share and sale under a gradually matured market (Lumpkin, 1996). Hughes and Morgan (2007) found that under a firm's growth stage, competitive aggressiveness holds no business performance value. Lumpkin and Dess (2001) found that competitive aggressiveness is associated with higher performance in more mature industry stages, but competitively aggressive firms would suffer in dynamic environments. From these cases, the long life cycle of a medical device product allows devices to sell for long periods in the market. A distinctive characteristic of medical devices makes theoretical variables different from the actual context of study. These distinctions allow this study to further investigate the effects of competitive aggressiveness on firm performance.

Empirical evidence showed conflicting relationships between competitive aggressiveness and firm performance. Lumpkin and Dess (2001) found that a competitively aggressive posture would enhance the performance of firms in hostile environments or in more mature industry stages. Moreover, Covin and Slevin (1990) also found that, under hostile environments, high-performing firms often exhibit an aggressive competitive orientation when faced with environmental hostility while low-performing firms tend to be more passive. However, younger firms generally perform better when they are not highly aggressive in technologically sophisticated environments. As a result, in hostile environments, competitively aggressive firms had stronger performance. However, this conclusion may not be entirely true; a study by Lechner and Gudmundsson (2014) found that competitive aggressiveness is negatively associated with both differentiation and cost-leadership strategies, which is entirely positively related to a small firm's performance. Dess and Lumpkin (2001) found that competitive aggressiveness is associated with higher performance in more mature industry stages. Hence, under different conditions, the relationship between competitive aggressiveness and firm performance varies. However, based on the case studies, the medical device industry has a slow product obsolescence rate or a low rate of new products coming into the market. A firm achieves commercial benefits by exploiting incremental product development. Based on these arguments, the following hypothesis is postulated:

Hypothesis 2: Competitive aggressiveness positively relates to firm performance.

Based on the second criterion, risk-taking, innovativeness, and autonomy have different characteristics based on real context and the literature. The rationale of this study is as follows: All six experts have commented that medical device firms do not take risks in terms of investing on new product development. For example, the CEO of case B said that “since 99 percent of medical research tends to fail in practice, so we have to consider each research project seriously to calculate the opportunity to exploit the marketing benefits.” Moreover, the business development manager of case D posited that “their firm never invested in the risky project because they always invest in risky free project that receive the supported funding from Chinese government only.” As a result, cases A, B, C, and D agree that they have to calculate the chance of success for every new investment project, but if new investments tend to fail in practice, they will ignore that opportunity. Firms will take risks if they have certain knowledge about certain outcomes because the cost to develop new medical device is high. Compared to the literature, risk-taking refers to taking action without certain knowledge of possible outcomes. Some actions may involve making considerable resource commitments in the business process (Dess and Lumpkin, 2005).

The theory of entrepreneurship explains that to get ahead of competitors, firms have a reasonable chance of costly failure under the dynamism environment characterized by rate of change and innovation in the industry as well as unpredictability of the actions of competitors and customers (Miller and Friesen, 1982). Therefore, risk-taking in the literature differs from the context of medical device firms. In the real context, firms will take risks if they have certain knowledge while EO literature refers to taking action without certain knowledge of possible

Table 21 Within Case and Cross Case Analysis among Case A, B, C, D and E of Risk Taking, Innovativeness and Autonomy

EO Dimensions	**Case**	√ / ×	**Code**
Risk-taking	Case A	√	Medium risk
	Case B	√	Calculated risk
	Case C	√	Assessing the opportunity to get payback.
	Case D	√	Does not take risks that have not been studied and often invest in the projects funded by the Chinese government.
	Case E	√	High risk high return
Innovativeness	Case A	√	Copy from a device made from abroad.
	Case B	√	Import devices from abroad and then developed own product to replace.
	Case C	√	Joint research projects among university and research government agency.
	Case D	√	Innovative products are made from the in-house R&D, M&A activities
	Case E	√	Innovative products are made from the in-house R&D, M&A activities
Autonomy	Case A	√	Think and work independently.
	Case B	√	R&D staffs are free to do their routine/meeting.
	Case C	√	Design own jobs under the extent of staffs' responsibility.
	Case D	√	Offer ideas within responsibilities scope. The final decision is made by the top management.
	Case E	√	Offer ideas within responsibilities scope. The final decision is made by the top management.

outcomes. Moreover, higher-risk actions might lead to bigger returns than lower-risk action if a project is accomplished (Zahra and Garvis, 2000); however, medical device firms tend to fail if they take risks without certain knowledge.

Based on the case study, innovativeness in medical device manufacturing involves an incremental process development of medical devices rather than radical innovation because diseases remain constant and physicians adopt the same practices to diagnose and treat patients.

Thus, medical devices are quite slowly obsolete in nature. New products mostly focus on improving a medical device's efficiency in terms of throughput, reliability, and validity to detect or diagnose disease. Therefore, core features are still relevant. For example, case A showed that "in case of manufactured products such as a filter cleaning machine and RO water purifier, R&D staffs will adjust the feature to meet customer need as much as possible. It will further forward the demand to the R&D department to develop the machine to meet the expectation of the customer." A medical firm cannot imitate another because each firm's technology has been licensed. For example, case C showed that "firm has a licensing of technology from university professors." The uniqueness of each firm technology is a driving force for developing incrementally new products. In the literature, innovativeness refers to introducing novelty by developing new products and services as well as new processes through experimentation and creative methods (Lumpkin and Dess, 1996a; Dess and Lumpkin, 2005). In summary, the nature of innovativeness in the real context differs from that in the literature. Innovativeness in the medical device industry discusses process innovation in their products while the literature discusses

firm-level characteristics or a firm's innovative behavior, such as new processes of manufacturing and new processes of services.

Based on case studies, all firms provide employees the autonomy to decide on their work. Employees can instigate act and think without interfere, and are free to communicate. Regarding the independence to design their own job responsibility, however, decisions are made by executives with higher authority at each decision level. For example, case A "allows employee to think and work; however, employees have to talk to the supervisor first"; in case B, "employees can design their own jobs under the extent of staffs' responsibility"; and case C "gives employees an opportunity to offer ideas within each responsibility." However, final decisions are from top management, and the owner has greater autonomy in terms of decision-making.

Hence, employees are not free to work, and their decision-making depends on high authorities or the owner of the firm. In summary, the variables in the theories and in the real context are different. Risk-taking in medical device manufacturing is a calculated risk. All firms need to study the target customer before deciding on new projects, as the high cost of R&D in medical projects influence differences between risk-taking in theory and the real world. Autonomy in theory reflects the role of employees; it explains the independence of the employee in creating success in their job.

3.10 Knowledge Absorptive Capacity

The following section aims to answer the following question: How important is knowledge ACAP within the medical device industry?

Based on these case studies, customer feedback, the production design of foreign devices, and external research agents are sources of external knowledge to develop a firm's new products (see Table 22). Thai medical device manufacturers use government-driven policy to create new products through external R&D activities. For example, medical research institutes transfer medical technology to case B, which has the marketing capability to turn medical research projects into commercial products. Case A and case B showed that firms used their experience or prior related knowledge to select which external R&D they would invest in, and they acquire and assimilate the external knowledge. Then the transformation and exploitation of external knowledge contribute to the success of commercial ends. This findings are consistent with a study by Cohen and Levinthal (1990), who argued that the success of a firm's performance is path-dependent. Similarities between external knowledge and the firm's prior related knowledge enhance its opportunities to apply new external knowledge to the basic knowledge that the firm has called potential ACAP; however, new knowledge cannot cause realized ACAP to bring about commercial-end benefits.

In addition, knowledge ACAP stimulates the effectiveness of entrepreneurial behavior process. External knowledge stimulates a firm's responsiveness to customer need. For example, case B argued that "firms should update new medical trend to create the fit between their product's quality and worldwide customers' need." Case C also showed that "firm used new knowledge to develop new products that have never been produced before, such as life science technology products." Moreover, knowledge ACAP enhances the way to do new things such as enhancing the ability to

Table 22 Within Case and Cross Case Analysis among Aase A, B, C, D and E of Knowledge ACAP

Knowledge ACAP	**Case**	√ / ×	**Characteristics**
Acquire external knowledge	Case A	√	Customer feedback/ copy foreign devices.
	Case B	√	University/ medical sciences department of Thailand/ Intellectual Property Institute of University
	Case C	√	Use external knowledge from various sources e.g., NSTDA*, NECTEC
	Case D	√	Merger and acquisition (M&A)
	Case E		Merger and acquisition (M&A)
Utilize external benefits until commercial end	Case A	×	Develop from existing product/ trial / launch
	Case B	√	Technology transfer/ production/ distribution and marketing
	Case C	√	Patent /Trial/ reliability and accuracy testing/ certified/ launching.
	Case D	√	Technology selection/ product trials/ clinical evaluation/ launching
	Case E	√	Technology selection/ product trials/ clinical evaluation/ launching

Note * NSTDA: National Science and Technology Development Agency of Thailand
** NECTEC : National Electronics and Computer Technology Center of Thailand

export abroad. For example, case B showed that “new knowledge facilitates B to work with researchers from the university to develop diagnostic test kits to look forward to export in the future.” However, all cases argued that the success rate of new medical devices is a challenge. Cases A, B, and C stated that it takes many years to develop new products. Their problems include the high cost of certified processes,

and not all medical research in the laboratory succeeds in being commercial products in the market.

In the literature, knowledge ACAP refers to the ability of a firm to recognize the value of new external information, assimilate it, and apply it to commercial ends (Cohen and Levinthal 1990). Knowledge ACAP results from a prolonged process of investment and knowledge accumulation within the firm, and its development is path-dependent (Cohen and Levinthal 1990). Therefore, the persistent development of the ability within the firm to absorb knowledge is a necessary condition for its successful exploitation of knowledge outside its boundaries. Based on this case, this study argues that medical device firms must accumulate knowledge related to their expertise in specific medical fields. Hence, it is essential to address these questions and attempt to investigate medical device firms in these related constructs: firm performance, EO, and knowledge ACAP.

The benefits of ACAP, including moderating the relationship between EO and performance, are the objective of the quantitative method. In the literature, empirical evidence showed that knowledge ACAP influences the dimensions of EO (Engelen et al., 2014a; Sciascia et al., 2014; Hernandez-Perlines, 2018). However, only the direct impact of proactiveness on performance of SME businesses (Kraus et al., 2012) was investigated while competitive aggressiveness has not been studied despite being an important dimension that explains why firms succeed in various contexts of study (Lumpkin and Dess, 2001; Hughes and Morgan, 2007). Based on these arguments, the following is postulated:

Hypothesis 3: Knowledge ACAP positively moderates the relationship between proactiveness and firm performance.

Based on these case studies, the competitive aggressiveness of medical device companies is different from other contexts because the long life cycle of medical devices allows for a longer period for each product to sell in the market. However, prior studies have not studied this aspect. Hence, to clarify the gap in these studies, based on the previous arguments, the following is postulated:

Hypothesis 4: Knowledge absorptive capacity positively moderates the positive relationship between competitive aggressiveness and firm performance.

3.11 Conceptual Framework

Conceptual framework is the belief or preliminary conclusion of the researcher. In other words, the concept framework is the system, concepts, conclusions, what we expect; beliefs that support and give research guidelines (Maxwell, 1996). Conceptual framework is considered a very important part of research design which may be in the form of a concept from knowledge and experience to explain the phenomenon that studied.

The conceptual framework that created for that research is "tentative theory. “This temporary theory tells on why is the phenomenon should happen?” (Maxwell, 1996). Tentative theory provides guidelines for explaining the phenomenon that we will study. It also provides (Maxwell, 1996) guidelines for doing research. Theory may be from two, the more concepts involved in the explanation on how each concept relates in order to explain phenomena or find the answers. The amount of concepts that researchers want to describe is often called "dependent variables". A relationship

will be in the manner in which one factor causes another factor directly, by other factors first, or may be in the form that both affect each other.

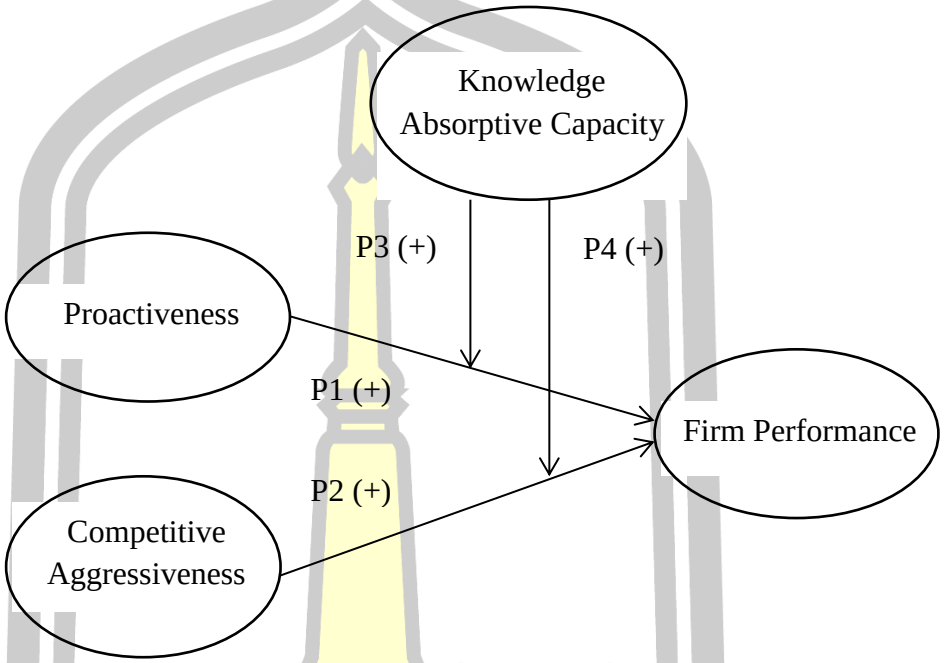


Figure 4 Conceptual Framework

According to research model, there are four hypotheses for statistical testing.

Table 23 Hypotheses for Statistical Testing

Hypothesis	Statement
1	Proactiveness positively relate to firm performance
2	Competitive aggressiveness positively relate to firm performance.
3	Knowledge ACAP positively moderates the relationship between proactiveness and firm performance.
4	Knowledge ACAP positively moderates the relationship between proactiveness and firm performance.

CHAPTER IV

QUANTITATIVE METHOD

This chapter illustrates the analyses of the survey data and the results of hypothesis testing. First, respondent and firm characteristics increase the understanding of the sample characteristic. Secondly, demonstrate correlation analysis, descriptive statistic, confirmatory factor analysis, and descriptive statistic. Third, demonstrate measurement model assessment and structural model assessment. Fourth, the hypothesis testing and results are detailed.

4.1 Survey Research

Survey research is widely employed in social science studies, and its successful use depends on a highly structured approach to data gathering (Bryman, 2004). It works best if the researchers know what kind of information is needed for providing the explanation according to the phenomena of interest and if the provisional questions can be standardized so as to assure that the questions convey the same meaning for the different respondents (Bryman, 2004). Thus, consistency in terms of the reliability of the measure, and measurement validity that has been created for a concept really does reflect the concept that it is supposed to be denoting, are major challenges for the researcher when drawing any conclusions from the study (Bryman, 2004; Brymman and Bell, 2007). Consistently, researchers need to have a clear

understanding of the measurements associated with the issues of interest and are created to choose well-tested measures to improve the measure validity. Furthermore, carrying out a pilot survey, gaining access to a large sample size in relation to the target population and deploying an appropriate sampling method, are crucial for improving the stability of the measure and for raising the levels of confidence with which the researcher can generalize study outcomes to a wider population (Brymman and Bell, 2007. In addition, the category survey research can be divided into cross-sectional and longitudinal designs, with the one referring to a survey in which the collection of all the data in connection with the study occurs at a single point in time, whereas the other involves a process whereby the sample is surveyed and then surveyed again on at least one further occasion (Brymman and Bell, 2007). Consequently, using cross-sectional survey data it is only possible to examine the pattern of association among the studied variables, whereas extending the research to make the data longitudinal allows for observation of changes and causal influences regarding the variables over time.

In this section, the explanation is given of the decisions regarding which data collection techniques were adopted as being the most appropriate for this research endeavor. There are two techniques comprising self-completion questionnaire surveys and interview-based surveys have been widely used for carrying out survey research (Brymman and Bell, 2007; Robson, 2002). The difference between these two techniques lie in the fact that with a self-completion questionnaire respondents answer the questions by completing the questionnaire themselves, whereas for the interview-based survey, an interviewer asks the respondents the questions and records their

answers conducted usually through either face-to-face or phone interviews. Both techniques have advantages and disadvantages which are considered next.

First, the cost of administering the self-completion questionnaire is much cheaper as compared to an interview-based survey. In general, the self-completion questionnaire entails sending to the respondents, usually by post, the questionnaire, a well-constructed cover letter and a stamped return envelope. In contrary, the second type of survey can involve far more time and costs of travel for the interviewer(s) carrying out face-to-face interviews, or great charges for lengthy telephone calls. Second, the length of time needed to conduct a postal survey is fairly consistent, usually taking eight to ten weeks (Robson, 2002), whereas for the interviewing technique, the length of time necessary to complete a project varies according to the sample size and the respondents' geographic locations covered that would take much longer to conduct a great number of interviews, even if several interviewers were employed for the task. Third, the self-completion questionnaire is viewed to be more convenient for the respondents to handle, since they can complete it whenever they wish. Fourth, the impacts that the presence of an interviewer may have are an important consideration when deciding which technique to adopt. The absence of an interviewer in the self-administered questionnaire means that there is no possibility of elaborating, or clarifying matters if the respondents experience difficulty answering some questions. As a result, they could skip certain questions, or not to participate in the survey at all. In contrast, this sort of problem can be solved should an interview-based questionnaire be conducted. However, the presence of the interviewer can potentially lead to problems of response bias, which can be associated with the personal characteristics of the interviewer such as gender and social background

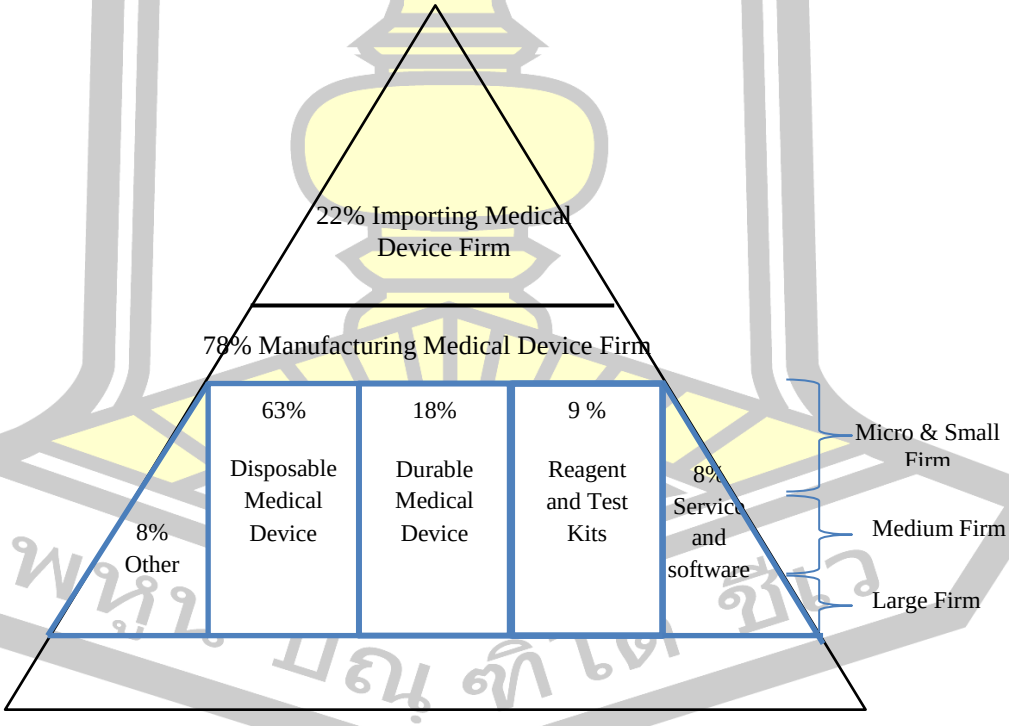
(Bryman and Bell, 2007; Robson, 2002). Moreover, when several interviewers are employed, their varying skills and levels of experience can result in inconsistent quality in terms of the responses. Last, researchers are likely to obtain a much lower response rate from a self-completion questionnaire than from a comparable interview based survey. This has been identified as the greatest disadvantage associated with the former kind of survey (Brymman and Bell, 2007) and could be attributed to the questionnaire being too long, looking complex and difficult to complete, or simply, not appealing to the respondents.

With regards to the current study, data collection from a total of 313 firms has locations spread across all regions in Thailand. The self-completion questionnaire survey was considered to be more effective than interview-based surveying in terms of time and costs. Further, the technique provided a relatively low response bias, since it did not involve a third party e.g., the interviewer administering the questionnaire, but nevertheless the potential problem of a low response rate still had to be managed. To address this, guidance on how to improve response rates to postal questionnaires (Bryman and Bell, 2007; Robson, 2002) was adopted, which included: (a) sending respondents a self-explanatory cover letter detailing the objectives of the research, why it was important, when and how to return the completed questionnaire, assurances of confidentiality, and a contact number in case they had any questions; (b) providing a stamped addressed envelope for the return of the survey; and (c) setting out clear instructions and using a professional questionnaire layout. All these activities, termed the survey administration, are explained next in the research methods section.

4.1.1 Population and Sample

This research selected medical device manufacturing firms in Thailand as the target population for sampling because they have never been studied before. The participants were obtained from the database of the Medical Device Intelligence Unit, retrieved in April 2018 (http://medicaldevices.oie.go.th), with a total of 313 firms.

According to Figure 5, these medical device manufacturers are classified into five main categories: 82 disposable-medical-device firms (62.2 percent), 24 durable-medical-device firms (18.3 percent), 11 reagent and test-kit firms (8.4 percent), 3 services and software firms, and 11 other firms (10.6 percent).



Note: Thai Medical Device Intelligence Unit (THAIMED), 2018)

Figure 5 Structure of the Medical Device Industry

In addition, medical device manufacturing firms have also been investigated for three additional reasons. First, the entrepreneurial characteristics of medical device manufacturing firms are appropriate to discuss in relation to EO. Medical device manufacturing firms encounter high risk because their operations need high investment capital. As a result, their production capacity is another important factor besides the ability to sell. Second, the difficulty of being a manufacturer involves producing new and more sophisticated products and at affordable prices. Thus, firms need to have continual adaptation. Knowledge ACAP acts as a critical firm capability to enhance firm performance because the degree to which a firm acquires market knowledge, technical knowledge, and medical practice shows the extent to which it renews their medical device products to create market benefits from external knowledge. Third, medical device manufacturing firms in Thailand have exhibited significant growth potential and are currently expanding continuously in Thailand (BOI, 2017). In addition, a report published by NSTDA (2017) indicated that Thailand is a major importer and exporter of durable medical devices in the ASEAN region. Government and private hospitals are rapidly improving their medical care. The importation of medical equipment to serve the needs of patients has increased (BOI, 2017). Therefore, as it appears, medical device manufacturing firms represent companies that need to have EO if they are to survive and maintain a competitive advantage. Moreover, knowledge ACAP stimulates the entrepreneurial process as well. Furthermore, a review of previous research indicates that they have been few, and in-depth empirical studies found that EO has a relationship with medical device manufacturing firms in Thailand.

4.1.2 Unit of Analysis

This research was set out to investigate the relationships between proactiveness and competitive aggressiveness, knowledge ACAP, and firm performance. Based on the research hypotheses, it was deemed appropriate to adopt the unit of analysis at a firm level.

4.1.3 Sample and Procedures

The sample in this study consisted of medical device manufacturing firms. This study obtained a list of 313 companies, which were sent mail-out questionnaires to be used for hypothesis testing. In this research, mail-out questionnaires were used as the main data collection device, as this was considered the best method of gathering data from a wide geographical area.

In formulating the questionnaire, the researcher relied on several sources drawn from previous studies and adapted the relevant literature and definitions. The basis for the calibration of responses was independently verified by two experts. Senior managers in the medical device manufacturing firms comprised the target population and were selected as key informants, as they are responsible for the day-to-day operations of their firms.

All the questionnaires were sent by mail, and it was estimated that it would take two to three weeks to obtain responses.

We initially checked the existence of the 313 firms and the accuracy of their addresses before delivering the documents. This was done by confirming via the telephone numbers provided online (http://medicaldevices.oie.go.th). We posted the survey packet addressed to the firm. The packet includes a personalized cover letter outlining the nature of the study and its confidential nature. The target respondents were identified by executive level. The survey targeted CEOs or the highest senior executives since they are the most appropriate informants about their firms' EO and knowledge ACAP. We distributed the first round of survey packets to 313 medical device manufacturing firms in September 2018.

Moreover, a follow-up technique was also utilized for a high response rate. Two weeks after the preliminary mailing, a follow-up telephone call was conducted for those who had not returned the surveys (Lamberti and Noci, 2010). After two weeks, a follow-up questionnaire was mailed out to non-respondents. The second round of questionnaire survey packets were distributed to the other 20 medical device manufacturing firms that have not yet received them in the first round, including those whose executives are foreigners and need an English questionnaire. As a result, a total of 81 questionnaires were returned, and 74 were usable because some questionnaires lacked important information. The total response rate was 24.26 percent.

Also, the details of questionnaire mailing are demonstrated in the Table 24.

Table 24 Details of Questionnaire Mailing

Details	**Numbers**
Mailed Questionnaire	313
Unreachable Respondents	8
Valid Questionnaire Mailing	305
Received Questionnaires	81
Unusable Questionnaire	7
Usable Questionnaire	74
Response Rate (74/305) x 100	**24.26 %**

4.1.4 Measurements of the Variables

In this research, the measurement and evaluation of responses were developed from several sources, including the relevant literature, definition of terms, and prior research devices. Each construct in the conceptual model was measured against multiple items. According to (Newman, Lim, and Pineda, 2013), the development of measurements of each construct is dispersed over multiples because multiple items can cover a wider range of definitions of each variable and can improve reliability. In addition, because all constructs in this research are abstract, they cannot be measured directly. The use of multiple items to measure abstract constructs is one of the methods for solving this situation (Churchill, 2006).

Dependent Variable

Firm performance was defined by indicators that measure a firm's incremental growth and capture different performance aspects (Chakravarthy, 1986; Murphy et al., 1996). Firm performance is multidimensional in nature, and it is, therefore, advantageous to integrate different dimensions of performance in empirical studies (Cameron, 1978; Wiklund and Shepherd, 2005). This study adopted Murphy et al., (1996) measurement to measure of firm performance. They separated firm performance into efficiency performance and growth performance. One item measured efficiency: return on investment (ROI). Two items measured profitability: sales and profit. Three items measured growth: sale growth, market share growth, and net profit relative to competitors (Murphy et al., 1996). Moreover, subjective measures are particularly useful for assessing the broader, nonfinancial dimensions of performance, which are generally more accessible than objective indicators and have been shown to exhibit strong reliability and validity (Dess and Robinson, 1984).

Independent Variables

1) Proactiveness is how market leaders perceive and seize new market opportunities and anticipate future demand (Dess and Lumpkin, 2005). It is assessed by the degree to which firms have the will to be a leader and the foresight to take advantage of new opportunities (Shan, Song, and Ju, 2016). Three items in the

questionnaire were based on existing items from Shan et al., (2016). Proactiveness is rated on a seven-point Likert scale (1 = strongly disagree, to 7 = strongly agree).

2) Competitive aggressiveness refers to the intensity of a firm's efforts to outperform industry rivals, characterized by a combative posture (defending posture to win) and a forceful response to a competitor's actions (Lumpkin and Dess, 1996). It is characterized by aggressive responsiveness aiming to improve competitive position or overcome threats in the market (Shan et al., 2016). Three items in the questionnaire were based on existing items from Shan et al. (2016). Competitive aggressiveness was rated on a seven-point Likert scale (1 = strongly disagree, to 7 = strongly agree).

Moderating Variable

Absorptive capacity is designated as a moderating variable. It is assessed by the extent of a firm's ability to assimilate and replicate new knowledge gained from external sources (Chen, 2004). It was measured by five items on a seven-point Likert scale. It was adapted from Chen (2004).

Control Variables

The study controlled for several factors that could be alternate explanations for variance in firm performance, that is, firm size and firm revenue. In the case of higher stability of control variables, there was not significant difference as explained below:

1) Firm size

Firm size is defined as the number of employees in an organization. Large firms have become financially superior (Leiblein et al., 2002; Richard and Johnson, 2001). Miller (1983) posited that firm size is a driver of entrepreneurship. Large firms may also have greater market power or positional advantages compared to their smaller rivals (Leiblein et al., 2002). When a large firm introduces innovation through the market, the likelihood of competitive aggressiveness is substantially high (Aboulnasr, Narasimhan, Blair, and Chandy, 2008). Chandy and Tellis (2003) also reported that large firms and incumbents are significantly more likely to introduce radical innovations than small firms and non-incumbents. However, in recent years the pattern has changed.

Smaller and younger firms are more likely to encounter resource constraint, and small firms might achieve higher firm performance since their high adaptation ability can help process information related to changing resources, therefore adapting to such conditions more quickly than bigger firms (Patel, Terjesen, and Li, 2012). Moreover, Chandy and Tellis (2003) reported that small firms and non-incumbents are slightly more likely to introduce radical product innovations than large firms and incumbents. In another view, firm performance will increase if the effectiveness of labor productivity growth in sales per employee increases (Belderbos, Carree, and Lokshin, 2004). It has been suggested that larger and older firms may face firm inertia (Huff, Huff, and Thomas, 1992).

In this research, firm size was measured by the number of employees. Firm capital is represented by a dummy variable in which “0” represents a firm size of fewer than 250 people while “1” represents a firm size of more than 250 people.

2) Firm Revenue

Revenue is the firm’s income from its normal business activities, usually from the sale of goods and services to customers (Gebauer, Friedli, and Fleisch, 2006) Revenue is also referred to as sales per year and represents the value created by firms. (Chen, Cheng, and Hwang, 2005). As a result, the higher firm revenue, the higher firm performance. Anderson, Covin, and Slevin (2009) posited that annual sale revenue is the income to endure the firm’s business.

In this research, firm capital is represented by a dummy variable in which “0” represents firms with an annual income of less than 1,500 million baht while “1” represents firms with an annual income of more than 1,500 million baht.

4.1.5 Scale Development and Questionnaire Design

A survey instrument, or questionnaire, is one of the most effective research instruments to generate a large amount of primary data for research projects. To minimize response errors, it is important to ensure that the questionnaire is well designed and structured. All measurement items for each construct are adapted from existing literature based on their reliability and relevance to this study. These

measurement items and their scales are formatted into a questionnaire to collect retrospective information from upper management.

Table 25 Definition and Operational Variables of Constructs

Constructs	Definition	Operational	Scale Source
Dependent Variable Firm performance	The indicators to measure firm's incremental growth and capture different aspects of firm performance	The extent of firm on growth, profitability, and efficiency.	Murphy et al., (1996)
Independent Variable Proactiveness	A characteristic of market leader's perspective of seeing and seizing new market opportunities occurring and anticipating future demand.	The extent of firms willing to be a leader and the foresight to seize new opportunities	Shan et al. (2016)
Independent Variable Competitive aggressiveness	The market competition efforts to outperform competitors in the industry.	The extent of aggressive response aimed to improve competitive positions or overcome the threat in the market	Shan et al. (2016)
Moderating Variable Knowledge ACAP	The ability of a firm to recognize the value of new, external information, to assimilate it, and to apply it to commercial ends	The extent of successfully absorb external knowledge which contributes to firm's performance.	Chen (2004)
Control Variable Firm size	The number of employee in the organization.	"0" : employee less than 250 people "1" : employee more than 250 people	Chandy and Tellis (2003)

Table 25 (Contd.)

Constructs	Definition	Operational	Scale Source
Control Variable Firm revenue	Revenue is the firm's revenue from its normal business activities, usually from the sale of goods and services to customers	"0": revenue per year less than 1,500 million baht "1": revenue per year more than 1,500 million baht	Gebauer, Friedli, and Fleisch (2006)

The instrument was prepared in English and then translated into Thai. The double-blind back translation process was used to check for accuracy (Sinaiko and Brislin, 1973). The purpose of using back translation is to ensure the accuracy and equivalence of meaning: that people who are native speakers of the target language would get the same meaning that was intended in the original language. In doing this, the original language (English) and target language (Thai) are then employed. A skilled Thai translator performed the questionnaire translation from English to Thai. Then the skilled English-speaking translator blindly translated it back from Thai to English. The two versions of the English-language questionnaire were compared and evaluated by a committee consisting of academic researchers. If they are identical, it suggests the Thai version is equivalent to the original version. If they are not identical, each error and difference is discussed and verified in terms of meaning and language grammar. After the translation is completed, the final Thai-language questionnaire was then pretested to ensure that respondents can comprehend all questions.

Table 26The Original Items of Three Main Constructs

Item Code	Firm Performance
FPER1	The return on investment (ROI) has exceeded what our investors expected as stated on our business plan
FPER 2	Our company has met all of our predefined goals and objectives (such as profitability, sales, etc.).
FPER 3	How successful is your company from an overall profitability standpoint (e.g., as stated in your business plan?)
FPER 4	Relative to competition, out company's sales growth is.
FPER 5	Relative to competition, our company's market share gains are.
FPER 6	Relative to competition, our company's net profits are.
Item Code	**Proactiveness**
PRO1	We always try to take the initiative in every situation (e.g., against competitors, in projects when working with others).
PRO2	We excel at identifying opportunities.
PRO3	We initiate actions to which other organizations respond.
Item Code	**Competitive aggressiveness**
COM1	Our business is intensely competitive.
COM1	In general, our business takes a bold or aggressive approach when competing.
COM1	We try to undo and out-maneuver the competition as best as we can.
Item Code	**Knowledge Absorptive Capacity**
ACAP1	The search for relevant information concerning our industry is every day business in our company.
ACAP2	In our company ideas and concepts are communicated cross-departmental.

Table 26 (Contd.)

Item Code	Knowledge Absorptive Capacity
ACAP3	Our company is used to absorb new knowledge as well as to prepare it for further purposes and to make it available.
ACAP4	Our company successfully link existing knowledge with new insights.
ACAP5	Our company successful utilizes the commercial benefits from new external knowledge.

4.2 Analytical Strategy

The analytical strategy describes the analysis employed to obtain valid results and conclusions for this research. First, the constructs were validated using exploratory factor analysis, and the reliability of scale was established. Then, descriptive statistics and Pearson's correlations were provided to verify the preliminary relationships among the concerned variables as described in the previous chapter. Following this, the tests of hypotheses were conducted using the partial least-squares structural equation model and hierarchical regression analysis. The rationale for using these is provided below along with the details of the appropriate statistics being used to test the hypotheses.

Based on (Hair, Ringle and Sarstedt, 2011), PLS-SEM is a causal modeling approach aimed at maximizing the explained variance of the dependent latent constructs. PLS-SEM often provides more robust estimations of the structural model (e.g., Reinartz, Haenlein, and Henseler, 2009). If researcher aims to emphasis more on exploration than confirmation, PLS−SEM is an attractive alternative and often more appropriate. PLS−SEM's ability to work efficiently with a much wider range of

sample sizes and increased model complexity, and its less restrictive assumptions about the data, it can address a broader range of problems such as constructs with fewer items (e.g., one or two), measurement model fails to meet the confirmatory factor analysis's criteria, including convergent validity and discriminant validity tests.

Based on (Hair et al., 2011), PLS-SEM is similar to using multiple regression analysis. The primary objective is to maximize explained variance in the dependent constructs but additionally to evaluate the data quality on the basis of measurement model characteristics. Estimates loadings of the indicator variables for the exogenous constructs based on their prediction of the endogenous constructs, not their shared variance among indicator variables on the same construct. Thus, the loadings in PLS-SEM are in a way their contribution to the path coefficients. PLS-SEM offers acceptable results for the measurement models whereas the structural model relationship is not significant (Hair et al., 2011).

Frazier, Tix, and Barron (2004) explain that the same variable could be cast as a moderator or a mediator that depend on the research question and the theory being tested. (Frazier et al., 2004) and among others such as Baron and Kenny (1986) suggest that research questions involving moderators address "when" or "for whom" a variable most strongly predicts or causes an outcome variable. Particularly, a moderator is a variable that changes the direction or strengthens of the relation between a predictor and a variable outcome. Thus, a moderator effect is nothing more than an interaction whereby the effect of one variable depends upon the level of another. Interaction effects are not only important for intervention studies, but also, for many other cases, researchers are interested in whether relations between predictor and outcome variables are stronger for some people than for others (e.g., Aiken and

West, 1991). The identification of important moderators of relations between predictors and outcomes indicates the sophistication of a field of research inquiry is at the heart of theory in social science (Frazier et al., 2004). However moderators address “when” or “for whom” a predictor is more strongly related to an outcome, mediators establish “how” or “why” one variable predicts or causes an outcome variable (Frazier et al., 2004). More specifically, a mediator is defined as a variable that explains the relation between a predictor and an outcome; in other words, a mediator is the mechanism through which a predictor influences an outcome variable Baron and Kenny (1986).

This research attempts to answer two specific questions: (a) to what extent do proactiveness and knowledge ACAP influence firm performance? (b) To what extent do competitive aggressiveness and knowledge ACAP influence firm performance? Accordingly, knowledge absorptive capacity could be conceptualized as a moderator of the relation between proactiveness, competitive aggressiveness, and firm performance. Theory suggests that intervention might be differentially effective for firm performance for high and low knowledge absorptive capacity. PLS-SEM can investigate the moderator analysis of the formative model if theory supports the existence of a moderate relationship (Hair et al., 2011).

This study uses PLS-SEM to analyze the data derived from respondents. PLS-SEM can also be used to examine the total effect of exogenous variables on endogenous variables in the structural model. The programs used to analyze the data in this study were Smart PLS3. The first step was to test the measurement model. This step examines the validity of a measurement model, including convergent validity, discriminant validity, and construct validity. Further, assessment of the fit of a

measurement model between the observed and estimated covariance matrix is taken. Confirmatory factor analysis (CFA) is used to assess fit and validity. The second step was to test the proposed conceptual model. This step verifies the fit of the hypotheses by comparing the observed variance in the dependent constructs. Also, four hypotheses for EO, knowledge ACAP, and firm performance are tested in this step.

4.3 Measurement Model Evaluation

The goodness of measurement, outer, model has been established through the content validity and the construct validity.

4.3.1 Validity

Validity is defined as the degree to which instruments measure the data correctly and accurately from the questionnaire (Hair et al., 2011). It is necessary to examine the quality of the questionnaire as a powerful predictor of future behaviors (Wainer, 1988; Piercy and Morgan, 1994). In this research, validity is appropriate for accurately confirming the concept or construct. Two types of validity, content validity and construct validity were tested.

1. Content validity

Content validity is the extent to which the items of the scales sufficiently reflect the interrelated theoretical domains (Green, Tull, and Albaum, 1988). Expert judgment by professional academics and the authors together evaluate the adequacy and improvement of the measurement, based on the relevant theory and literature review (Rosier, Morgan, and Cadogan, 2010). The items are scaled in each construct by not only the hard literature reviews to ensure conceptual correction, but also the appropriate word, phrase, and statement of the interrogation that should verify appropriation in the context.

Content validity is the systematic examination of scaled items to ensure they sufficiently reflect the interrelated theoretical domains (Green et al., 1988). The quantitative research method provides a numerical representation for describing the phenomena or hypothesizes relationships. For these reasons, a survey method is conducted to confirm the empirical relationships hypothesized among constructs—EO, knowledge ACAP, and firm performance as shown in the conceptual model in the previous chapter. This study developed the survey instrument based on existing scales derived from the literature review. Then the questionnaire items were validated by ten experts from the sample firms, including one business development manager, two sale managers, two product managers and five academicians as shown in Table 27.

Table 27 Lists of Experts to Ensure Construct Validity

No	Expert	Areas of Expertise	Institute
E1	Mr. Kriangsak Wongyachai	Medical device selling	In-vitro diagnostic rapid test kit manufacturing firm
E2	Ms.Nutcha Sritong	Medical device selling	Renal dialysis sterilization manufacturing firm
E3	Mr. Wanchai Tanasombut	Medical device development	Renal dialysis sterilization machine manufacturing firm
E4	Ms. Salilrat Wannapa Business Development Manager	Implement global selling policy	Genomic analyzers manufacturing firm
E5	Mr. Somwit Phumeesin Sale Manager	Implement global selling policy	Wide range of medical products
E6	Asso. Prof. Chonlatis Darawong	New Product Development (NPD)	Sripatum University
E7	Asst.Prof. Nitiphong Songsrirote	Economics	Mahasarakham University
E8	Asst.Prof. Sujinda Popaitoon	HR-Performance, AMO Theory, Team performance	Mahasarakham University
E9	Asst.Prof. Pornlapas Suwannarat	International business management	Mahasarakham University
E10	Dr. Pakorn Sujchaphong	Human resource management	Mahasarakham University

The result of item-objective congruence (IOC) equals 0.96 ≥ 0.50 is acceptable (Turner and Carlson, 2003). After these ten experts designed the questionnaire, they provided comments and improvements; and they then chose the best possible scale of measure corresponding with the conceptual definitions.

Hair et al. (2011), factor loading of the items could be used to confirm the content validity of the measurement model. More specifically, all the items meant to measure a particular construct should load highly on the construct they were designed to measure. If some items load on some other factors higher than their respective construct, these items will be candidate for deletion. Further, all the measures of the construct should be significantly loaded on their respective construct.

2. Construct validity

Construct validity refers to harmony, and the internal consisting of a theoretical concept and a specific concept which are used for measures and instruments (Trochim, 2006). Construct validity is an agreement between a theoretical concept and a particular measuring instrument or procedure. Additionally, construct validity refers to a set of measured items that reflect the latent theoretical constructs that those items are designed to measure (Hair et al., 2011). Convergent and discriminant validity are both considered subcategories and subtypes of construct validity.

2.1 Convergent validity

The convergent validity is defined to be the degree to which a set of variables converge in measuring the concept on construct (Hair et al., 2011). To establish convergent validity, researcher needs to show that measures that should be

related are in reality related should be related. Correlations value range from -1.00 to +1.00, so high correlations provide evidence that the items all converge on the same construct. The statistics used to measure convergence validity is the average variance extract (AVE). AVE must be at least 0.5, it indicating that the latent variable can be able to explain the variance of the indicator variable more than 50 percent (Hair et al. , 2011). This provides evidence that our theory that all four items are related to the same construct is supported.

2.2 Discriminant validity

The discriminant validity shows to which degree a set of items differentiate a construct from other constructs in the model. This means that the shared variance between each construct and its measures is greater than the variance shared among distinct constructs (Compeau, Higgins, and Huff, 2006). To examine the discriminant validity of the measurement model, this research use two criterions.

First, criterion suggested by Fornell and Larcker (2006). By comparing the square root of the average variance extract (AVE) of each latent construct relatives to other constructs. The discriminant validity is assumed if the square root of the average variance extract of the same construct is greater than other constructs, this situation is apparently the case in the correlation matrix and thus the discriminant validity is confirmed.

Second, cross loading is a criterion of discriminant validity, researchers considering the relationship between the weight of the indicators in each latent variable and the weight of the indicators in other latent variables in the model. The

weight of each indicator under the same latent variable should higher than other latent variables (Hair, Sarstedt, Hopkins, and Kuppelwieser, 2014). The weight value should be not less than 0.7 (Lee, Petter, Fayard, and Robinson, 2011).

In summary, convergent and discriminant validity are both considered subcategories and subtypes of construct validity. It recognizes is that they work together if researcher can demonstrate the evidence that the measure both convergent and discriminant validity, then researcher definition demonstrated that you have evidence for construct validity. But, neither one alone is sufficient for establishing construct validity.

4.3.2 Reliability

1. Cronbach alpha

To capture the reliabilities of constructs with multiple indicators, the internal consistency was assessed with Cronbach's alpha values with the rule of thumb for the value to exceed 0.70 (Nunnally and Bernstein, 1994). Cronbach alpha designates the degree of internal consistency between the multiple variables (Hair et al., 2010). For examining the internal consistency or reliability of the constructs, Cronbach's alpha is widely used to evaluate questionnaire reliability (Hair et al., 2010). Additionally, (Nunnally and Bernstein, 1994) suggested that Cronbach's alpha coefficients have to be greater than 0.70 which is widely accepted and represent high

construct validity. In this study, all variables which have reliability more than 0.70 are acceptable. Hence, the reliability of questionnaire is accepted.

2. Composite reliability

Composite reliability (CR) is as an estimate of a construct's internal consistency. Unlike Cronbach's alpha, composite reliability does not assume that all indicators are equally reliable, making it more suitable for PLS-SEM, which prioritizes indicators according to their reliability during model estimation. Composite reliability values of 0.60 to 0.70 in exploratory research and values from 0.70 to 0.90 in more advanced stages of research are regarded as satisfactory (Nunnally and Bernstein, 1994), whereas values below 0.60 indicate a lack of reliability. Likewise, each indicator's reliability needs to be taken into account, whereby each indicator's absolute standardized loading should be higher than 0.70. Generally, indicators with loadings between 0.40 and 0.70 should only be considered for removal from the scale if deleting this indicator leads to an increase in composite reliability above the suggested threshold value.

4.4 Structural Model Assessment

4.4.1 Coefficient of determinant (R^2)

Based on Hair et al. (2011); the primary evaluation criteria for the structural model are the R^2 measures and the level and significance of the path coefficients.

Because the goal of the prediction-oriented PLS-SEM approach is to explain the endogenous latent variables' variance, the key target constructs' level of R^2 should be high. R^2 values of 0.75, 0.50, or 0.25 for endogenous latent variables in the structural model can, as a rule of thumb, be described as substantial, moderate, or weak, respectively.

4.4.2 Path coefficient

Based on Hair et al. (2011), hypothesis testing is the test of the path coefficient of inner model (independent variable affect dependent variable). By considering the path coefficient, the value represents the relationship between latent variables according to the hypothesis set. Path coefficient's value is ranging between -1 and +1. If there is a value approaching 1, indicates that the relationship is strong in a positive way. But if the value approaching -1 shows that the relationship is strong in the negative way. The path coefficient has a significant level of 0.05 means that $p < 0.05$ and the t-value must be higher than 1.96, indicating that the path coefficient supports the research hypotheses.

4.5 Descriptive characteristics

4.5.1 Respondent characteristics

In this research the respondents are the chief executive director (CEO), managing director and department manager who have the most comprehensive knowledge regarding entrepreneurial orientation, knowledge absorptive capacity, and

firm performance of medical device manufacturing firm. The respondent characteristics are described by the demographic characteristics, and working experience.

Table 28 Characteristics of Respondents

Description	**Categories**	**Frequencies**	**Percentage**
Position	CEO	18	24.3
	Managing Director	26	35.1
	Department Manager	29	39.2
	Others	1	1.4
	Total	74	100
Work experience	Less than 5 years	13	17.6
	5-10 years	14	18.9
	11-15 years	9	12.2
	More than 15 years	38	51.4
	Total	74	100

According to Table 28, the demographic characteristics of respondents are as the following. Approximately 39.2 percent are department manager, 35.1 percent of respondents are managing director, and 24.3 percent are the CEO, while 1.4 percent is other titles such as secretary. For, work experience or prior related knowledge, approximately 51.4 percent have working experience more than 15 years. 18.9 percent have working experience among 5-10 years, 12.2 percent have working experience among 10-15 years and 17.6 percent have working experience less than 15 years.

4.5.2 Firm Characteristics

Table 29 Characteristics of Medical Device Manufacturing for Which Respondents Have Worked

Descriptive statistics		Frequency	Percent
Shareholder	100% Wholly own of Thai owner	55	74.3
	Joint venture with foreign	10	13.5
	Wholly own of foreign owner	9	12.2
	Total	74	100.0
Firm Age	Less than 5 years	5	6.8
	5 - 10 years	10	13.5
	11 - 15 years	21	28.4
	More than 15 years	38	51.4
	Total	74	100.0
Firm Capital	Less than 0.5 million baht	6	8.1
	0.5 - 8 million baht	33	44.6
	8 - 50 million baht	22	29.7
	More than 50 million baht	13	17.6
	Total	74	100.0
Firm Size*	Less than 50 employees	23	31.1
	50-150 employees	24	32.4
	151-250 employees	11	14.9
	More than 250 employees	16	21.6
	Total	74	100.0
Firm Revenue**	Less than 500 million baht	45	60.8
	500 - 1,000 million baht	15	20.3
	1,000 - 1,500 million baht	7	9.5
	More than 1,500 million baht	7	9.5
	Total	74	100.0

Table 29 (contd.)

Descriptive statistics		Frequency	Percent
R&D expense per sale	Less than 0.10 percent	27	36.5
	0.10 - 0.20 percent	23	31.1
	0.21 - 0.30 percent	11	14.9
	More than 0.30 percent	13	17.6
	Total	74	100.0

Note: *N* = 74 respondents

*Before any transformation for control variable (more than 250 employees = 1, Less than 250 employees = 0)

**Before any transformation for control variable (more than 1,500 million baht = 1, less than 1,500 million baht = 0)

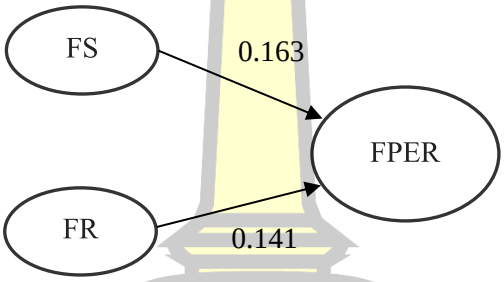
Table 29 demonstrates the characteristics wherein the 74 medical devices manufacturing firms. Most of the firms are Thai-owned (74.3 percent). Mostly, the firm age was more than 15 years (51.4 percent). The majority of the firm respondents have firm capital of 0.5 – 8 million baht (44.6 percent). The majority of firm size had a number of full time employee 50-150 employees (32.4 percent). Most of firm has revenue less than 0.5 million baht (60.8 percent).

4.6 Testing Validity of Observed Variable

This section examines the validity of the observed variables. There are four variables (three exogenous variables and one endogenous variable) in this research. Table 30 provides details of all variables in this study and their abbreviations.

Table 30 Abbreviations of Exogenous Latent Variables and Endogenous Latent Variables

Variable	**Abbreviations**
Endogenous latent variables	
• Firm Performance	FPER
Exogenous latent variables	
• Proactiveness	PRO
• Competitive Aggressiveness	COM
• Knowledge Absorptive Capacity	ACAP



Note: FS = Firm size, FR= Firm revenue

Figure 6 The Effect of Firm Size and Firm Revenue to Firm Performance

According to Table 31, the effect of firm size and firm revenue to firm performance are considered from the t-value. The t-value of firm size and firm revenue are 1.470 and 1.219 respectively, which < 1.96 (significance level = 0.05).

Therefore, it can be concluded that firm size and firm revenue do not have an impact on the firm performance. Thus, confirmed that firm size and firm revenue will be excluded from the model.

Table 31 Coefficient, t-value, p-value of Control Variable

Construct	Coefficient	t-value	p-value
FS	0.163	1.470	0.143
FR	0.141	1.219	0.308

Note FS = Firm size, FR= Firm revenue

4.7 Descriptive Statistics of Variables in this Research

Table 32 provides descriptive statistics and displays the means, standard deviations, and minimum and maximum values for all variables included in the research.

From Table 32, twice the S.E Skewness is 2 X 0.27 = 0.52. Now look at the range from -0.52 to + 0.52 and check whether the value for Skewness falls within this range (George and Mallery, 2003). The Skewness value of FPER falls within the range -0.52 to + 0.52, while the Skewness value of PRO, COM, and ACAP are falls out the range -0.52 to + 0.52. For FPER construct the distribution of data is significantly normal in term of Skewness. For PRO, COM, and ACAP construct, the distribution of data is significantly negatively skewed.

Consider the Kurtosis, twice the S.E Kurtosis is 2 X 0.55 = 1.05. Now look at the range from -1.05 to + 1.05 and check whether the value for Kurtosis within this range (George and Mallery, 2003). The Kurtosis value of FPER, PRO, COM, and ACAP fall within the range -1.05 to + 1.05. Hence, the distribution of data for FPER, PRO, COM, and ACAP construct are significantly normal in term of Kurtosis.

According to Hair et al. (2012) and Cohen (1992), use PLS-SEM when the data are non-normally distributed and the sample size is small. Hence, the PLS-SEM analysis fit to the data of this study.

Table 32 Descriptive Statistics of Variables in This Study

Construct	Mean	Median	S.D.	Skewness	S.E. Skew.	Kurtosis	S.E. Kur..
FPER	4.33	4.16	1.18	-0.25	0.27	0.69	0.55
PRO	4.69	5.00	1.35	-0.61	0.27	-0.07	0.55
COM	4.84	5.16	1.30	-0.69	0.27	-0.07	0.55
ACAP	5.18	5.20	0.96	-0.66	0.27	0.98	0.55

Note: N = 74 respondents
S.E Skew. = Standard Error of Skewness
S.E Kur. = Standard Error of Kurtosis

Moreover, assessing the normality assumption should be taken of which the Shapiro-Wilk test, provided by the SPSS software. The Shapiro-Wilk test is based on the correlation between the data and the corresponding normal scores (Peat and Barton, 2008) and provides better power or the ability to detect whether a sample comes from a non-normal distribution. Shapiro-Wilk test as the best choice for testing the normality of data (Shapiro and Francia, 1972).

This research select the PLS-SEM to analyses the relationship of the hypothesis because of the two rules of thumb for selecting PLS-SEM. First, the sample size is relative low (1) the minimum sample size should equal ten times of the largest number of formative indicators and (2) ten times the largest number of structural paths directed at a particular latent construct in the structural model (Hair et al., 2011). Sample size of this study was 74, and four reflective indicators, and two structural paths (PRO-FPER, COM-FPER) are showed in this research model.

Second, the data are to some extent abnormal distribution from kurtosis. Hence, the PLS-SEM analysis fit to the data of this study.

Table 33 Statistical Value of Tests of Normality

Shapiro-Wilk		
Construct	**df**	**p-value**
FPER	74	0.501
PRO	74	0.009
COM	74	0.004
ACAP	74	0.053

Note: df: Degree of freedom

According to Table 33, an absolute value of the score is significant at the level of P < 0.05 in PRO, COM, and ACAP construct In small samples, values greater or lesser than 1.96 are sufficient to establish normality of the data (Ghasemi and Zahediasl, 2012). However, FPER construct which found p-value above 0.05. According to Hair et al. (2012) and Cohen (1992), use PLS-SEM when the data are non-normally distributed and the sample size is small. Hence, the PLS-SEM analysis fit to the data of this study.

4.8 Correlation Analysis

The correlation coefficient is a measure of linear association between two variables that the values of the correlation coefficient are between -1 and +1. Correlation coefficient of +1 indicates that two variables are perfectly related in a positive linear sense while a correlation coefficient of -1 indicates that two variables

are perfectly related in a negative linear sense. In addition, correlation coefficient of 0 indicates that there is no linear relationship between the two variables. Correlation analyses can be interpreted only the degree of linear association between two variables (Erdfelder, FAul, Buchner, and Lang, 2009). To interpret its value, below are the following values and interpretation that correlation is closest:

0 = No linear relationship

+0.30 = A weak uphill (positive) linear relationship

+0.50 = A moderate uphill (positive) relationship

+0.70 = A strong uphill (positive) linear relationship

Exactly +1 = A perfect uphill (positive) linear relationship.

In this research, a bivariate correlation analysis of Pearson's correlation on all variables is employed for two purposes. The first purpose is to explore the relationships among variables. The second purpose is to verify the multicollinearity problem which exists when inter-correlation between independent variables exceeds 0.80 (Hair et al., 2010). In this research, the bivariate correlation procedure is scaled to a two-tailed test of statistical significance as $p < 0.05$ and $p < 0.10$.

Table 34 demonstrates the correlation among proactiveness, competitive aggressiveness, ACAP, and firm performance. First, proactiveness is positively and significantly correlated to firm performance ($r = 0.418$, $p < 0.01$), and has a positively significantly correlated with competitive aggressiveness ($r = 0.404$, $p < 0.01$). . Second, competitive aggressiveness is negatively correlated with no significant to firm performance ($r = -0.013$, $p > 0.05$). Third, ACAP has a positively correlated with no significant with firm performance ($r = 0.206$, $p < 0.01$), and ACAP has a positively and significant correlation with proactiveness ($r = 0.509$, $p < 0.01$). Hence, it is

revealed that all inter-correlations do not exceed 0.80 which is suggested by (Hair et al., 2010). In addition, Table 34 shows that the maximum value of VIF 1.836, which is not exceeding 10 in the scale (Hair et al., 2010). Therefore, both VIF and correlations confirms that multicollinearity problems do not occur in this research.

Table 34 Reliability and Correlation Matrix and Multicollinearity of All Variables

Variable	**1**	**2**	**3**	**4**	**5**	**6**	**VIF**
1. FS	1						
2. FR	0.615**	1					
3. FPER	0.283*	0.263*	1				
4. COM	-0.003	0.028	-0.013	1			1.397
5. PRO	0.215	0.164	0.418**	0.404**	1		1.836
6.ACAP	0.203	-0.015	0.206	0.386**	0.509**	1	1.802

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

4.9 Measurement of Model Assessment

This research comprises of 17 observed variables and four latent constructs. Following section will describes the measurement model assessment, structural model assessment, and final section presents the hypothesis testing.

4.9.1 Investigation of Correlation Matrix between Main variables

Table 35 KMO and Bartlette's Test

Statistics	Value
Kaiser-Meyer- Olkin Measure of Sampling Adequacy	0.776
Bartlette's test of Sphericity	
Approx. chi-square	957.766
df	135
Sig	0.000

Statistics used to verify the correlation matrix are Bartlette's test of Sphericity and Kaiser- Meyer- Olkin Measure of Sampling Adequacy (MSA). The Kaiser-Meyer-Olkin Measure of Sampling Adequacy is a statistic that indicates the proportion of variance in variables that might be caused by underlying factors. High values (close to 1.0) generally indicate that a factor analysis may be useful with the data. If the value is less than 0.50, the results of the factor analysis probably won't be very useful. Bartlett's test of sphericity tests the hypothesis that your correlation matrix is an identity matrix, which would indicate that your variables are unrelated and therefore unsuitable for structure detection. Small values (less than 0.05) of the significance level indicate that a factor analysis may be useful with your data.

From Table 35, an initial analysis was run to obtain eigenvalues for each factor in the data. The Kaiser-Meyer-Olkin Measure verified the sampling adequacy for the analysis, KMO=.714 which is above Kaiser's recommended threshold of 0.6 (Kaiser, 1974). Bartlett's test of sphericity, $\chi 2$ (136) = 957.766, $p < .000$, indicated that correlations between items were sufficiently large for EFA.

4.9.2 Investigation of the Exploratory Factor Analysis (EFA)

Exploratory factor analysis (EFA) is a statistical method used to uncover the underlying structure of a relatively large set of variables (Norris and Lecavalier, 2010). Overarching goal is to increase the reliability of the scale by identifying inappropriate items that can be removed and the dimensionality of constructs by examining the existence of relationships between items and factors when the information of the dimensionality is limited (Netemeyer and Bearden and Sharma, 2003).

Table 36 Loading of All Variables in This Study

Construct	**Firm Performance**	**Proactiveness**	**Competitive Aggressiveness**	**Absorptive Capacity**
PER1	**0.933**	0.432	0.201	0.192
PER2	**0.924**	0.369	0.080	0.190
PER3	**0.916**	0.394	0.049	0.191
PER4	**0.893**	0.486	0.152	0.238
PER5	**0.843**	0.456	0.064	0.201
PER6	**0.822**	0.437	0.102	0.176
PRO1	0.454	**0.823**	0.267	0.404
PRO2	0.415	**0.782**	0.370	0.564
PRO3	0.399	**0.634**	0.449	0.458
COM1	0.143	0.333	**0.771**	0.235
COM2	0.134	0.413	**0.858**	0.345
COM3	0.070	0.327	**0.875**	0.439
ACAP1	0.113	0.403	0.546	**0.727**
ACAP2	0.150	0.435	0.377	**0.778**
ACAP3	0.027	0.280	0.164	**0.911**
ACAP4	0.157	0.298	0.152	**0.898**
ACAP5	0.227	0.514	0.264	**0.816**

EFA assumes that any indicator/measured variable may be associated with any factor. When developing a scale, researchers should use EFA first before moving on to confirmatory factor analysis (Worthington and Whittaker, 2006). This research, EFA was conducted on the 17 items with a varimax rotation using SPSS 22. In this study, the four factors (proactiveness, competitive aggressiveness, knowledge absorptive capacity and firm performance) were used to determine the pattern of the structure in the 17 items.

From Table, 36 the factor loading of all 17 variables is ranging from 0.634 to 0.933 which is more than 0.7. Therefore, there are 6 measured variables (FPER1, PFER2, FPER3, FPER4, FPER5 and FPER6) under firm performance construct (FPER), 3 measured variables (PRO1, PRO2, PRO3) underlying proactiveness construct (PRO), 3 measured variables (COM1, COM2, COM3) underlying competitive aggressiveness construct (COM), and 5 measured variables (ACAP1, ACAP2, ACAP3, ACAP4, and ACAP5) underlying knowledge absorptive capacity construct (ACAP)

Table 37 Eigen Value of Exploratory Factor Analysis

Factor	Initial Eigen Value			Extraction Sums of Squared Loading			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.11	35.96	35.96	6.114	35.965	35.965	5.027	29.57	29.57
2	3.64	21.39	57.35	3.636	21.389	57.354	2.480	14.59	44.16
3	1.63	9.61	66.97	1.634	9.612	66.966	2.178	12.81	56.97
4	1.17	6.86	73.82	1.167	6.862	73.828	2.125	12.50	69.47

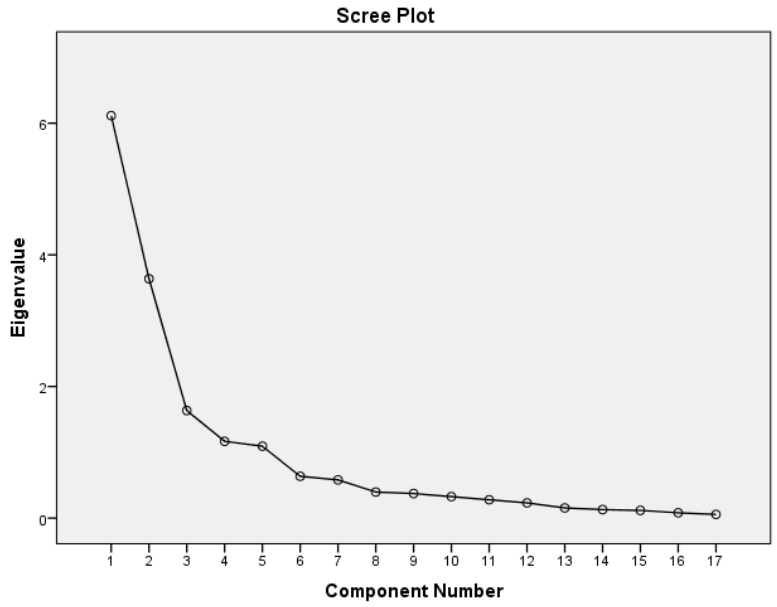


Figure 7 Scree Plot

From Table 37, four factors had eigenvalues greater than one, as the scree plot clearly illustrates in Figure 7. The initial 17 items structure explained 69.47 % of the variance in the pattern of relationships among the items. The percentages explained by each factor were 29.57 % (firm performance), 14.588% (competitive aggressiveness), 12.81 % (knowledge ACAP), and 12.50 % (proactiveness), respectively.

4.9.3 Investigation of the Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis (CFA) allows the researcher to test the hypothesis that a relationship between the observed variables and their underlying latent factor(s)/construct(s) exists. Factor loadings are numerical values that indicate the strength and direction of a factor on a measured variable. Factor loadings indicate how strongly the factor influences the measured variable.

As suggested by (Hair et al., 2011), factor loading of the items could be used to confirm the content validity of the measurement model. More specifically, all the items meant to measure a particular construct should load highly on the construct they were designed to measure. If some items load on some other factors higher than their respective construct, these items will be candidate for deletion. Further, all the measures of the construct should be significantly loaded on their respective construct. As illustrated in Table 36, all the items load highly and significantly on the constructs they were designed to measure. Thus, the content validity of the measurement, outer, model was confirmed.

4.9.3 Investigation of Confirmatory Factor Analysis

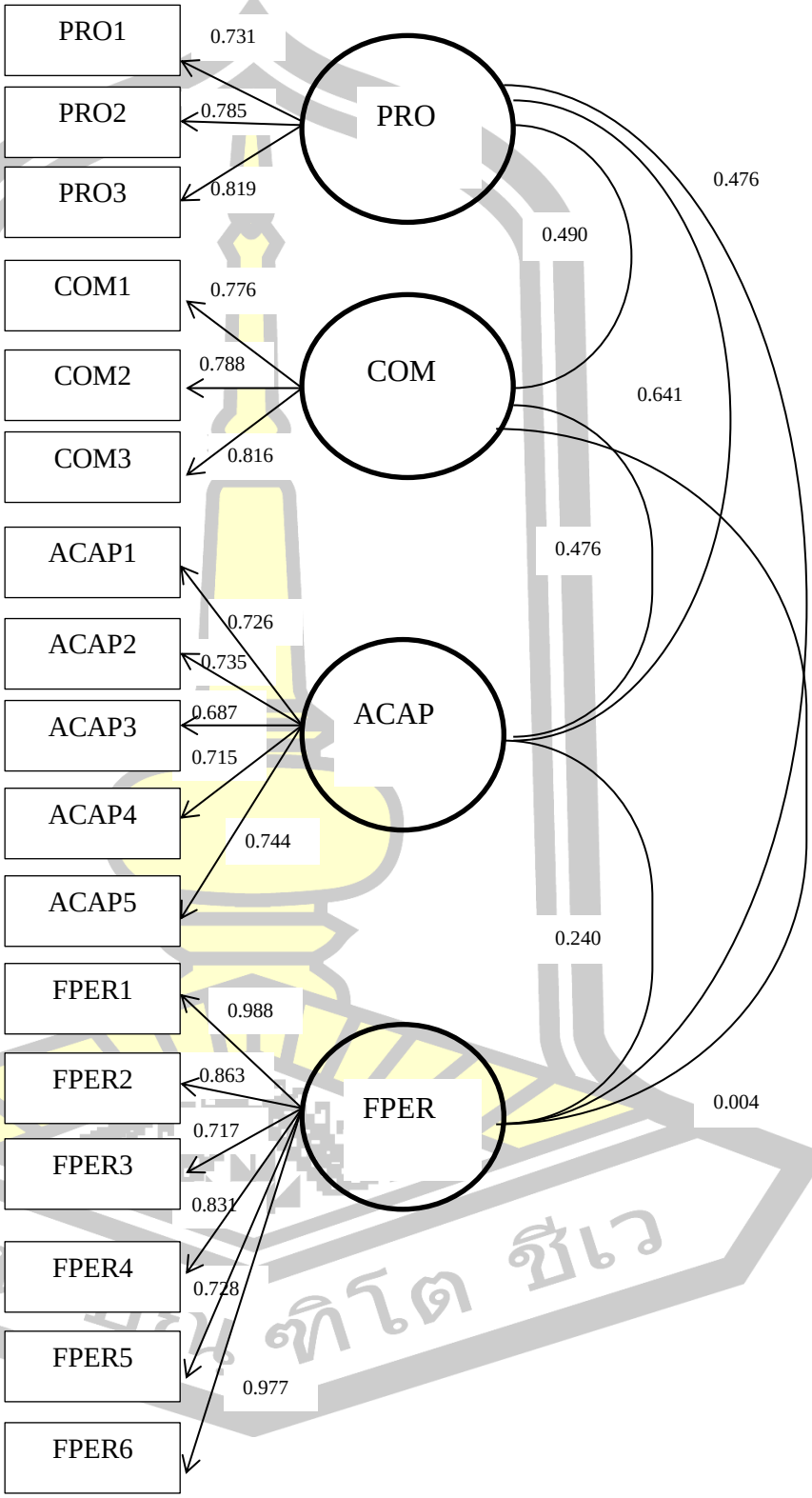


Figure 8 Confirmatory Factor Analysis of Proactiveness and CompettitiveAggressiveness Model

Table 38 Rules of Thumb of PLS-SEM

Measurement model		
Rules of Thumb	**Statistic**	**Criterion**
Indicator reliability	Factor Loading	>0.7 (Hair et al., 2011)
Convergent validity	AVE	>0.5 (Hair et al., 2011)
Discriminant validity	AVE	AVE of each latent construct should higher than the construct's highest squared correlation with any other latent construct (Fornell-Larker criterion)
	Heterotrait-Monotrait Ratio of Correlation (HTMT)	To assess discriminant validity. If the HTMT value is < 1.0 (Hair et al., 2011)0.90, discriminant validity has been established between two reflective constructs.
	Cross loadings	An indicator loadings should be higher than all of its cross loadings (Hair et al., 2011).
Internal consistency reliability	Composite reliability	>0.7 (Hair et al., 2011)
	Cronbach's Alpha	>0.7 (Nunnally and Bernstein, 1994)
	Dijkstra- Henseler's (rho)	>0.7 (Hair et al., 2011)
Structural model		
Rules of Thumb	**Statistic**	**Criterion**
Coefficient of determination	R^2	0.25 = weak 0.50= moderate 0.75= substantial (Hair et al., 2011)

Table 39 Statistical Value of Measurement Model Assessment

Exogenous Variable	**Factor Loading**	**AVE**	**CR**	**Dijkstra-Henseler's (rho)**	**Cronbach's Alpha (α)**
Proactiveness (PRO)	-	0.607	0.822	0.824	0.823
PRO1	0.731				
PRO2	0.785				
PRO3	0.819				
Competitive Aggressiveness (COM)	-	0.630	0.836	0.837	0.835
COM1	0.776				
COM2	0.778				
COM3	0.816				
Absorptive Capacity (ACAP)	-	0.424	0.781	0.801	0.786
ACAP1	0.726				
ACAP2	0.735				
ACAP3	0.687				
ACAP4	0.715				
ACAP5	0.744				

Table 39 (contd.)

Exogenous Variable	**Factor Loading**	**AVE**	**CR**	**Dijkstra-Henseler's (rho)**	**Cronbach's Alpha (α)**
Proactiveness (PRO)	-	0.772	0.952	0.967	0.955
FPER1	0.988				
FPER2	0.863				
FPER3	0.717				
FPER4	0.831				
FPER5	0.728				
FPER6	0.977				

In table 39, the factor loading for all 17 items is raging from 0.687 to 0.977. ACAP3 has factor loading equal 0.687 which is still acceptable (Hulland, 2002). According to Hulland (2002), if it is an exploratory research, 0.4 or higher is acceptable. Items should above 0.7 (Hair et al., 2011) indicates the indicator adequate indicator reliability in 17 items.

In Table 39, average variance extract (AVE) are as follow; proactiveness = 0.607, competitive aggressiveness = 0.630, knowledge ACAP = 0.424 and firm performance = 0.772. It above 0.5 (Hair et al., 2011) which indicates the indicator convergent validity reliability in following variables, proactiveness (PRO), competitive aggressiveness (COM), and firm performance (FPER). However, AVE for knowledge absorptive capacity (ACAP) equal 0.424 is still adequate. According to (Fornell and Larcker, 2006), the cut-off value of AVE 0.40 is acceptable in case of composite reliability is higher than 0.6, the convergent validity of the construct is still

adequate. For this case, the composite reliability equal 0.781. Hence, the AVE of the PRO, COM, ACAP and FPER construct indicate adequate convergent validity.

In Table 39, composite reliability (CR) are as follow; proactiveness = 0.822, competitive aggressiveness = 0.836, knowledge ACAP = 0.781 and firm performance = 0.952. It above 0.7 (Hair et al., 2011) which indicates the construct's internal consistency in following variables, proactiveness (PRO), competitive aggressiveness (COM), and firm performance (FPER). Hence, all constructs indicate adequate construct's internal consistency.

Dijkstra-Henseler's rho (rhoA) was estimation of data consistency provides a more accurate estimation of data consistency (Dijkstra and Henseler, 2015). In Table 39, Rho A are as follow; proactiveness = 0.824, competitive aggressiveness = 0.837, knowledge ACAP = 0.801 and firm performance = 0.967. It above the value of 0.7 (Hair et al., 2011) which indicate reliability coefficient in following variables, proactiveness (PRO), competitive aggressiveness (COM), and firm performance (FPER). Hence, the values indicate that the items loaded on all construct are reliable.

Cronbach's Alpha designates the degree of internal consistency between the multiple variables (Hair et al., 2010). In Table 39, Cronbach's alpha values are as follow; proactiveness = 0.823, competitive aggressiveness = 0.835, knowledge ACAP = 0.786 and firm performance = 0.955. It above 0.70 (Nunnally and Bernstein, 1994) in following variables; proactiveness (PRO), competitive aggressiveness (COM), and firm performance (FPER). Hence, all constructs indicate adequate internal consistency between the multiple items (Hair et al., 2010).

4.10 The Discriminant Validity

The discriminant validity shows to which degree a set of items differentiate a construct from other measures is greater than the variance shared among distinct constructs (D Compeau and Higgins, 1991). The diagonal elements are the square root of the average variance extracted of all the latent constructs (Fornell and Larcker, 2006a). The discriminant validity is assumed if the diagonal elements are higher than other off-diagonal elements in their rows and columns. In Table 40, A square root of the average variance extracted in the diagonal is higher than all constructs in their rows and columns (Hair et al., 2011).

Table 40 Discriminant Validity: Fornell-Larcker Criterion

Construct	**Firm Performance**	**Proactiveness**	**Competitive Aggressiveness**	**Absorptive Capacity**
Firm Performance	0.878	-	-	-
Proactiveness	0.476	0.779	-	-
Competitive Aggressiveness	0.004	0.490	0.794	-
Absorptive Capacity	0.240	0.641	0.476	0.651

Heterotrait–monotrait (HTMT) ratio of correlations evaluates the average of the Heterotrait–heteromethod correlations (Henseler, Ringle, and Sarstedt, 2015). In TabIe 41, HTMT value is < 1.0 (Hair et al., 2011) in firm performance, proactiveness, competitive aggressiveness, and knowledge ACAP. Hence, discriminant validity in all variables has been established.

Table 41 Discriminant Validity Heterotrait-Monotrait Ration of Correlation (HTMT)

Construct	**Firm Performance**	**Proactiveness**	**Competitive Aggressiveness**	**Absorptive Capacity**
Firm Performance	-	-	-	-
Proactiveness	0.471	-	-	-
Competitive Aggressiveness	0.142	0.486	-	-
Absorptive Capacity	0.234	0.635	0.463	-

Having established the validity and the reliability of the measurement model, the next step was to test the hypothesized relationship by running PLS algorithm and Bootstrapping algorithm in Smart-PLS 3.0-PLS 3.0. Two-stage approach and mean centered was selected approach for investigation of moderation effect of knowledge ACAP. According to proposed research model, there are four hypotheses for statistical testing.

4.11 Model Fit Index

4.11.1 Goodness of Fit (GoF)

Goodness of Fit (GoF) is a measure combining effect size with convergent validity, suggested by(Tenenhaus, Vinzi, Chatelin, and Lauro, 2005). GoF is the geometric mean of average communality for the outer model and average R^2 for the inner model. That is, goodness-of-fit equals the square root of communality times R^2. GoF will vary from 0 to 1 (Sarstedt and Henseler, 2012). GoF useful in assessing which datasets PLS-SEM explains better than others, with higher reflecting better explanation.

$$GoF = \sqrt{\emptyset Com \times \emptyset R^2_{inner}}$$

ØCom = An average communality for latent variables (Fornell and Larcker, 1981)

$\emptyset R^2_{inner} = R^2$ for endogenous constructs

However, researcher can use the average variances extracted (AVEs) instead of average communality. As noted by Wetzels and Odekerkenr (2009), the AVE for each latent variable equals the corresponding communality index. So the average AVE for the model can be used instead of the average communality index for the model. The formula for calculating the GoF proposed by (Wetzels and Odekerkenr, 2009) then becomes:

GoF = square root of: (average AVE) x (average R-squared)

$$GoF = \sqrt{\frac{0.607 + 0.630 + 0.424 + 0.772}{4} \times 0.311}$$

$$= 0.43$$

Wetzels and Odekerkenr (2009) also proposed the following thresholds for the GoF: small=0.1, medium=0.25, and large=0.36.

According to Wetzels and Odekerkenr (2009) , the goodness of fit index equal 0.43 indicates the large threshold for the GoF. It can be implied that there is a large goodness of fit between observed data and estimated model.

4.12 Hypotheses Testing

Table 42 Hypotheses Testing Results

Effect	Expected Sign	Path Coefficients	t-value	p-value	Support/ Not support
H1: PRO ---> FPER	+	**0.334***	2.859	0.006	**Support**
H2: COM ---> FPER	+	-0.151	-1.381	0.172	Not support
H3: PRO*ACAP ---> FPER	+	-0.364	-3.353	0.001	Not support
H4: COM*ACAP ---> FPER	+	0.144	1.377	0.173	Not support

Note: * is significate level at 0.05.

4.11.1 The impact of proactiveness on firm performance

The first question addressed was to what extent do proactiveness and competitive aggressiveness influence firm performance? In Table 42, the path coefficient between proactiveness and firm performance is 0.334 (p = 0.006, t-value = 2.859). Proactiveness had positive significant effect on firm performance. ***Thus, hypothesis 1 was supported***

4.11.2 The impact of competitive aggressiveness on firm performance.

The second question addressed was to what extent does competitive aggressiveness influence firm performance? In Table 42, the path coefficient between competitive aggressiveness and firm performance is -0.151 which is not significant (p

= 0.172, t-value = -1.381). Competitive aggressiveness had non- significant negative effect on firm performance. ***Thus, hypothesis 2 was not supported.***

According to Table 34 (p.146), the linear relationship between competitive aggressiveness and firm performance is – 0.013 (p> 0.05). Hence, this non- significant negative effect might cause from low correlations between the independent (competitive aggressiveness) and dependent variable (firm performance).

4.11.3 The moderating role of knowledge ACAP on a relationship between proactiveness and firm performance

The third question addressed was to what extent does knowledge absorptive capacity moderate the relationship between proactiveness and firm performance? In Table 42, the results demonstrate that knowledge ACAP negatively moderated the relationship between proactiveness and firm performance and was also not significant (path coefficient= -0.364; p = 0.001, t- value = -3.353). ***Thus, hypothesis 3 was not supported.***

According to Table 34 (p.146), the linear relationship between knowledge ACAP and firm performance is 0.206 (p> 0.05). Hence, this non- significant effect might cause from low correlations between the independent (knowledge ACAP) and dependent variable (firm performance).

4.11.4 The moderating role of knowledge ACAP on a relationship between competitive aggressiveness and firm performance

The fourth question addressed was to what extent does knowledge absorptive capacity moderate the relationship between competitive aggressiveness and firm performance? In Table 42, the results demonstrate that knowledge ACAP positively moderated the relationship between competitive aggressiveness and firm performance and was also not significant (path coefficient= 0.144; p = 0.173, t- value = 1.377).

Thus, hypothesis 4 was not supported.

According to Table 34 (p.146), the linear relationship between competitive aggressiveness and firm performance is – 0.013 (p> 0.05). Moreover, the linear relationship between knowledge ACAP and firm performance is 0.206 (p> 0.05). Hence, this non- significant effect might cause from low correlations between the independent (competitive aggressiveness, knowledge ACAP) and dependent variable (firm performance).

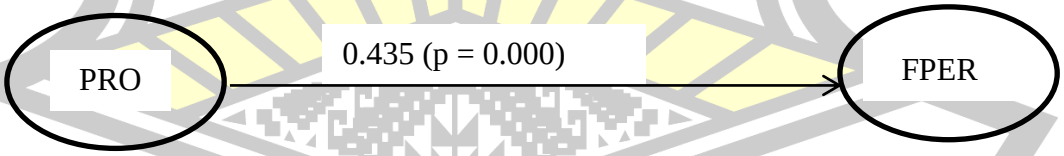


Figure 9 Path-Coefficient between Proactiveness and Firm Performance

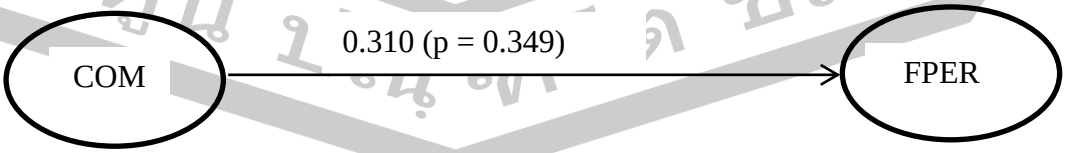


Figure 10 Path-Coefficient between Competitive Aggressiveness and Firm Performance

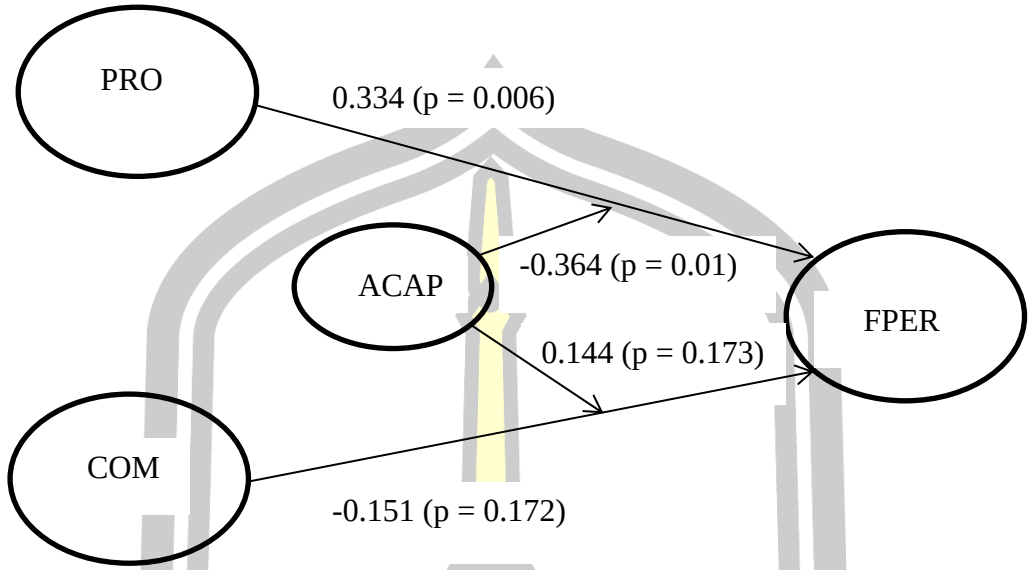


Figure 11 Structural Model of Proactiveness,Competitive Aggressiveness and Firm Performance

Comparing the sign of the path coefficient between competitive aggressiveness and firm performance in Figure 9 (0.310) and in Figure 11 (-0.151), it shows the opposite directions of sign. In Figure 11, the negative coefficient might cause from the multicollinearity problem. The inter-correlations from Table 34 (p.146) are as follow. (1) ACAP and COM = 0.386 ($p < 0.001$), (2) ACAP and PRO = 0.509 ($p < 0.001$), and (3) PRO and COM= 0.404 ($p < 0.001$). Hence, very high inter-correlations among the independent variables (ACAP, PRO, and COM) results in a change in the signs as well as in the magnitudes of the partial regression coefficients from one sample to another sample.

Table 43 Summary of Hypotheses Testing Results

Hypotheses		Results
Hypothesis1:	Proactiveness positively related to firm performance	Supported
Hypothesis2	Competitive aggressiveness positively related to firm performance.	Not supported
Hypothesis3	Knowledge ACAP positively moderates the relationship between proactiveness and firm performance.	Not supported
Hypothesis 4:	Knowledge ACAP positive moderates the positive relationship between competitive aggressiveness and firm performance.	Not supported

4.12 Predictive Relevance of the Model

The quality of the structural model can be assessed by R^2 which shows the variance in the endogenous variable that is explained by the exogenous variables. Based on the results reported in Table 44, the R^2 was found to be 0.311 indicating that proactiveness, competitive aggressiveness, and knowledge absorptive capacity can account for 31.1% of the variance in the firm performance. Based on the assessment criterion suggested by Hair et al. (2011), R^2 here is considered weak.

Table 44 Statistical Value of Coefficient of Determinant (R^2)

Construct	R Square	R Square Adjusted
Firm Performance	0.311	0.261

To better explain the form of interaction effects, this study plotted the interaction effects in the graph shown in Figure 12 using one standard deviation above

and below the mean to capture high and low knowledge ACAP (Aiken and West, 1991). This method is designed for the interpretation of the interaction effect of two continuous predictor variables.

The regression analysis results in the following equation when:

Y = firm performance;

X = proactiveness; and

Z = knowledge absorptive capacity

Based on the results of hierarchical regression analysis

Equation 1: $Y = 4.462 + 0.316 (X) - 0.0113 (Z) - 0.270 (XZ)$

To illustrate and test the significant interaction effect, separate regression lines are computed, plotted, and tested for each individual as shown in Table 45 and Figure 12—i.e., one standard deviation below the mean on predictor Z, at the mean of predictor Z, and one standard deviation below the mean of predictor Z.

First the overall regression equation is rearranged so it can be expressed only in terms of values of X:

Equation 2: $Y = ((0.316 - 0.270 (Z))(X) - 0.0113 (Z) + 4.462$

To calculate an equation for Z one standard deviation above the mean, the standard deviation of Z (SD of ACAP = +0.969) is substituted for Z in equation 2. This results in:

Equation 3: Y = 0.054 (X) + 4.451, for all those +1 SD above the mean on Z

For those at the mean of Z, a value of 0 is substituted for Z in equation 2. This results in:

Equation 4: Y = 0.316 (X) + 4.46

To calculate an equation for Z one standard deviation below the mean, the standard deviation of Z (-1.10) is substituted for Z and subtracted in equation 2. This results in:

Equation 5: Y = 0.578 (X) + 4.473, for all those -1 SD below the mean on Z

Actual values of Y can now be calculated by substituting values of predictor X, ACAP, that values are computed for X at the mean, one standard deviation above the mean, and one standard deviation below the mean (SD of X = 1.35). This results in Table 45

Table 45The Interaction Values For Plotting

Firm Performance	Pro on-1S.D.	Pro-mean	PRO on +1S.D.
on High ACAP	4.378	4.451	4.524
on ACAP on mean	4.033	4.462	4.889
on Low ACAP	3.693	4.473	5.253

Table 45 illustrates the significant interaction effect and separates regression lines that are computed, plotted, and tested for individual one standard deviation above the mean values on predictor, knowledge ACAP (for H3), at the mean of

predictor knowledge ACAP, and one standard deviation below the mean of predictor knowledge ACAP (Aiken and West, 1991). Then, this study plotted the interaction effects in the graphs shown (see Figure 12), using one standard deviation above and below the mean to capture high and low knowledge ACAP as shown details in Table 45 (Aiken and West, 1991).

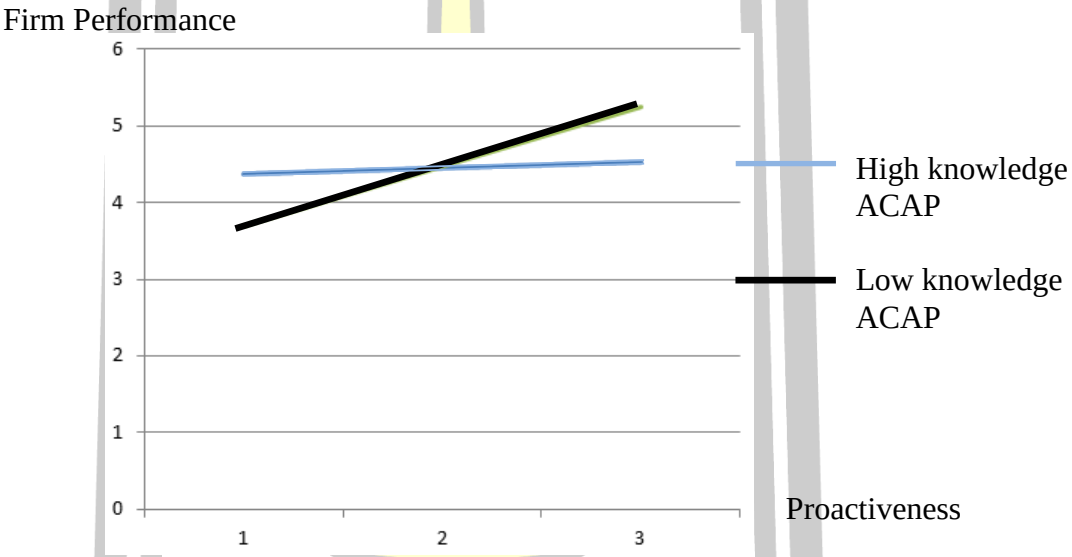


Figure 12 Interaction Effects of Knowledge ACAP on Proactiveness and Firm Performance

Figure 12 illustrates the findings for the relative firm performance when considering knowledge ACAP as the moderating variable. It indicates that the effect of proactiveness on the firm performance is dependent on knowledge ACAP. Hence hypothesis 3 is supported. Accordingly, knowledge ACAP strengthens the relationship between proactiveness and the firm performance, however; the strengthening is differing depending on the level of knowledge ACPA. The lower level of knowledge ACAP strengthens the relationship between proactiveness and the firm performance better than the higher level of knowledge ACAP.

CHAPTER V

CONCLUSION AND DISCUSSION

5.1 Conclusion

This research adopts the mixed-method approach to answer research questions. For the first research question, the researcher aims to adopt a case study design. Based on Yin, (2013, pp. 10-11), “what” and “how” questions are more explanatory and are likely to be used in a case study as the preferred research method. This is because such questions deal with operational links or the need to be traced over time rather than mere frequencies or incidence. As the research on medical device firms is limited to Thailand, unclear boundaries in the unexplored context stimulate the researcher to adopt a mixed-method study. First, this research takes a constructivist paradigm to understand the multidimensional EO as entrepreneurial processes that determine a firm performance in the context of the medical device industry in Thailand. Five medical manufacturing device firms were selected, and six experts were interviewed. Cases A and C are Thai-owned firms, case B is Thai–foreign owned, and cases D and E are foreign-owned. A case study approach and in-depth interviews were adopted to gain an understanding of what and how EO and knowledge ACAP contribute to firm performance.

This research has achieved the six main outcomes that meet the objectives set out in Chapter 1: A contribution has been made to the literature by providing a theoretical explanation on how and why the key characteristics of EO contribute to

firm performance within the medical device industry (research question 1) and how important knowledge ACAP is to EO and why it contributes to firm performance within the medical device industry (research question 2). These two questions have been addressed with reference to empirical findings from the case study research, more specifically, to what extent do proactiveness and competitive aggressiveness influence firm performance (research question 3 and 4), to what extent does knowledge ACAP moderate the relationship between proactiveness and firm performance (research question 5), and to what extent does knowledge ACAP moderate the relationship between competitive aggressiveness and firm performance (research question 6). These questions have been addressed with reference to empirical findings from survey research (H1, H2, H3, and H4 for research questions 3, 4, 5, and 6). This research takes a positivist paradigm, where a deductive approach and a quantitative research approach are adopted to guide the research design and methods for data collection. Survey research was used through a self-completed questionnaire to collect data from executives in the Thai medical device firm. Theoretical concepts and results in relation to these research questions were explained and discussed in Chapter 5, along with discussion of the results, contributions to knowledge, limitations, and directions for future research agenda.

The objectives of this concluding chapter are to synthesize the main findings of the study and to draw out their implications on a wider context of the main literature areas of EO, knowledge ACAP, and firm performance. Based on case studies, the results of EO and knowledge ACAP characteristics from the interview narrative scripts are compared with the literature. The salient dimensions of EO that describe its key characteristics in the medical device context are proactiveness and

competitive aggressiveness, which affect firm performance. However, risk-taking, innovativeness, and autonomy are not valid and irrelevant to the Thai's medical device context because their characteristics under the real context differ from the literature. Thus, proactiveness and competitive aggressiveness were selected to investigate their relationship with knowledge ACAP and firm performance. Based on the empirical findings, a conceptual framework is provided by a set of hypotheses presented in Figure 11.

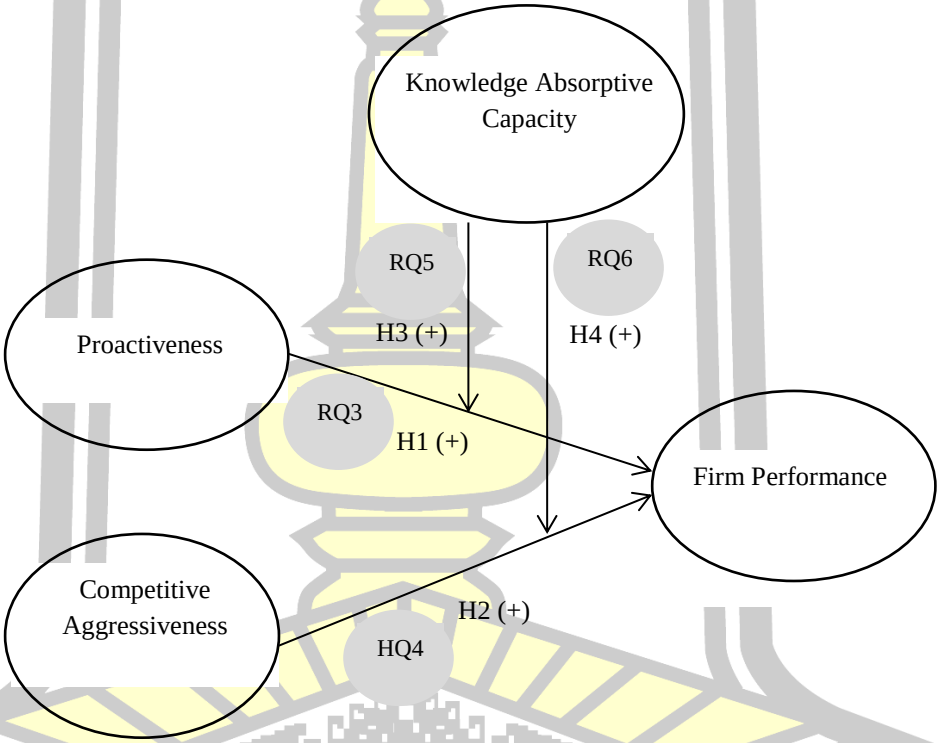


Figure 13 The Association of the Research Questions and Hypotheses with the Research Framework

5.2 Discussion

The result of the survey indicates three important evidences.

First, firms engage in proactiveness increase firm performance. From the case study result, firm proactively find a new market that can sell more products by two reasons, (1) increasing the exploitation rate of firm's existing resources, and (2) firm avoids price war in the current market which destroys profitability in the near future. Hence, proactive behavior is positively correlated with the firm's performance due to the growth of sales, return on sales and profits (Lumpkin and Dess, 2001). From three cases (A, B, and C), Thai medical device manufacturers expand their market to overseas to increase because the disease of people around the world is the same and medical practices are similar. So medical device products can be sold around the world in case of the products achieve standards certified that is accepted in each country e.g., US FDA, CE. Moreover, exports allow the firm to avoid price competition in domestics market because it will adversely affect the firm's performance. This case study results consistent with Lechner and Gudmundsson, (2014) who found that competitive aggression had a negative relationship with firm's performance. Moreover, Thai medical device manufacturers do not focus on prices cutting; however, they focus on product development to achieve better quality. Medical device is an expensive product and use for a long time because medical practice quite consistence as long as the treatment guidelines for each disease still remain. So, familiarity with the tools of health care professionals (physician, nurse) for each type of equipment is important for the examination and treatment Therefore, health care professionals will not change the product brand frequently. As a result,

brand loyalty occurs and allows the firm to maintain their sales, including increasing sales in case of the number of patients in each disease has increased. The results of this study are consistent with previous research's result.

From the past research findings, firms engage in proactiveness activities involving new ideas and new products by pursuing and identifying new opportunities, raising the opportunity to explore the attractive niche market, which is positively relate to increasing an opportunities to sell both existing and new products (Lumpkin & Dess, 2006). Hughes and Morgan (2007) found that proactiveness has a positive influence on business performance in young high-technology firms. Lumpkin and Dess (2001) suggested that proactiveness is a firm response to opportunities, (Chen and Hambrick, 2018) further suggested that firms proactive and responsive when they face a challenging in technology, innovation, competition, customers change.

Second, this research found that knowledge ACAP diminishes a positive relationship between proactiveness and firm performance. For theoretical evidences, there are two reasons to explain on the diminishing effect of knowledge ACAP on the relationship between proactiveness and firm performance. First, medical device firm might lack of existing knowledge related to new knowledge so, firm unable to apply new knowledge. Based on survey data, 60 percent of Thai manufacturing medical device firm data have been invested in research and development less than 0.2 percent per years. Hence, it shows that the ability to utilize the commercial benefits might limit. The extent to which prior knowledge facilitates the subsequent development of ACAP and the lack of early investment in knowledge ACAP make it more costly to develop a given level of it in the subsequent period. Cohen and Levinthal (1990a)

argued that firms cannot maximize the benefit of knowledge ACAP for two possible causes. First, the ability to exploit the external knowledge element of innovative capabilities is largely a function of the level of prior related knowledge. Second, not invent here syndrome (NIH) in which firms resist accepting innovative ideas from the environment, may also reflect what we call lockout at times. Such ideas may be too distant from the firm's existing knowledge base—its absorptive capacity to be either appreciated or accessed. In this particular setting, NIH may be pathological behavior only in retrospect. The firm need not act irrationally in the development of capabilities that yield the NIH syndrome.

Hence, this finding contradicts with past research results which highlighting the effectiveness of knowledge ACAP on entrepreneurial processes in terms of new products and service development and, finally, firm performance increase (Cohen and Levinthal, 1990a; Lane et al., 2001; Zhao, Li, Lee, and Chen, 2011). Moreover, Caloghirou et al. (2004) found that seeking new ideas from scientific or business journals have a positive relationship with innovation under medical device firm. They argued that publications in journals constitute a mechanism of knowledge diffusion. Additionally, knowledge ACAP enhances commercialization success when firms know how to diffuse new knowledge through their actions. This research argues from the past theoretical evidences and the case study results.

Third, too much knowledge ACAP is harmful to financial outcomes because a cost to develop new knowledge until firm can utilize the commercial benefits is challenging. This study found that low level of knowledge ACAP strengthens the relationship between proactiveness and the firm performance better than high level of

knowledge ACAP. This finding is supported by the study of Wales et al. (2013), who found that too much knowledge ACAP is harmful to financial outcomes. They indicated that a lower level of ACAP appears to produce the strongest returns to financial performance. They also highlight the importance of the cost of developed knowledge ACAP; they also posited that firms must continuously emphasize investment on knowledge. In the literature, the cost-associated knowledge ACAP has diminished firm performance because the benefits of knowledge ACAP to firm performance occur when firms can utilize knowledge ACAP to commercial ends. Volberda, Foss, and Lyles (2010) suggested that ACAP is a capability that requires firm investment. Hence, firms encounter financial risk if firms cannot utilize new external knowledge in terms of commercial benefits.

From the case study results, medical device manufacturing firms can better recognize and exploit new information relevant to their particular products by developing knowledge ACAP; for example, multifaceted ideas of scientists, engineers, clinicians, and patients allow beneficial technologies to reach the market more quickly in an evidence-focused way (Davey, Brennan, Meenan, & Mcadam, 2010). However, not every firm can exploit commercial benefits from new external knowledge. Scholars highlight the importance of path dependence and NIH, which might inhibit a firm's utilization of new knowledge, as medical device firms have to recognize varying types of knowledge. Hence, a firm's prior knowledge and path dependence act as a precondition to capture a variety of knowledge and exploit commercial benefits. As a result, persistent development of knowledge accumulation within the firm or the ability to absorb knowledge is a necessary condition for

successful exploitation of external knowledge (Mowery et al., 1996). In other words, the ability to exploit external knowledge is largely a function of the level of prior related knowledge.

Moreover, this study argues here that early investment in knowledge ACAP makes it more costly to develop a given level of it in the subsequent period. Therefore, firms should build a stock of related knowledge within their own operations (Cohen and Levinthal, 1990a). Prior related knowledge comes from experience, called potential absorptive capacity, and inside people, called tacit knowledge (Nonaka, Toyama, and Hirata, 2008). Collective of individual prior-related knowledge represent the firm-prior related knowledge (Cohen and Levinthal, 1990a). The similarities between a firm's prior related knowledge and external knowledge acquisition contribute to the successful acquisition of external knowledge. Assimilate and then transform external knowledge to create innovativeness and apply it to commercial end.

In addition, to avoid the NIH syndrome, firms must increase their stock of prior related knowledge until their prior related knowledge and new external knowledge are relevant. Then, firms can recognize, assimilate, and exploit the commercial benefits from external knowledge.

5.3 Theoretical Contributions

This research has been inspired by ongoing debates regarding the link between EO, knowledge ACAP, and firm performance. This research has adopted the theoretical perspective of dynamic capability to address the gap in the literature.

5.3.1 Theoretical Contributions from Case Study Result

First, this case study results provides first empirical evidences describing EO characteristics of the medical device firm regard to the approach where the EO dimension is prominent and relevant to the context of study. Based on case studies, this research explained the characteristics of five dimensional EO: proactiveness, competitive aggressiveness, risk-taking, innovativeness, and autonomy. Scholars have pointed out that it is not possible to compare results among studies even within the same context, as they have different approaches to defining EO. As a result, the key debates in EO literature include how to treat EO as a unidimensional or multidimensional construct. This research describes EO characteristics from a multidimensional approach and further suggests that proactiveness and competitive aggressiveness are two prominent and relevant EO constructs that may determine variation in medical device firms.

Second, in different industries, the results of EO are different. Therefore, EO studies must focus on context of the study because generalization EO characteristics in different context might be limited. In the setting of young high-technology firms, Hughes and Morgan (2007) investigated the unidimensional EO conceptualization approach in terms of proactiveness, competitive aggressiveness, risk-taking,

innovativeness, and autonomy. Their results showed that competitive aggressiveness and autonomy held no firm performance value at the growth stage while in medium and large high-technology and industrial manufacturing firms. (Morgan and Strong, 2003) conceptualized a firm's strategic orientation with aggressiveness, riskiness, proactiveness, futurity, defensiveness, and analysis. The results indicated that proactiveness and aggressiveness are not related to business performance. Hence, research context determines the choice of EO conceptualization approaches. How each dimension of EO is characterized and why they are crucial for firm performance act as initial steps to explore the research within EO in various settings. Hence, the interdependence effect and inconsistent effects of multidimensional EO among various studies observed. EO researchers should pay attention to the qualitative approach as an initial research method to determine which EO conceptualization approach will suit each context of study. Moreover, researchers should highlight which EO dimension is most important in explaining variations of firm performance.

This case study results also provides a narrative describing why each EO dimension contributes to firm performance based on real-world context. Scholars have highlighted the importance of proactiveness and competitive aggressiveness to firm performance in several approaches (Covin et al., 2006; Lumpkin and Dess, 2001; Tang et al., 2008; and Hughes and Morgan, 2007) because proactiveness and competitive aggressiveness influence performance differently. This result supports previous empirical findings in various contexts (e.g., Lumpkin and Dess, 2001; Dai et al., 2014). Lumpkin and Dess (2001) suggested that competitive aggressiveness is a response to threats while, proactiveness is a response to opportunities, whereas;

Chen and Hambrick (1995) further suggested that firm's proactive and responsive when they face a challenging in technology, innovation, competition, customers change. Proactiveness involves taking the initiative to shape new opportunities in the market; responsiveness involves adapting to competitors.

This research adopts a case study approach to explain the characteristics of knowledge ACAP and provide a rationale on how the roles of knowledge ACAP enhance the dimensions of EO. Cohen and Levinthal (1990a) have argued that the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends is critical to its innovation capabilities.

5.3.2 Theoretical Contributions from Survey Result

First, this research firstly assesses specifically which dimensions of EO are most valuable to securing performance. This research suggested that proactiveness is the most important characteristics to enhance firm performance in medical device industry. Proactiveness positively contributes to firm performance. In this research, proactiveness refers to how firms relate to market opportunities by seizing initiatives in the marketplace (Lumpkin and Dess, 1996a)

Second, this study highlights the negative moderating effect of knowledge ACAP on the relationship between proactiveness and firm performance which could explain a distinctiveness of medical device characteristics of medical device firm. This research points out the importance of knowledge ACAP in explaining how knowledge ACAP decreases firm performance. Scholars found that knowledge ACAP

is associated with the EO and performance relationship; however, only a small number of researchers investigated this relationship (Hughes and Morgan, 2007; Wales et al., 2013; Sciascia et al., 2014; Hernandez-Perlines, 2018). This study responds to calls for research on (1) the relationship between EO and firm performance (Lumpkin & Dess, 1996a; Lumpkin and Dess, 2001; Covin et al., 2006; (Dess et al., 1997, (2) EO scholars' adoption of the contingency approach to test the EO performance relationship (Lumpkin and Dess, 1996a; Covin and Lumpkin, 2011; Zellweger and Sieger, 2012), and (3) the link of knowledge ACAP to multidimensional EO and firm performance (Wales et al., 2013; Sciascia et al., 2014; Hernández-Perlines and Xu, 2018) and knowledge ACAP may have distinctly different effects on multiple dimensions of EO and avenues to firm success (Sciascia et al., 2014; Hernández-Perlines and Xu, 2018). This study confirms that the extent of the independent effects of proactiveness and competitive aggressiveness that influence firm performance and is applied in the studies varies depending on the internal factors, that is, the firm's knowledge ACAP.

Third, this research supports the theoretical argument on a multidimensional of entrepreneurial orientation (Miller, 1983b). Lumpkin & Dess (1996a) asserted that these dimensions may vary independently of each other and thus should be modeled in some combination which the authors termed "EO." Based on the survey result, this study argues that proactiveness have a positive effects to firm performance while, competitive aggressiveness vary independently in different direction. Hence, this study confirms that EO dimensions vary independently. Moreover, this present research explained proactiveness and competitive aggressiveness as a unidimensional construct considered to be positively related to performance (Lumpkin and Dess,

2006). This responds to the call for research on the multidimensional characteristics of EO that separately affect firm performance (Lumpkin and Dess, 2001; Casillas et al., 2011; Hernández-Perlines and Xu, 2018).

Fourth, scholars suggest that resolving the multiple dimensions of EO facilitates the understanding of distinct EO characteristics in various settings of research. Consistent with the suggestion of Huge and Morgan (2007), some scholars do not pay attention on the individual influence of dimensional EO and combine each dimension into a single construct. Moreover, Lumpkin and Dess, (1996a) treated EO as a superordinate construct and each of the five dimensions range from low to high according. Therefore, different research settings found inconsistent results of the effect of each dimension of EO on firm performance. Edwards (2001) posited that multidimensional constructs typically exist in two basic forms: aggregate and superordinate. (Stetz et al., 2000) suggested that the approaches through which the first-order dimensions of EO are operationalized as latent or summate significantly affect analysis. This study supports the arguments of Huges and Morgan (2007) and argues that individual influence of proactiveness and competitive aggressiveness affect to firm performance differently. As a result, multidimensional entrepreneurial orientation construct should be opera ionized as first-order dimensions to observe the individual influence of each dimension.

Fifth, this research argued that the definition of knowledge ACAP by (Cohen and Levinthal, 1990a), defined as “the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends,” is suitable when the context of study is knowledge-intensive firms. Because in terms of assessing

success in using new external knowledge as the driving force of a firm's new product development, the indicators relevant in evaluating new products' success is clearly in terms of sales. Finally, this research indicates that proactiveness and competitive aggressiveness of entrepreneurs may have different effects on firm performance. The differences were particularly apparent in the way firms relate to their knowledge ACAP. In other words, by gaining new knowledge, firms engage in various types of entrepreneurial activities that allow them to successfully exploit new opportunities in markets differently.

5.4 Agenda for Future Research

This study has several limitations that should be addressed in future research. Apart from these aspects, there might be some other factors that may have reinforced the impact of knowledge ACAP on the EO and performance relationship.

First, the study uses cross-sectional data. As such, cause-and-effect relationships cannot be definitively inferred from the results because causality can only be tested with data collected at different points in time (Wiklund and Shepherd, 2003a). Thus, future studies would benefit from the use of longitudinal data to observe how relationships between these variables develop over time.

Second, this research develops a contingent model that has a two-way interaction to explain EO effectiveness on firm performance. To increase explanatory power, future research should adopt other contingency models, that is, the three-way interaction test. It could add more factors to explain the variation in firm performance, which is the key debate of EO literature. Based on these case studies, additional

factors were raised from the interview results, which are social capital (Nahapiet and Ghoshal, 1998), external R&D, and internal R&D (Cassiman and Veugelers, 2006). These contingency factors have been studied in various contexts of study except the medical device industry. Hence, to grow a body of EO literature, adopting a three-way interaction might improve the understanding of how to manipulate EO effectiveness on firm performance.

Third, the present empirical study was conducted in the empirical context focusing on small and medium-sized medical device firms in Thailand, so, following (Bamberger, 2008), future research should evaluate other contexts of study in order to determine how the findings discussed here change. Moreover, future studies should focus on large medical device firms because they have more resources and may have better knowledge ACAP, which may strengthen EO and firm performance. It would facilitate ongoing discussions on scholars' belief that knowledge ACAP is stronger in smaller firms since they are more flexible and can assimilate and transform knowledge more easily (Engelen et al., 2014a).

Finally, the results available do not permit generalizations on the findings between EO, knowledge ACAP, and firm performance because the sample was drawn from medical device manufacturing firms in Thailand. Explored relationships may change across countries because EO constructs and knowledge ACAP constructs investigated in this study are bound to cultural contingencies (Hayton, George, and Zahra, 2018) Hence, future research should confirm these findings in the medical device industry in other countries.

The author of this study hopes that articulating and developing a further understanding of EO effectiveness in the medical device industry will stimulate future research on this more complex . It is also an important aspect of strategic management studies.

5.5 Managerial Contributions

Although this research inquiry is largely generated in response to academic debates with its findings providing theoretical contributions to the field, its range of managerial implications, particularly for executives, business managers, business advisors, and policymakers in the medical device industry is also highly relevant. The findings offer important managerial implications.

First, the result underlines the role of proactive behavior in enhancing a firm's performance in the medical device industry. In order to sustain the effectiveness of proactiveness on firm performance, managers should explicitly consider the strategy to manage an optimum level of knowledge ACAP. Based on the research result, a lower level of knowledge ACAP is more effective strategy to increase firm performance. Managers should focus on how to accumulate prior stock of medical knowledge. This strategy might not only prevent not invent here syndrome (NIH) syndrome but also enhance the firm's knowledge ACAP to accumulate prior related knowledge for future ongoing product development projects. In addition, managers of medical device firms should be aware of the cost to acquire new external knowledge.

Second, this study suggests that firms can increase performance by pursuing proactive strategies, for example, searching for relevant medical information, and participating in medical seminars both domestic and international will increase new medical trends and the ability to recognize information and knowledge relevant to existing knowledge. Then firms could filter such information and knowledge and select only those that could enhance their product effectiveness. In case a firm still lacks opportunities to use external knowledge, they must accumulate prior knowledge. Accumulated knowledge develops experience and makes a firm an expert one within this specific medical field of knowledge. Moreover, pursuing customer needs until the firm has enough understanding of them will improve their success in gaining new knowledge until they achieve commercial benefits because the medical device market is characterized as customer-driven. Targeted customers are healthcare professionals such as doctors and nurses, medical technologists, and other medical specialists in various sections in hospitals. Hence, to improve performance by proactive strategy and the ability to launch new successful products and improve existing ones, firms must attempt to gain relevant knowledge and understand the target customers' needs and improve its prior related knowledge as crucial processes for an effective utilization of external knowledge.

Third, this study additionally suggested that firms' competitive strategy against rivals with similar medical products have distinctive characteristics. The results of the case study show that healthcare customers do not find much difference between a firm's products. Most customers are usually familiar with the technologies of each brand they use. Therefore, customers have high brand loyalty and rarely change the brand if the customer does not realize obvious differences in the benefits.

As a result, each firm does not compete aggressively relative to other high-technology firms such as mobile phone and electronics companies, which are volume-driven, so firms try to reduce cost by high-volume production. Meanwhile, medical technology relies on customers and focuses on specialty. For medical devices, firms should focus on retaining existing customers and incremental product development because the number of patients increasing each year automatically means an increase in sales in the existing market. Thus, managers of medical device firms must track new medical trends related to their medical field, find opportunities to improve their products' efficiency, and update themselves on competitor movement.

Fourth, managers must consider that gaining new external knowledge will be effective when such knowledge is relevant and similar to existing knowledge, and there are three reasons for this: (1) Combining new knowledge with existing knowledge is a challenging first step. (2) The product development process is lengthy and takes time and high investment. Thus, firms must specify clearly how their new product will succeed on the market and why target customers have to buy their products. These questions facilitate how possibilities of the commercialization process lead to success. As a result, firms need to understand and learn customer needs and then attempt to develop products that meet these needs by using existing product development such as increasing the reliability or efficiency of the tools to facilitate customer use. Finally, the most important is that managers have to particularly consider the optimum level of new external knowledge that the firm will gain.

Fifth, policymakers should support the medical device industry to stimulate medical device knowledge through the incubation center of medical innovation.

Additionally, policymakers must enhance the success rate of technology transfer from medical research projects into medical products available in the market, which play a crucial role for medical device entrepreneurs. Moreover, from the case study, medical device entrepreneurs still lack the ability to put forward their medical device to sell in commercial terms, so the government should support the continuity of the this process. The R&D manager of case A suggested that, the government should support the medical device inspection center and the price that entrepreneurs can access. Moreover, the government agency should assist the process of medical device approval quite as well.

Finally, based on the case studies, this study suggests that managers of medical device firms must conduct trials before commercialize their products. Medical devices rely on an intensive clinical trial processes which requires medical expertise and medical engineering. The complexity of manufacturing requires clinical trials until the product is marketed. As a result, managers must pay particular attention to those processes because they will help the firm assess the possibility of launching products into the market as soon as possible.

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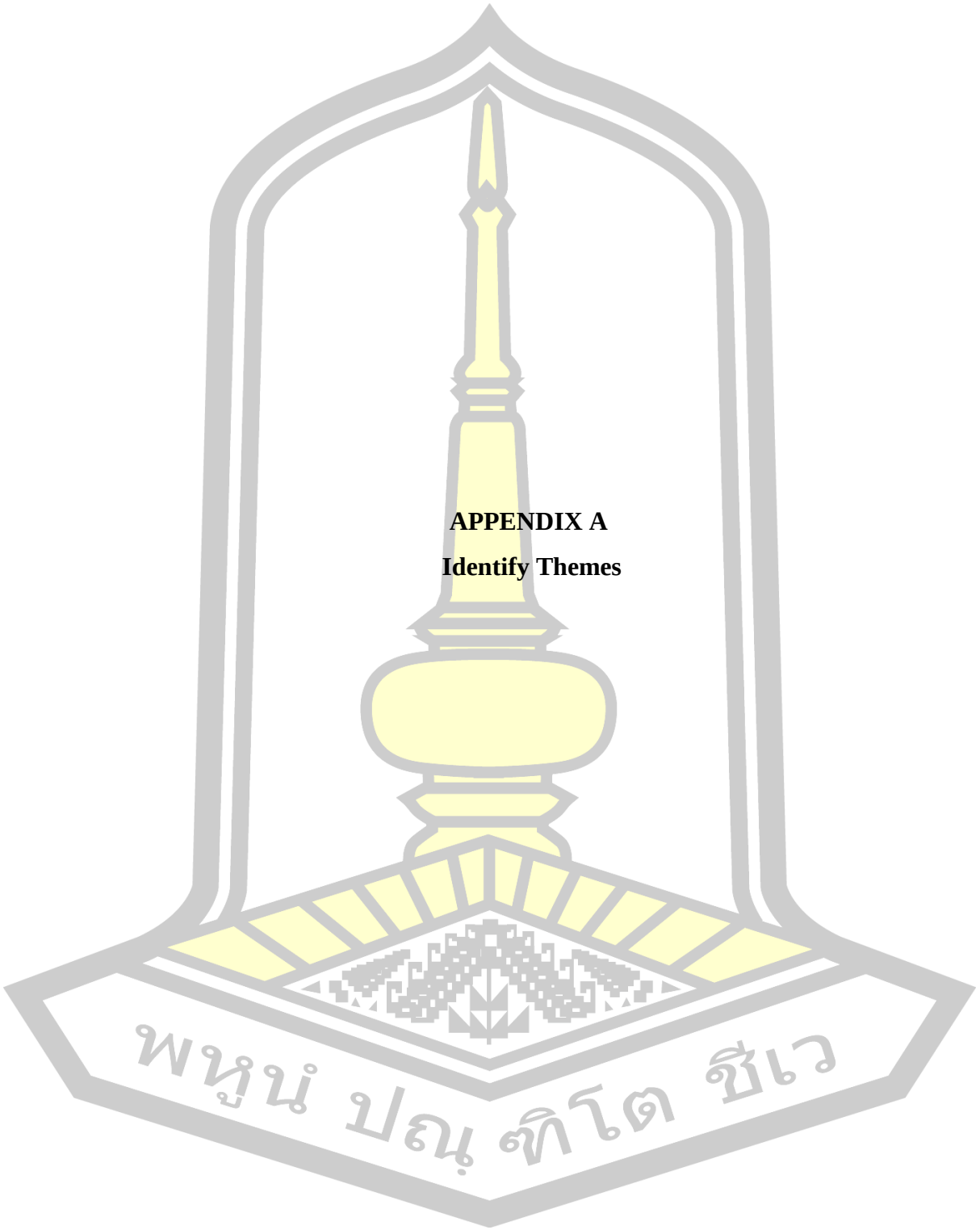
APPENDICES



APPENDIX A

Identify Themes

Table 1A Additional Identifying the Characteristics of Proactiveness

Proactiveness characteristics	Author (s)						
	Hamel (2000)	Wiklund and Shepherd (2005)	Zahra and Covin (1995)	Christensen (2013)	Lumpkin and Dess (2001)	Rauch, Wiklund, Lumpkin and Frese, (2009)	Hughes and Morgan (2007)
Involve in new ideas, new products					√		
Take initiative in situations					√	√	√
Committing to large resources	√	√	√	√			
Pursue new opportunity			√	√			
First mover advantage	√		√	√		√	
Initiate actions which competitors respond							√
Identify new opportunities							√

Table 2A Identifying the Characteristics of Competitive Aggressiveness

Competitive aggressiveness characteristics	Author (s)		
	Lumpkin and Dess (2001)	Rauch, Wiklund, Lumpkin and Frese (2009)	Hughes and Morgan (2007)
Aggressiveness and intensely competitive	√	√	√
Undo competitor	√	√	√
Bold and aggressiveness to compete		√	√

Table 3A Identifying the Characteristics of Innovativeness

Innovativeness characteristics	Author (s)		
	Rauch, Wiklund, Lumpkin and Frese, (2009)	Hughes and Morgan (2007)	Dai, Maksimov, Gilbert and Fernhaber (2014)
Introduce improvements innovations	√	√	
Creativity in its methods of operation	√	√	
New process and service development			√
Tried & tested practices, equipment & products or services			√
Seeks out new ways to do things	√		

Table 4A Identifying the Characteristics of Autonomy

Autonomy characteristics	Author (s)		
	Rauch, Wiklund, Lumpkin and Frese, (2009)	Hughes and Morgan (2007)	Cogliser and Schneider (2009).
Make and instigate changes	√	√	√
Act and think without interference	√	√	√
Independence to decide on work Lumpkin,	√	√	√
Freedom to communicate	√	√	
Authority and responsibility to act alone	√	√	√
Access to all vital information	√	√	

Table 5A Identifying the Characteristics of Risk-Taking

Risk-taking characteristics	Author (s)						
	Lumpkin and Dess (2001)	Zahra and Covin (1995)	Christensen (2013)	Miller and Friesen (1982)	Covin and Slevin (1988)	Rauch, Wiklund, Lumpkin and Frese, (2009)	Hughes and Morgan (2007)
Take calculated risks with new ideas				√	√	√	
Seeks out new ways to do things		√	√				
creative in its methods of operation		√	√				
Dominating distribution channels					√		
Withdraw resources					√		
First mover advantage	√	√	√				√
Emphasizes both exploration and experimentation	√						√

Table 6A Identifying the Characteristics of Knowledge Absorptive Capacity

Knowledge ACAP characteristics	Author (s)	
	Su, Ahlstrom and Cheng (2013)	Liao, Fei, and Chen (2007)
Identifying new and useful knowledge	√	√
Understanding new and useful knowledge	√	√
Valuing new and useful knowledge	√	
Assimilating new and useful knowledge owned	√	
Applying new and useful knowledge	√	
Exploiting new and useful knowledge	√	√

APPENDIX B

In depth- Interviewing's Questions and Results

Question no.1: How does the firm invest in new business opportunities? Is your firm take a risk when firm find new opportunities?

Table 1B In depth- Interviewing Results of Question No.1

Case	**Results**
Case A	The new investment guidelines separate into two situations. First, for importing, the owner observes the market trend by going to the medical devices seminar both in Thailand and abroad. The sale managers of each division track the growth of the market and report monthly to the management. Both the management and owner of the firm will have the decisions together about the potential of the market and whether or not to import new products. For the manufacturing, the product development department is responsible for producing the renal dialysis sterilization and RO machine. Now, it has not yet invested in the production section. It has just developed some items for the better responding for customer's need. Firm take a medium risky investment because the importing devices from many countries are our main business. If the manufacturer does not create something new, the product will be the same. Unless the manufacturer thinks of new products, we will bring it to try the market.
Case B	Case B will take new opportunities to invest in producing goods worldwide; not only in Thailand. B focuses on investment in a wild range of biotechnology in the diagnostic field. B products produce bases on the knowledge from medical researchers. As a result, B takes a risk in case of calculated risk. Since 99 percent of medical research tends to fail in practice, so we have to consider each research project seriously to calculate the opportunity to exploit the marketing benefits. The challenges of a biotech firm in Thailand are the confidence in domestic consumers such as the quality of Thai medical products. Country's ecosystems need to be built to support emerging businesses that can create value globally.

Table 1B (Contd.)

Case	Results
Case C	If competitor's new product affects the sales, case C staffs try to find their information's related to competitor's products. Case C tries to use our strengths to counter these situations. Their product performance is comparable to foreign products; moreover, easy to detect, no required expensive devices are our strengths. In additions, their products give benefits to customers such as reduce blood transfusion problems and the doctor gets faster results.
Case D	In the point of view of the investors, no one likes risk. Information is important when new competitors' products launched in the market. We need to find a product's details of competitors as much as possible. Moreover, we will analyze the published paper that competitors made and we have to find out what are the better benefits competitors give to the customer. However, if a competitor's products launch in Thailand, it has been doing marketing before. So, the global team already knows about the advantages of the competitor's products. Case D does not take risks that have not been studied. For example, if case D wants to invest in something new, case D must choose between take own investment or acquire firm that already existing product or technology that case D required. The owner of case D thinks that there is no risk to medical goods because they study the market before and case D often invests in the projects funded by the Chinese government.

Question no.2 How does the firm respond when competitors offer new products on the market?

Table 2B In depth- Interviewing Results of Question No.2

Case	Results
Case A	In the case of imported products, case A will consider the actual use of customers and compare properties between the new device and existing device. If it is no different, A will try to explain to their customers that an existing device that customer has can serve their need well. In addition, case A will try to keep existing customers as long as possible. In case of manufactured products such as a filter cleaning machine and RO water purifier, R&D staffs will adjust the features to meet customer need as much as possible. Any suggestions will further forward to the R&D department to develop the device. For manufacturing, only foreign firms are competitors. As seen, the new device is an adjustment from the existing device such as making it smaller. Case A might develop our products if the competitor is doing better than our existing products.
Case B	Case B uses the quality and lower price as a selling point. Case B gives customers to compare products and made a decision. B produces new products to maintain and expand the market wildly. Case B monitor new medical trend by participating in international medical seminar every year.
Case C	Case C responds to the market by increasing the performance of their manufactured products. B offers Thai diagnostic kit with cheaper, easier to detect, no less expensive devices relative to imported products. Case C try to expand market cover domestic market, and now export to abroad.
Case D	Case D focuses on providing specialized services to focus group of customer. Case D always offers new devices and products to the market. Competitors are only American manufacturers, but they focus just on production and sales their device only, while D focuses on manufacturing, sales, and research services. As a result, case D will offer new products more quickly than competitors.

Question no.3: Please give your opinion on a competitive position of your firm relative to your competitors in your industry (market leader or market follower).

Table 3B In depth- Interviewing Results of Question No.3

Case	Results
Case A	We may be around rank number three in the diagnostics market in Thailand. Moreover, we accounted for 90 percent of the market for medical devices we produce. Moreover, our product quality equivalent to a foreign products.
Case B	B is the first private diagnostic laboratory in Thailand. Case B is the first firm to produce AIDS screening kit in Thailand. Case B is the market leader. Their expertise in diagnostics makes B well understands the needs of customers.
Case C	As a limit number of the manufacturing firm in Thailand, we are a leader because a firm has the know-how of manufacturing a diagnostic test kit. The firm has a licensing of technology from university professors. It is enough to call us a leader. However, if compared with a foreign firm with similar technology, we are also a follower in sales.
Case D	For genome analysis market, the firm is not a market leader in term of the quantities of devices and reagents. The worldwide proportion would be 50:50 percent share relatives to an American manufacturer. However, in the case of comparing the service value of genome analysis; the firm is a market leader because an America manufacturer has only sold device and reagents without the genome analysis service. The advantage of our product is a cheaper price than competitor even though the technology is similar.

Question no.4: Are employees in your firm free to think and decide on their own work?

Table 4B In depth- Interviewing Results of Question No.4

Case	Results
Case A	Firm gives staff the opportunity to present their opinion. We communicate within workplace via line application and e-mail. Firms allows employee to think and work; however, employees have to talk to the supervisor first. The staffs in research and production department are free to think and work, because we have to find information and do all things by ourselves.
Case B	Case B's staffs are medical knowledgeable. Staffs are free to find their own way of doing their routine especially for the R&D department. Case B provides the meeting to solve problems and exchanges opinions on a regular basis if there is information or something to discuss.
Case C	Firm gives freedom to staffs, for example, variety of comments is propose and staffs discuss together. Brainstorming occurred if the problems are difficult to solve or staffs need a new approach. Employees can design their own jobs under the extent of staffs' responsibility.
Case D	We use skype to contact the office in China when the head office has a conference. Firm gives employees an opportunity to offer ideas within the scope of each person's responsibilities. However, the final decision is based on the top management because some staff information is not known.

Question no.5: Please provide your opinions on the firm's ability to create innovative products.

Table 5B In depth- Interviewing Results of Question No.5

Case	Results
Case A	R&D department is in-house. The engineers in the production unit are about five staffs. This dialysis machine is likely to be upgraded to fixing slow performance because the speed of cleaning and the accuracy of the machine are important. Case A produces their machine from experience by copying from machine made from abroad. First engineers saw how the machine work, then they tries to Figure out by themselves. Case A spends Almost ten years to develop the first product and then put it to customers to use their product and monitor the feedbacks.
Case B	Technology changed fast and forever so, case B monitor medical trend and technological advancement through medical journal and attending the international medical associations. Case B has R&D staff to monitor the proper technology which suitable for firm products. Expensive technology might not suit for Thailand market. Most 99 percent of researches are not success because the complication of medical disease. Before case B have own brand products, they started importing a devices from abroad and then they developed own product to replace. However, each development is difficult because of its complexity and diversity, and quality control is very important. This is an experiment that takes time and money to produce a lot of researches. Case B manufactures diagnostic rapid test kit by the various specialists' teams. The lab is equipped with state-of-the-art equipment and technology to ensure the quality of the test kit. Case B diagnostic test kit is accepted by many countries around the world.

Table 5B (Contd.)

Case	Results
Case C	About 2007, case C contacted the NSTDA and invests in research with NSTDA to produce a diagnostic test kit. It takes 2 years, the first diagnostic test kit test was launched. Customers give good feedback on Thailand's brand. Later, case C launched pregnancy test kit and hepatitis test kit by receiving the knowledge of the production through NSTDA again. After manufacturing the diagnostic test kit in the lab, the firm began to produce life science technology products that focused on the digital hearing aids. It is the result of jointing research projects between the National Electronics and Computer Technology Center and C since 2010. National Center for Genetic Engineering and Biotechnology (BIOTEC) and Thailand Research Fund (TRF) are sources of new knowledge for leverage firm's ability to innovate.
Case D	Case D's machines and reagents are innovations in the niche market. The basic technology is a genetic modification and denaturation genetic protein. Manufacturing and R&D center in China. Innovative product made from the in-house R&D team. Our production team comes from an American manufacturer firm which we acquired their technology since we decide to start a production unit of the genomic machine instead of being genomics analysis provider only. Firm's innovation usually developed within the R&D staff which comprise of doctors and engineers.

Question no.6: How firm use new external knowledge for the innovative outcome of new product development?

Table 6B In depth- Interviewing Results of Question No.6

Case	**Results**
Case A	We use customers 'feedback from both domestic and foreign customers to improve the performance of the device we produce. Knowledge to develop products provided by engineers within the firm. Knowhow on what to for a better machine, we have seen from a variety of foreign devices.
Case B	External knowledge is derived from the university and medical sciences department of Thailand to develop drug resistance kit.
Case C	The external knowledge of production is derived from joining research between the National Electronics and Computer Technology Center (NECTEC) and the firm since 2010.
Case D	The research team consists of doctors and engineers. They use the knowledge they have to solve problems and recruiting new features to put in the machine to make the genome detector easier.

Question no.7: What are your opinions on how firm develop new product between improved from the existing product or introduction of new knowledge and technology into a new product?

Table 7B In depth- Interviewing Results of Question No.7

Case	**Results**
Case A	After staffs received a customer complaint or competitors develop their machine and launch to the market, R&D try to adjust and develop the device by using the long experience working with the product. Staffs consider what materials to develop the machine. Production unit will develop products to meet customer's expectation. After the finished product completed, the staff takes their developed product to the trial process. If the trial succeeds, the newly developed device will launch to the market.
Case B	Firm receive technology transfer from the public sector by the Intellectual Property Institute of University. Under the sponsorship of the technology transfer Program funded by the National Innovation Agency in 2011. B gets support to develop research into production, distribution, and marketing.
Case C	New external knowledge aims to solve the problem or try to make customers use faster and more reliable. NECTEC is the developer of electronic technology, while our firm responsible for the design of products as well as conducting studies on the manufacturing process in accordance with the medical device standard. When we derive new knowledge from the patent, the first factory will have to see what factors required. Then make a sample product and test products reliability and accuracy. We usually test by asking the university which the researcher is working. After calculate the accuracy and precision, these products must be certified by several agencies and finally, request a registered of medical device with Thai FDA. Those processes take years. Additionally, National

Table 7B (Contd.)

Case	Results
Case C	Center for Genetic Engineering and Biotechnology (BIOTEC) and Thailand Research Fund (TRF) are sources of new knowledge for leverage firm's ability to innovate.
Case D	The R& D team is almost an engineer. They choose which technology helps to develop the machine? After selection process complete, product trials are made and follow by the clinical evaluation processes. When all processes complete, new product will launch to the market.

Question no.8: In your opinion, what is a medical device innovation? Would you give me for the definition of a medical device's innovation and disruptive innovation?

Table 8B In depth- Interviewing Results of Question No.8

Case	**Results**
Case A	Manufactured products are adjusted from the existing dialysis machines that the firm has and customized according to customer needs. For 5-6 years ago, innovation has been changed not much. For kidney device, mixing blood with dilution together could be innovation because it enhances the quality of dialysis, reduces the duration of dialysis and reduce the infection incident. Medical device are the least obsolete because medical technology changed very slowly as a result, the disruptive innovation seems to rarely occur.
Case B	Case B's new product develops from both existing knowledge and new knowledge. As B has an existing knowledge on working reagent in the laboratory, case B can produce these products to sell to hospital. Their products are more affordable than imported goods. For new knowledge, case B is committed to working with researchers from the university to develop diagnostic test kits to look forward to export in the future.
Case C	Case C has developed products from the existing knowledge such as Thalassemia kit which developed to be able to diagnose disease with the CBC machine that customers have in the lab. Moreover, firm used new knowledge to develop new products that have never been produced before, such as life science technology products.

Table 8B (Contd.)

Case	Results
Case D	First, D provides genomic services using American manufacturer. Later, American manufacturer do not sell the machine to the D. The president of D has a connection with some spare part's manufacturer of the sequencer or genomic analyzer in America. Hence, the president decides to acquire the American manufacturer to produce their own Chinese brand. For specialized medical product, sometimes customers do not choose the best innovation. Customers might use the same brand because they are familiarized. D serves the customer need by changing the machine model every year to make its throughput faster. The R&D team always develops all the time. The firm's innovation is based on an improvement of existing innovation. For example, the technology in each firm will not be the same because technology is protected by a patent. D has made a product by own patent so, the price is cheaper than the competitors who lack manufacture capacity. The production team that the company bought was can produce both devices and reagents. Medical devices and equipment have been upgraded to serve customer's expectation. However, changing model occurred not very often because of each upgrade takes time. Most of them are also used existing core technology but improve better properties. The R&D team has the ability to combine the knowledge of medicine, technology, and the requirements to think. Recently, our product changes the way to diagnose the down syndrome disease. It reduces the risk of pregnant infection because the technology can detect down syndrome by blood sample instead of piercing the amniotic fluid.

Question no.9: Please provide comments on your sales performance over the past 3-5 years as compared to your firm's goals and comparing with competitors in the market.

Table 9B In depth- Interviewing Results of Question No.9

Case	In-Depth Interview Results
Case A	There are no innovative machines that change the way of disease is treated. Most of the products are developed their effectiveness. It usually adapts from their original. Innovation is what makes doctors diagnosis and patients cure better. In term of the medical device, it seems to be a device or something that makes it easy to work out and reduce the workload of the workers. Disruptive innovation is an innovation that makes existing devices old and it causes a new way for a doctor to examine and diagnose the disease. For example, cell blood counting machine usually equips with blood stain examination to confirm cell morphology but now cell blood counting machine can examine the cell counting with visual cell picture. Moreover, some models can also be plowed with.
Case B	Innovation is a modern technology that makes the medical device more effective, accuracy, reliable and faster for diagnostic the disease. Disruptive innovation is technology that changes existing practices of diagnosis relative to existing technology.
Case C	Medical innovation is usually an adaptation from the existing. I have never encountered a new technology that is different from the original. Medical innovation is the technology which makes the diagnosis easier, faster and more reliable. Innovation also reduces the cost of production such as use a bioship sensor instead of using a solution to diagnose the disease. Disruptive innovation is usually different from existing technology. It usually uses high technology to help the doctor or patient easy to use. For example, porTable sugar testing changes the way of patients to monitor their blood sugar level. This porTable machine allows patients to check their own sugar level at home because of its small, quick and easy to use.

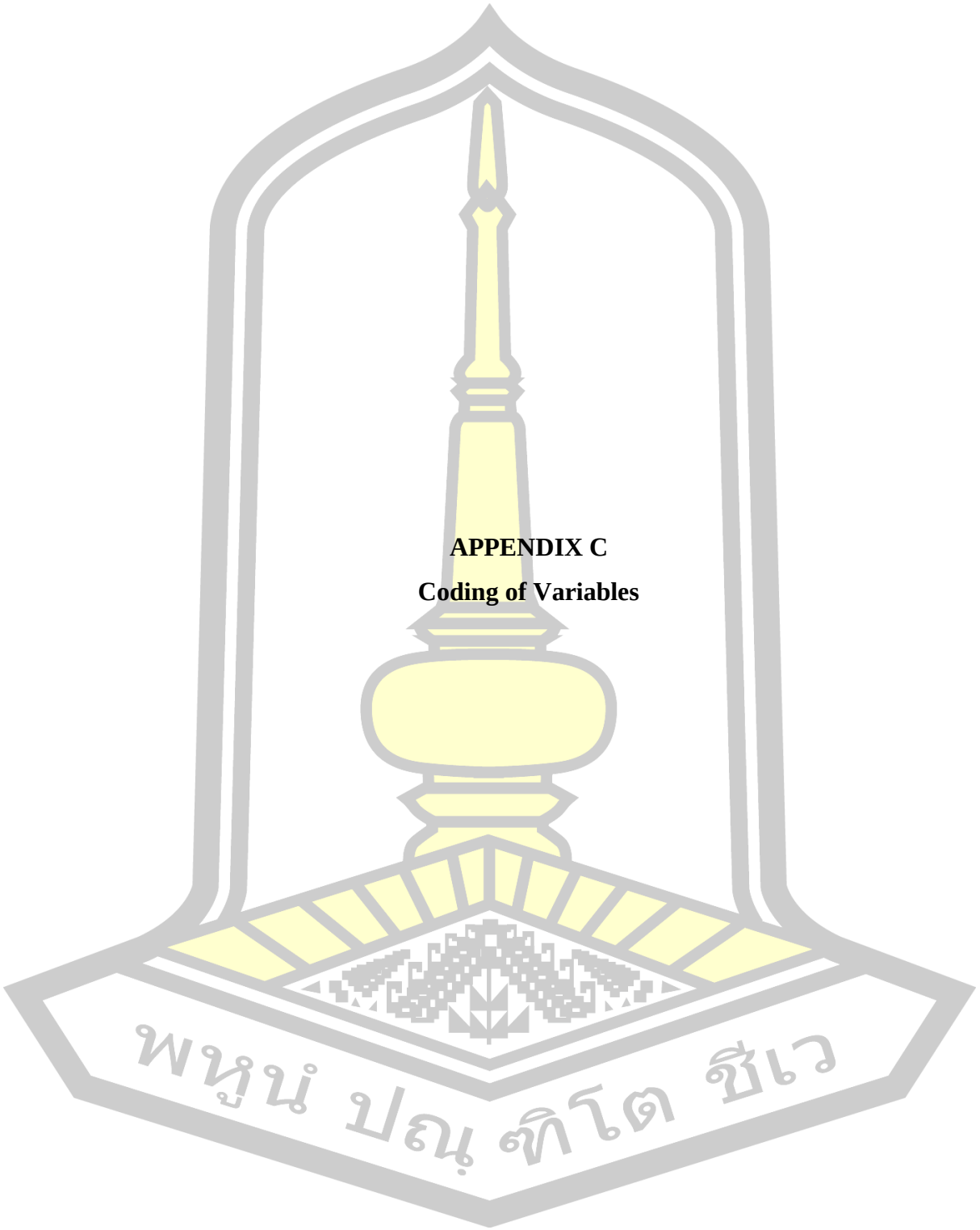
Table 9B (Contd.)

Case	In-Depth Interview Results
	Patients just apply blood from their fingertips and then the embedded biosensor will read the sugar level within 30 seconds. Biosensor technology is a disruptive technology for medical diagnosis.
Case D	Medical innovation is something that makes diagnosis easier and more accurate. Disruptive innovation in the medical field is faster throughput and easy to use. Its benefits reduce the workload of staffs and finally benefits to the doctor. In the field of genomics, the firm now offer a new method to detect genomes from blood directly without penetrating the patient's amniotic fluid. New method offers 99.99% accuracy and reduces a patient's risky to get infected. Moreover, it is easier to detect, lower price relative to the old method and more automation system reduce the number of staff working and use of the machine easier. It called disruptive in this field.

Question 10: Please provide comments on your sales performance over the past 3-5 years as compared to your firm's goals and comparing with competitors in the market.

Table 10B In depth- Interviewing Results of Question No.10

Case	In-Depth Interview Results
Case A	Sales are increased because the incidence of chronic kidney disease is increasing. The rate will increase by about 10 percent every year. Additionally, we produce for export in Burma, Malaysia, India, and South East Asia. This year 50 kidney dialysis machines are sold in both domestic and international markets. The sale growth rate increases about 10% every year.
Case B	Firm's total sales increase every year. For products manufactured itself, sales increase by 10-15% every year. Growing sale come from the number of customers increased both within Thailand, abroad, and the customers who hire our factory produce products.
Case C	Sales increase every year especially patented products such as CD 4 reagent kit. Moreover, the production is increasing about 10-15% in total especially the product that we have own production patent such as CD 4 reagent kit.
Case D	The sales are very high. The firm focuses on two income stream; research service and device and reagent selling. Nowadays, our company produces thousands of machines and sells them all over the world. The expansion overseas aims to service the research center and other customers who need the genomic analysis. For example, in Thailand, we have collaboration with a research center and university hospitals to help the doctor cure for chronic diseases by analyzing genomes. When we produce the machine itself, the selling price is down 30%.



APPENDIX C

Coding of Variables

Table 1C Code of Proactiveness

No	Code	Case A	Case B	Case C	Case D	Case E
1	Involve in new ideas, new products	√	√	√	√	√
2	Take initiative in situations	√	√	-	√	√
3	Committing to large resources	-	√	-	√	√
4	Pursue new opportunity	√	√	√	√	√
5	First mover advantage	√	-	-	√	√
6	Initiate actions which competitors respond	-	-	-	√	√
7	Identify new opportunities	√	√	√	√	√

Table 2C Code of Risk-Taking

No	Code	Case A	Case B	Case C	Case D	Case E
1	Take calculated risks with new ideas	-	-	-	√	√
2	Seeks out new ways to do things	-	-	-	√	√
3	Creative in its methods of operation	-	-	-	√	√
4	Dominating distribution channels	-	-	-	-	√
5	Withdraw resources	-	-	-	-	-
6	First mover advantage	-	-	-	√	√
7	Emphasizes both exploration and experimentation	-	-	-	√	√

Table 3C Coding of Competitive Aggressiveness

No	Code	Case A	Case B	Case C	Case D	Case E
1	Aggressiveness and intensely competitive	-	-	-		√
2	Undo competitor	√	√	√	√	√
3	Bold and aggressiveness to compete	-	-	-	-	√

Table 4C Coding of Innovativeness

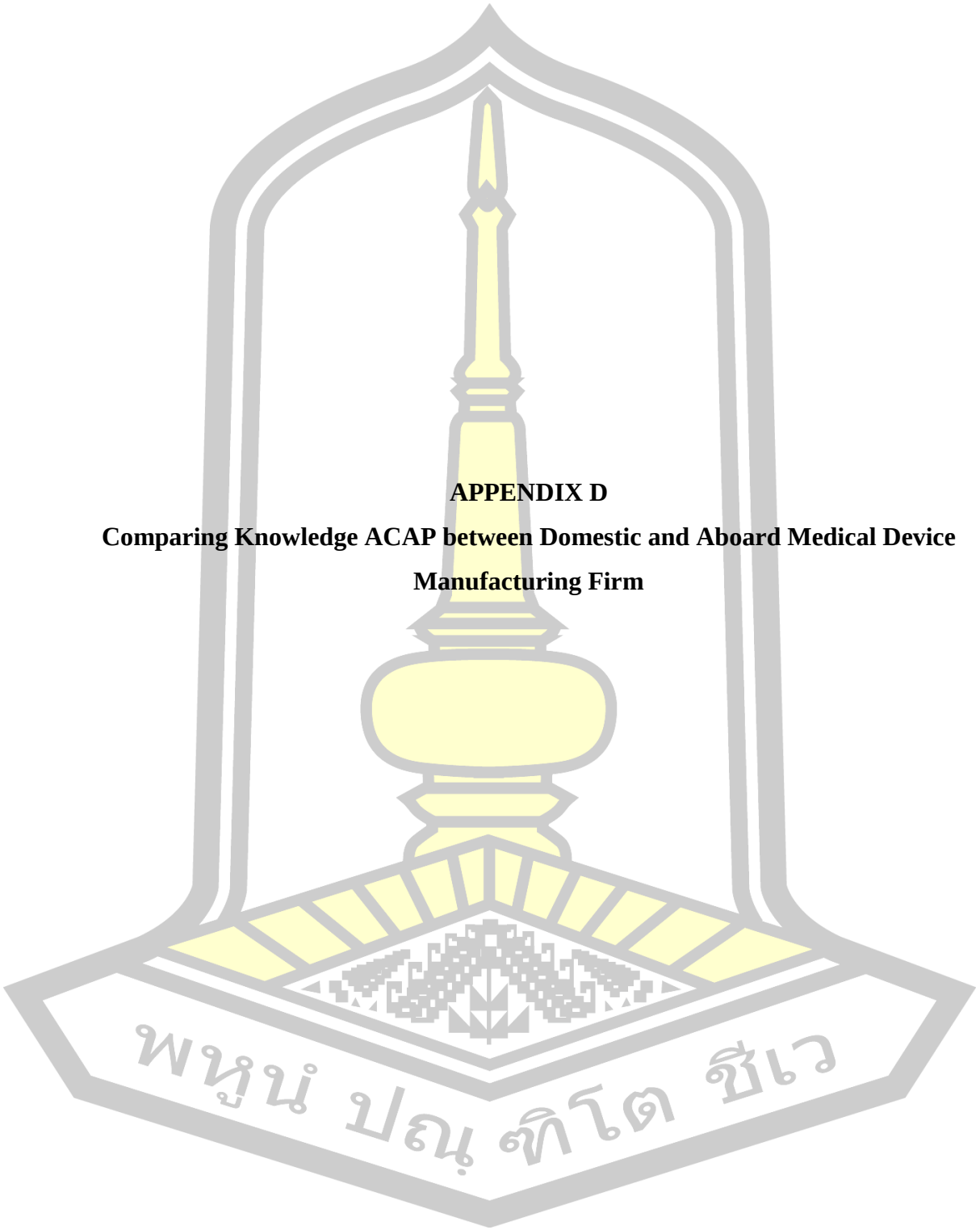
No	Code	Case A	Case B	Case C	Case D	Case E
1	Introduce improvements innovations	√	√	√	√	√
2	Creativity in its methods of operation	-	-	√	√	√
3	New process and service development	-	-	√	√	√
4	Tried & tested practices, equipment, & products or services	-	√	√	√	√
5	Seeks out new ways to do things	-	-	-	-	√

Table 5C Coding of Autonomy

No	Code	Case A	Case B	Case C	Case D	Case E
1	Make and instigate changes	-	-	-	√	√
2	Act and think without interference	-	√	√	√	-
3	Independence to decide on work	-	-	√	√	-
4	Freedom to communicate	√	√	√	√	√
5	Authority and responsibility to act alone	√	-	-	√	-
6	Access to all vital information	-	√	√	-	-

Table 6C Coding of Knowledge ACAP

No	Code	Case A	Case B	Case C	Case D	Case E
1	Identifying new and useful knowledge	√	√	√	√	√
2	Understanding new and useful knowledge	√	√	√	√	√
3	Valuing new and useful knowledge	√	√	√	√	√
4	Assimilating new and useful knowledge owned	√	√	√	√	√
5	Applying new and useful knowledge	√	√	√	√	√
6	Exploiting new and useful knowledge	√	√	√	√	√

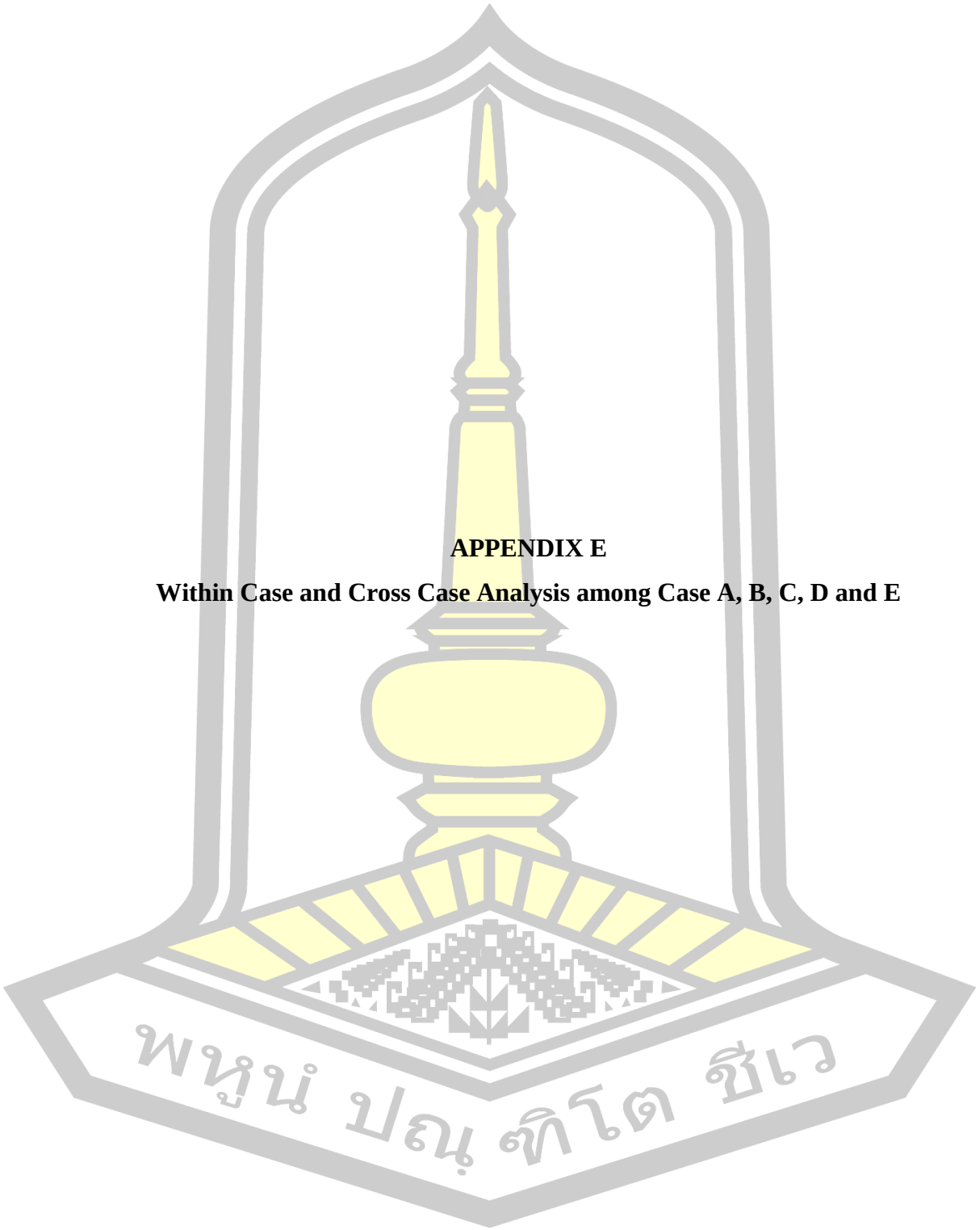


APPENDIX D

Comparing Knowledge ACAP between Domestic and Aboard Medical Device Manufacturing Firm

Table 1D Comparing the Characteristics between Domestic Medical Device Manufacturing Firm and Abroad Medical Device Manufacturing Firm

Construct	**Location**	**Characteristics**
Knowledge Absorptive Capacity	Thailand	Customer feedback/ copy foreign machines University Medical sciences department of Thailand Intellectual Property Institute of University NSTDA, NECTEC -Develop existing product/ trial / launching -Technology transfer/ production/ distribution and marketing -Patent /Trial/ reliability and accuracy testing/ certified/ launching
	Abroad	-Technology selection/ product trials/ clinical evaluation/ launching.

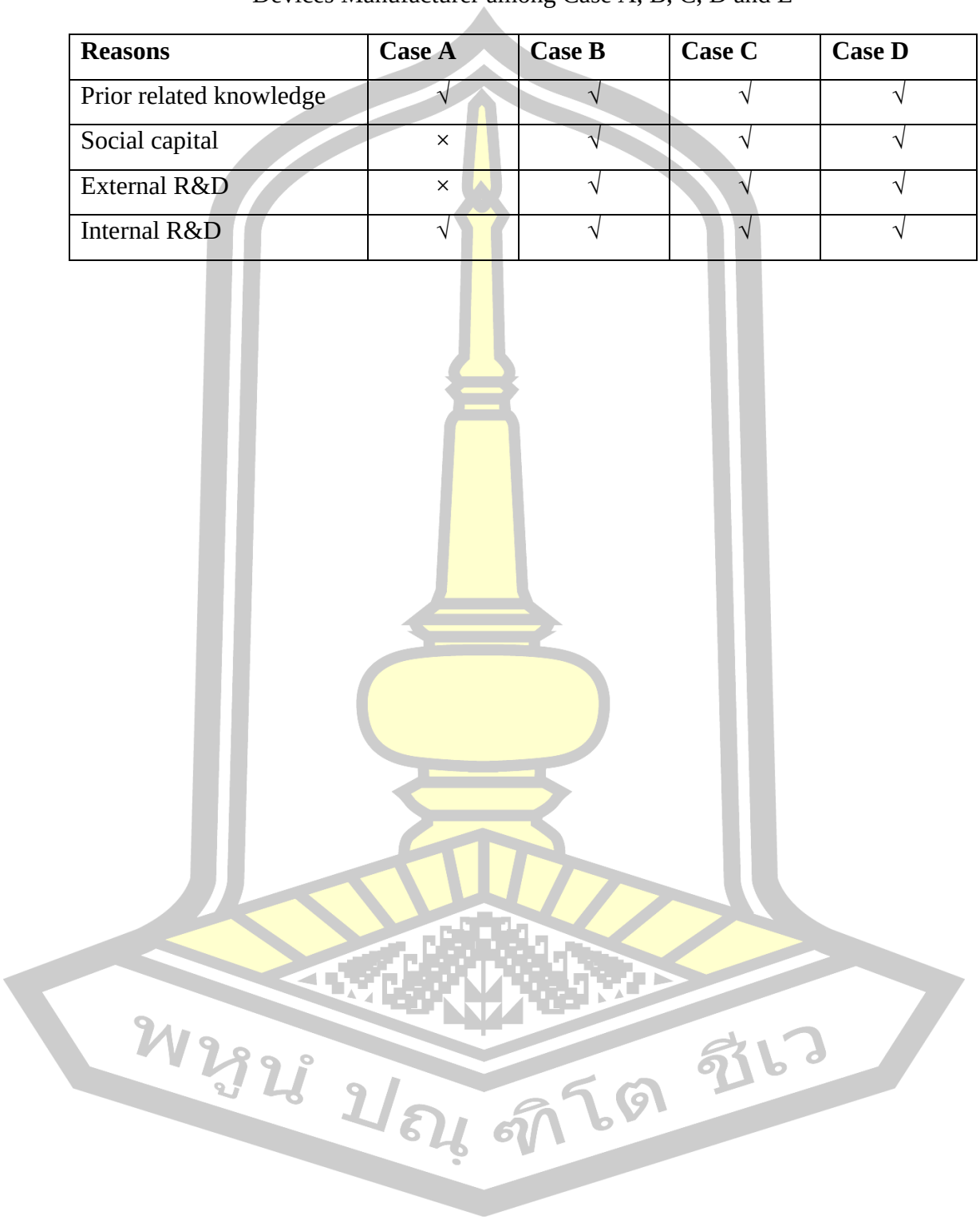


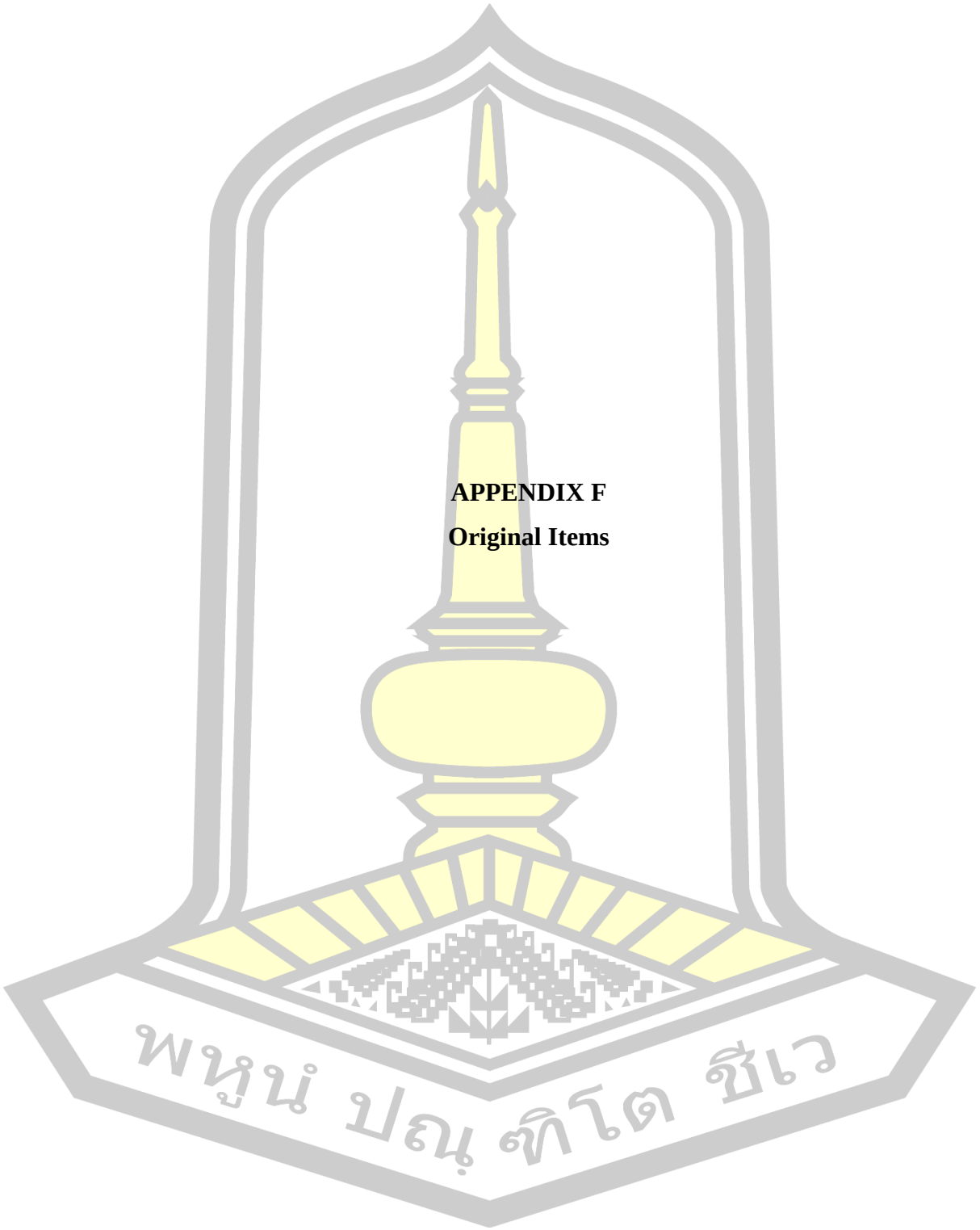
APPENDIX E

Within Case and Cross Case Analysis among Case A, B, C, D and E

Table 2E Within Case and Cross Case Analysis E of the Reasons to Being a Medical Devices Manufacturer among Case A, B, C, D and E

Reasons	**Case A**	**Case B**	**Case C**	**Case D**
Prior related knowledge	√	√	√	√
Social capital	×	√	√	√
External R&D	×	√	√	√
Internal R&D	√	√	√	√





APPENDIX F

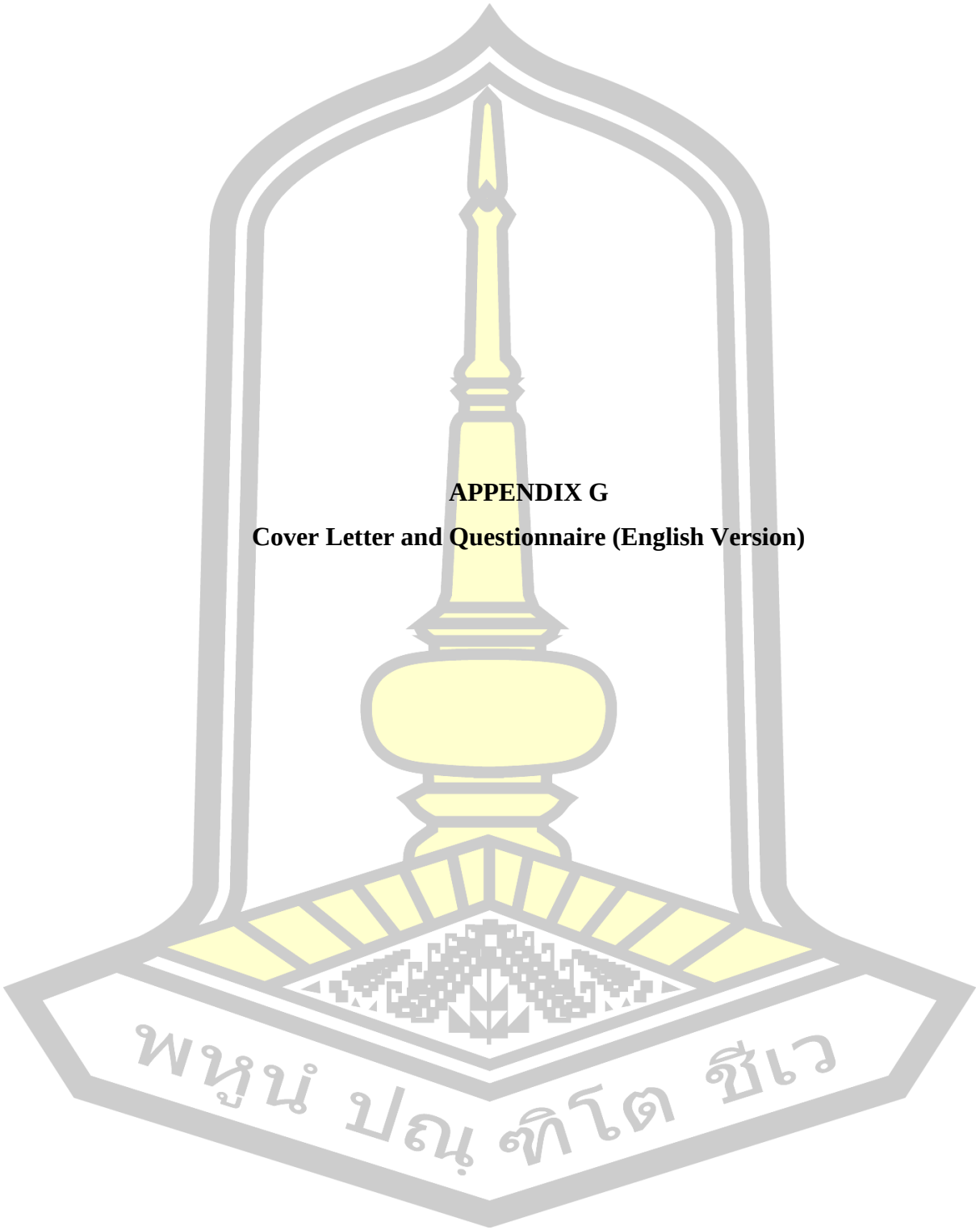
Original Items

Table F1: Original Items in Scales

Constructs	Items
PRO1	We always try to take the initiative in every situation (e.g., against competitors, in projects when working with others).
PRO2	We excel at identifying opportunities.
PRO3	We initiate actions to which other organizations respond.
COM1	Our business is intensely competitive.
COM2	In general, our business takes a bold or aggressive approach when competing.
COM3	We try to undo and out-maneuver the competition as best as we can.

Table F2: Original Items in Scales

Constructs	Items
Knowledge Absorptive Capacity (Knowledge ACAP)	
Knowledge ACAP1	The search for relevant information concerning our industry is every-day business in our company.
Knowledge ACAP 2	In our company ideas and concepts are communicated cross-departmental.
Knowledge ACAP 3	Our employees are used to absorb new knowledge as well as to prepare it for further purposes and to make it available
Knowledge ACAP 4	Our employees successfully link existing knowledge with new insights
Knowledge ACAP 5	Our company regularly reconsiders technologies and adapts them accordant to new knowledge
Firm Performance	
FP1	The return on investment (ROI) has exceeded what our investors expected as stated on our business plan
FP2	Our company has met all of our predefined goals and objectives (such as profitability, sales, etc.).
FP3	How successful is your company from an overall profitability standpoint (e.g., as stated in your business plan?)
FP4	Relative to competition, out company's sales growth is.
FP5	Relative to competition, our company’s market share gains are.
FP6	Relative to competition, our company's net profits are.



APPENDIX G

Cover Letter and Questionnaire (English Version)

Questionnaire to the Ph. D. Dissertation Research
Proactiveness, Competitive aggressiveness, Knowledge Absorptive Capacity, and Performance Empirical Evidence from Medical Device Industry in Thailand"

Explanations:

The objective of this research is to examine the entrepreneurial orientation of medical industry in Thailand. This research is a part of doctoral dissertation of Mrs. Chanarus Wongcharee at Mahasarakham Business School, Mahasarakham University, Thailand. The question is divided into seven parts.

Part 1: General information about medical device industry in Thailand.

Part 2: Opinion on proactiveness, competitive aggressiveness and knowledge absorptive capacity

Part 3: Opinion on overall performance

Part 4: Personal information about top manager of medical device industry in Thailand

Part 5: Recommendations and suggestions.

Your answers will be kept in confidentiality and your information will not be shared with any outside party without your permission.

Do you want a summary of the results?

( ) Yes, e-mail…….. (….) No

If you want a summary of this research, please indicate your e-mail address or attach your business card with this questionnaire. The summary will be mailed to you as soon as the analysis is complete.

Thank you for your time answering all questions. I have no doubt that your answer will provide valuable information for academic advancement. If you have any questions with respect to this research, please contact me directly. Cell phone: 092-5562954/ e-mail umapu_tap@hotmail.com

Sincerely yours,

(Chanarus Wongcharee)
Ph. D. Student
Mahasarakham Business School
Mahasarakham University, Thailand

Part I : General information about medical device industry in Thailand.

1) What are your company's objectives?

○ Made for sale in the country ○ made to export for sale abroad

○ Other (please specify) _____

2) What is your products category? (Can select more than 1 group)

○ Durable medical devices ○ Disposable medical devices

○ Reagents and test kits ○ other (please specify)_____

3) How many new products has your company been launching over the past 3 years?

(The new product is including a new product developed from existing products and creating new products that are different)

○None ○ 1-3 products

○4-6 products ○ above 6 products

4) The average annual revenue of your company is

○ Less than $15 million ○ $15 million to $30 million

○$30 million to $45 million ○ above $ 45 million

5) Nationality of the company's owner is

○ 100% Thai company

○ Thai company joint venture with foreign company

(Please specify the most-invested countries. _____)

○ Foreign companies (Please specify country of ownership_____

6) The capital investment of the company is

○ Less than 15,000 dollars ○ 15,000 dollars to 240,000 dollars

○ 240,000 dollar to 1.5 million dollars ○ above 1.5 million dollars

7) The total number of employees is

○ Less than 50 people ○ 50 - 150 people

○151 - 250 people ○ Above 250 people

8) How long does your company operate the business?

○Less than 5 years ○ 5 - 10 years

○11 - 15 years ○above 15 years

9) What is the proportion of research and development expenses per total sales over the past 3 years of your company?

○ Less than 0.10 % ○ 0.10 % - 0.20 %

○ 0.21 % - 0.30 % ○ Above 0.30 %

Part II : Entrepreneurship Orientation and Knowledge Absorptive Capacity of the Company

Explanation: Please include √ in field that best reflects your opinion about the overall entrepreneurial orientation and absorptive capacity of the company.

1 = Very strongly disagree 7 = Very strongly agree

	Level of your opinions	Very strongly disagree ← → Very strongly agree
1	We always try to take the initiative in every situation (e.g., against competitors, in projects when working with others).	① ② ③ ④ ⑤ ⑥ ⑦
2	We excellence at identifying opportunities.	① ② ③ ④ ⑤ ⑥ ⑦
3	We initiate actions to which other organizations respond.	① ② ③ ④ ⑤ ⑥ ⑦
4	Our business is intensely competitive.	① ② ③ ④ ⑤ ⑥ ⑦
5	In general, our business takes a bold or aggressive approach when competing.	① ② ③ ④ ⑤ ⑥ ⑦
6	We try to undo and out-maneuver the competition as best as we can	① ② ③ ④ ⑤ ⑥ ⑦
7	The search for relevant information concerning our industry is every-day business in our company.	① ② ③ ④ ⑤ ⑥ ⑦
8	In our company ideas and concepts are communicated cross-departmental.	① ② ③ ④ ⑤ ⑥ ⑦
9	Our employees are used to absorb new knowledge as well as to prepare it for further purposes and to make it available	① ② ③ ④ ⑤ ⑥ ⑦
10	Our employees successfully link existing knowledge with new insights	① ② ③ ④ ⑤ ⑥ ⑦
11	Our company regularly reconsiders technologies and adapts them accordant to new knowledge	① ② ③ ④ ⑤ ⑥ ⑦

Part III: Overall Performance

Explanation: Please include √ in field that best reflects the true level of company's performance ***compared to the company's goals.***

0 = equal to company's goals

+ 3 = the most higher than the company's goal

-3 = the most lower than the company's goal

		Very strongly disagree ← → Very strongly agree
1	The return on investment (ROI) has exceeded what our investors expected as stated on our business plan.	- 3 - 2 - 1 ⓪ + 1 + 2 + 3
2	Our company has met all of our predefined goals and objectives (such as profitability, sales, etc.).	- 3 - 2 - 1 ⓪ + 1 + 2 + 3
3	How successful is your company from an overall profitability standpoint (e.g., as stated in your business plan?)	- 3 - 2 - 1 ⓪ + 1 + 2 + 3

Explanation: Please include √ in field that best reflects the true level of company's performance ***compared to your competitor.***

0 = equal to company's goals

+ 3 = the most higher than the company's goal

- 3 = the most lower than the company's goal

		Very strongly disagree ← → Very strongly agree
1	Relative to competition, out company's sales growth is.	- 3 - 2 - 1 ⓪ + 1 + 2 + 3
2	Relative to competition, our company's market share gains are.	- 3 - 2 - 1 ⓪ + 1 + 2 + 3
3	Relative to competition, our company's net profits are.	- 3 - 2 - 1 ⓪ + 1 + 2 + 3

Part IV: About Company and You

1) Your job title in your company is

○ Chief Executive Officer (CEO) ○ Executive Director

○ Manager of _____ ○ other (please specify _____)

2) How long have you been working in the medical device industry? (Including the time before joining this company)

○ Less than 5 years ○ 5-10 years

○ 11-15 years ○ above15 years

Part V: Recommendations and suggestions regarding renewal capability of medical device industry in Thailand.

……

……

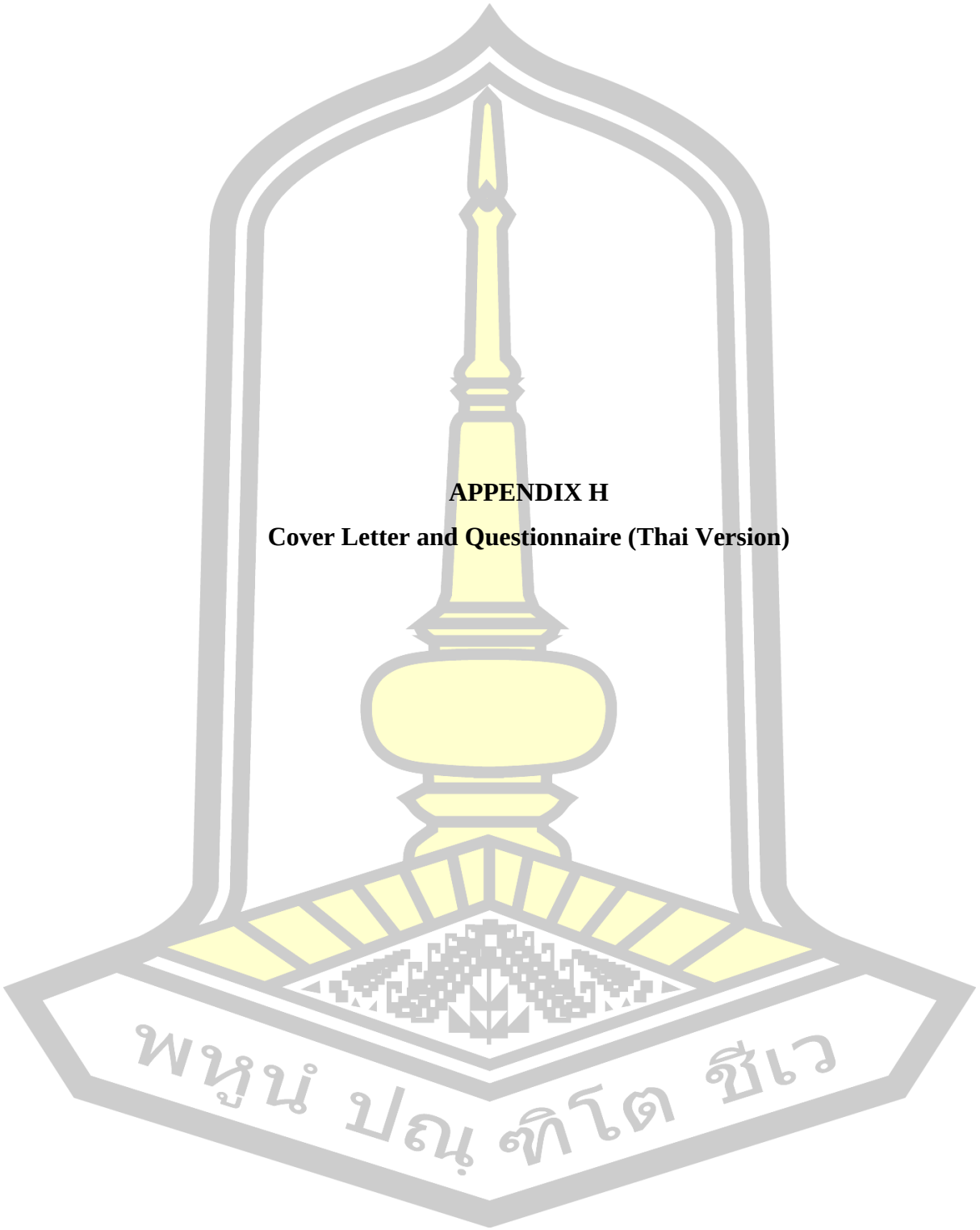
……

……

Thank you for your time and attention to this matter. Please fold and return in provided envelope and return to me. If you desire a summary report of this study, please give your business card attached with this questionnaire. The summary will be mailed to you upon the completion of data analysis

Thank you for taking the time to participate in this research.

Please fold the questionnaire in the enclosed envelope and return it to the address provided in the envelope. If you would like to report the results, please provide your e-mail…….



APPENDIX H

Cover Letter and Questionnaire (Thai Version)

แบบสอบถามเพื่อการวิจัย

เรื่อง การทำงานเชิงรุกและความก้าวร้าวในการแข่งขัน ความความสามารถในการดูดซับความรู้ และผลการปฏิบัติงาน จากอุตสาหกรรมเครื่องมือทางการแพทย์ในประเทศไทย "

คำชี้แจง:

การวิจัยครั้งนี้มีวัตถุประสงค์เพื่อศึกษาการมุ่งเน้นการเป็นผู้ประกอบการ ของอุตสาหกรรมเครื่องมือทางการแพทย์ในประเทศไทย ซึ่งข้อมูลที่ได้รับจากท่าน มีความสำคัญอย่างยิ่งต่อความเที่ยงตรงของผลการวิจัย และการนำผลวิจัยไปใช้ให้เกิดประโยชน์อย่างแท้จริง จึงขอความกรุณาจากท่านโปรดให้ข้อมูลให้ครบทุกข้อในทุกตอนตามความเป็นจริง และกรุณาส่งคืนแบบสอบถามนี้ แก่ผู้วิจัย จึงขอความกรุณาท่านส่งคืนแบบสอบถามที่ได้ตอบอย่างครบถ้วน พับใส่ซองจดหมายที่ได้ระบุที่อยู่ และติดแสตมป์ที่ได้แนบมาด้วย โดยรายละเอียดของแบบสอบถามประกอบด้วย คำถามนี้แบ่งเป็น 7 ตอน ดังนี้

ตอนที่ 1: ข้อมูลทั่วไปเกี่ยวกับธุรกิจเครื่องมือทางการแพทย์
ตอนที่ 2: ข้อมูลเกี่ยวกับการริเริ่ม และ ความสามารถในการเรียนรู้ของบริษัท
ตอนที่ 3: ความเห็นเกี่ยวกับผลประกอบการของบริษัท
ตอนที่ 4 ข้อมูลส่วนบุคคลของผู้บริหารในธุรกิจเครื่องมือทางการแพทย์
ตอนที่ 5: ข้อคิดเห็นและข้อเสนอแนะของท่านต่ออุตสาหกรรมเครื่องมือทางการแพทย์

ข้อมูลของท่านจะถูกเก็บไว้เป็นความลับและจะมีการใช้ข้อมูลใดๆที่เกี่ยวกับตัวท่านในการรายงานข้อมูล รวมทั้งข้อมูลของท่านจะไม่มีการเปิดเผยกับบุคคลภายนอกโดยไม่ได้รับอนุญาตจากท่าน

ท่านต้องการรายงานสรุปผลการวิจัยหรือไม่

(….) ต้องการ ระบุ E-Mail…….. (....) ไม่ต้องการ

ผู้วิจัยขอขอบคุณสำหรับเวลาที่ท่านได้สละเวลาในการให้ข้อมูลที่เป็นประโยชน์อย่างยิ่งต่อการวิจัย หากท่านมีข้อสงสัยประการใด โปรดติดต่อผู้วิจัย นาง ชนารัศมิ์ วงชารี โทรศัพท์มือถือ: 092-5562954 หรือ E-Mail: umapu_tap@hotmail.com

ขอขอบพระคุณสำหรับข้อมูล ไว้ ณ.โอกาสนี้

(ชนารัศมิ์ วงชารี)
นิสิตปริญญาเอก สาขาวิชาการจัดการ
คณะบัญชี และการจัดการ มหาวิทยาลัยมหาสารคาม

ตอนที่ 1: ข้อมูลทั่วไปเกี่ยวกับธุรกิจเครื่องมือทางการแพทย์

1) บริษัทของท่านมีลักษณะแบบใด

○ ผลิตเพื่อขายภายในประเทศ ○ ผลิตเพื่อส่งออกขายต่างประเทศ

○ อื่นๆ(โปรดระบุ)_____

2) ผลิตภัณฑ์ที่บริษัทของท่านผลิตจัดอยู่ในเครื่องมือแพทย์กลุ่มใด (เลือกได้มากกว่า 1 กลุ่ม)

○ ครุภัณฑ์ทางการแพทย์ ○ วัสดุสิ้นเปลืองทางการแพทย์

○ ชุดน้ำยาและชุดวินิจฉัยโรค ○อื่นๆ(กรุณาระบุ) _____

3) บริษัทของท่านมีจำนวนผลิตภัณฑ์ใหม่กี่ชิ้นในช่วง 3 ปีที่ผ่านมา (ผลิตภัณฑ์ใหม่ คือ การปรับปรุงจากผลิตภัณฑ์เดิม และสร้างผลิตภัณฑ์ใหม่ที่แตกต่างจากเดิม)

○ ไม่มี ○ 1-3 ผลิตภัณฑ์

○4-6 ผลิตภัณฑ์ ○ มากกว่า 6 ผลิตภัณฑ์

4) รายได้ของธุรกิจเฉลี่ยต่อปีของบริษัทท่าน คือ

○ น้อยกว่า 500 ล้านบาท ○ 500 ล้านบาท ถึง 1,000 ล้านบาท

○ 1,000 ล้านบาทถึง 1,500 ล้านบาท ○ มากกว่า 1,500 ล้านบาท

5) ลักษณะของบริษัทคุณคือแบบใด

○ บริษัทที่คนไทยถือหุ้น 100%

○ บริษัทไทยร่วมทุนกับบริษัทต่างชาติ (โปรดระบุ ประเทศที่ร่วมทุนมาที่สุด_____)

○ บริษัทต่างชาติ (โปรดระบุ ประเทศเจ้าของกิจการ_____)

6) จำนวนเงินลงทุนจดทะเบียนของบริษัทท่าน คือ

○ น้อยกว่า 500,000 บาท ○ 500,000 บาท ถึง 8 ล้านบาท

○ 8 ล้านบาท ถึง 50 ล้านบาท ○ มากกว่า 50 ล้านบาท

7) จำนวนพนักงานทั้งหมดของบริษัทท่าน คือ

○ น้อยกว่า 50 คน ○ 50 – 150 คน

○ 151 คน - 250 คน ○ มากกว่า 250 คน

8) บริษัทของท่านได้ดำเนินธุรกิจมาเป็นระยะเวลาเท่าใด

○ น้อยกว่า 5 ปี ○ 5 - 10 ปี

○ 11 - 15 ปี ○ มากกว่า 15 ปี

9) ในช่วง 3 ปีที่ผ่านมาบริษัทของท่าน*มีสัดส่วนของค่าใช้จ่ายในการวิจัยและพัฒนาผลิตภัณฑ์ ต่อ ยอดขายของบริษัท* คิดเป็นร้อยละเท่าไร

○ น้อยกว่าร้อยละ 0.10 ○ร้อยละ 0.10 - 0.20

○ ร้อยละ 0.21 - 0.30 ○ มากกว่าร้อยละ 0.30

ส่วนที่ 2 ข้อมูลเกี่ยวกับความเป็นผู้ประกอบการ และ ความสามารถในการเรียนรู้ของบริษัท

คำชี้แจง คุณเห็นด้วยหรือไม่กับข้อความข้างล่างนี้ กรุณาใส่เครื่องหมาย √ ในช่องตัวเลขที่ตรงกับระดับความคิดเห็นของท่านมากที่สุดเกี่ยวกับความเป็นผู้ประกอบการของ***บริษัทโดยรวม***

โดย ระดับ 1 = เห็นด้วยน้อยที่สุด และ ระดับ 7 = เห็นด้วยมากที่สุด

	ความเป็นผู้ประกอบการ และ	เห็นด้วยน้อยที่สุด ← → เห็นด้วยมากที่สุด						
1	บริษัทเป็นผู้ริเริ่มทำในทุกสถานการณ์ เช่น เริ่มต่อต้านคู่แข่ง เริ่มสร้างความร่วมมือกับหน่วยงานภายนอกเพื่อประโยชน์ทางธุรกิจ	①	②	③	④	⑤	⑥	⑦
2	บริษัทเชี่ยวชาญในการหาโอกาสใหม่ๆทางธุรกิจ	①	②	③	④	⑤	⑥	⑦
3	การเคลื่อนไหวทางธุรกิจของบริษัทได้รับการตอบสนองจากคู่แข่ง	①	②	③	④	⑤	⑥	⑦
4	บริษัทแข่งขันอย่างหนักกับคู่แข่งในอุตสาหกรรม	①	②	③	④	⑤	⑥	⑦
5	บริษัทกล้าได้กล้าเสียในการตัดสินใจทำธุรกิจกับคู่แข่ง	①	②	③	④	⑤	⑥	⑦
6	บริษัทพยายามทำทุกวิถีทาง เพื่อให้ชนะคู่แข่งในการทำธุรกิจ	①	②	③	④	⑤	⑥	⑦
7	การแสวงหาข่าวสาร ข้อมูล ติดตามสถานการณ์ และความเคลื่อนไหวของตลาดในอุตสาหกรรมถือเป็นกิจวัตรประจำวันของบริษัท	①	②	③	④	⑤	⑥	⑦
8	ความคิดและแนวคิดต่างๆจากภายนอกบริษัทถูกสื่อสารไปยังแผนกและฝ่ายงานอื่นๆ ภายในบริษัทอย่างทั่วถึง	①	②	③	④	⑤	⑥	⑦
9	พนักงานสามารถเก็บรวบรวม จัดเก็บความรู้ใหม่ๆ ให้ง่ายต่อการเข้าใจและสะดวกต่อการนำไปในอนาคตได้	①	②	③	④	⑤	⑥	⑦
10	พนักงานสามารถผสมผสานความรู้ใหม่และความรู้ที่มีอยู่ได้อย่างสัมฤทธิ์ผล	①	②	③	④	⑤	⑥	⑦
11	บริษัททบทวนและปรับปรุงเทคโนโลยีที่บริษัทมีอย่างสม่ำเสมอ ทั้งยังประยุกต์เทคโนโลยีให้เหมาะสมกับความรู้ใหม่ที่รับเข้ามาอีกด้วย	①	②	③	④	⑤	⑥	⑦

ส่วนที่ 3 ผลการปฏิบัติงานของบริษัท

คำชี้แจง กรุณาใส่ √ บนตัวเลขซึ่งตรงกับระดับผลการดำเนินงานของบริษัท

-3= ต่ำกว่าเป้าหมายที่กำหนดที่สุด **0 = เท่ากับเป้าหมายที่กำหนด** **+3=สูงกว่าเป้าหมายที่กำหนดมากที่สุด**

ผลการปฏิบัติงานของบริษัทจริงเมื่อเปรียบเทียบกับเป้าหมายของบริษัท								
1	ผลตอบแทนจากการลงทุน (ROI)	- 3	- 2	- 1	⓪	+ 1	+ 2	+ 3
2	ยอดขายโดยรวม	- 3	- 2	- 1	⓪	+ 1	+ 2	+ 3
3	ผลกำไรโดยรวม	- 3	- 2	- 1	⓪	+ 1	+ 2	+ 3

-3= ต่ำกว่าคู่แข่งมาก **0 = เท่ากับคู่แข่ง** **+3= สูงกว่าคู่แข่งมาก**

ผลการปฏิบัติงานของบริษัทเมื่อเปรียบเทียบกับคู่แข่งของท่าน								
1	การเติบโตของยอดขาย	- 3	- 2	- 1	⓪	+ 1	+ 2	+ 3
2	ส่วนแบ่งการตลาดเพิ่มขึ้น	- 3	- 2	- 1	⓪	+ 1	+ 2	+ 3
3	กำไรสุทธิ	- 3	- 2	- 1	⓪	+ 1	+ 2	+ 3

ส่วนที่ 4 ข้อมูลเกี่ยวกับตัวคุณ

1) ตำแหน่งงานของท่านในปัจจุบัน คือ

○ ประธานเจ้าหน้าที่บริหาร (CEO) ○ กรรมการบริหาร

○ ผู้จัดการแผนก (โปรดระบุ_____) ○ อื่นๆ (โปรดระบุ_____)

2) ท่านมีประสบการณ์การทำงานด้านอุตสาหกรรมเครื่องมือแพทย์เป็นระยะเวลาเท่าใด (รวมถึงระยะเวลาก่อนที่จะมาร่วมงานกับบริษัทนี้ด้วย)

○ ต่ำกว่า 5 ปี ○ 5-10 ปี

○ 11-15 ปี ○ 15 ปีขึ้นไป

ตอนที่ 5: ข้อคิดเห็นและข้อเสนอแนะของท่านต่ออุตสาหกรรมเครื่องมือทางการแพทย์

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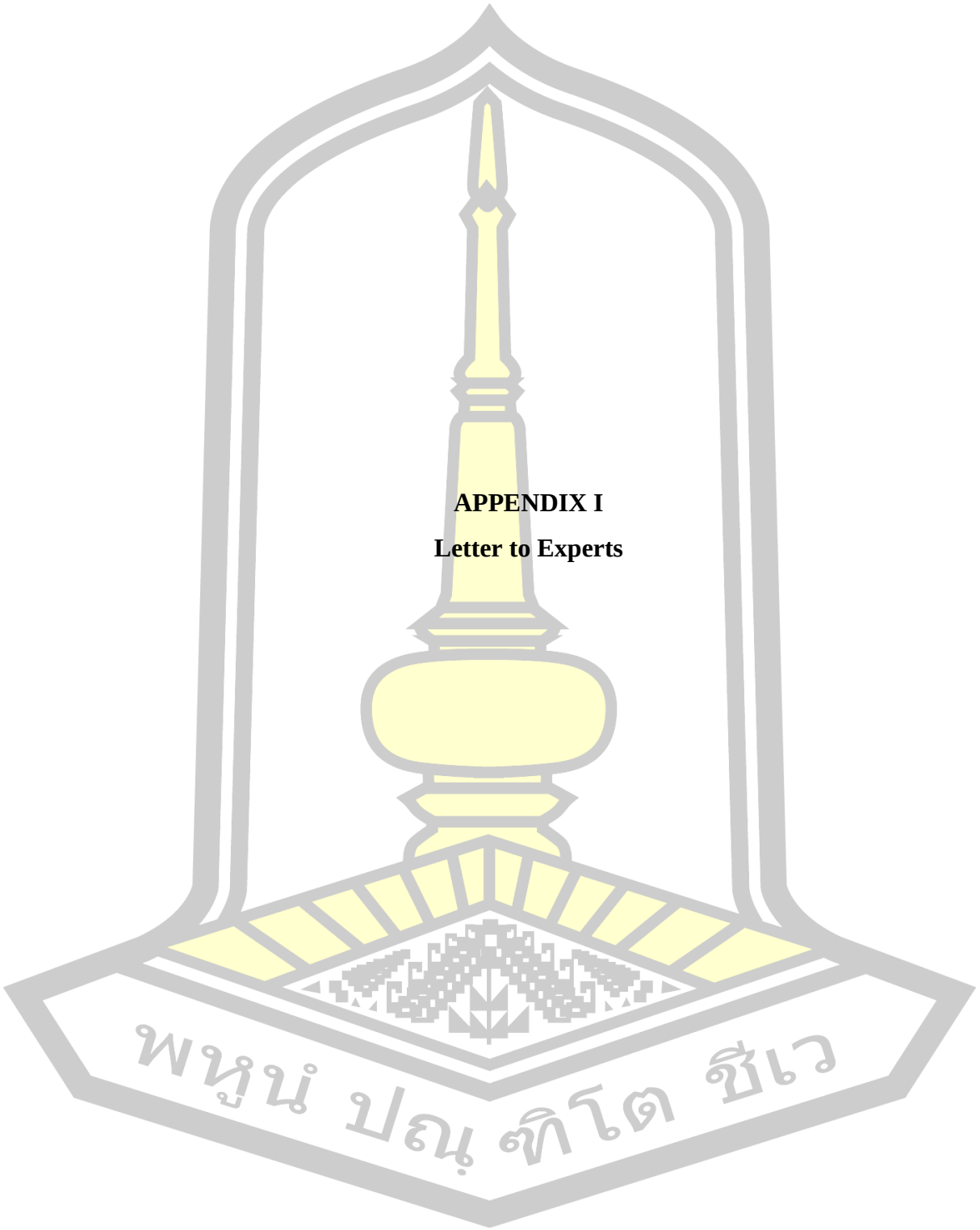
ขอขอบพระคุณท่านที่ได้สละเวลาตอบแบบสอบถามทุกข้อ และได้โปรดพับแบบสอบถามใส่ซองที่แนบมาพร้อมนี้ส่งคืนตามที่อยู่ที่ระบุไว้หน้าซอง หากท่านต้องการรายงานสรุปผลการวิจัยครั้งนี้ ได้โปรดแสดงความประสงค์ในหน้าแรกของแบบสอบถามนี้ ข้าพเจ้ายินดีที่จะจัดส่งรายงานสรุปฉบับสมบูรณ์ให้แก่ท่านหลังเสร็จสิ้นการนำเสนอรายงานวิจัยแล้ว

ขอขอบพระคุณที่ท่านช่วยสละเวลาอันมีค่าต่อการมีส่วนร่วมในการวิจัยครั้งนี้

โปรดพับแบบสอบถามใส่ซองที่แนบมาพร้อม และ ส่งคืนตามที่อยู่ที่ระบุไว้หน้าซอง หากท่านต้องการ

รายงานสรุปผลการวิจัย กรุณาระบุ e-mail ของท่าน _____



APPENDIX I

Letter to Experts

บันทึกข้อความ

หน่วยงาน คณะการบัญชีและการจัดการ มหาวิทยาลัยมหาสารคาม โทรศัพท์ 043-754333-3431 Fax 043- 754422
ที่ ศธ.0530.10/ **วันที่** 6 สิงหาคม 2561
เรื่อง ขอเรียนเชิญเป็นผู้เชี่ยวชาญตรวจสอบเครื่องมือวิจัย

เรียน ผู้ช่วยศาสตราจารย์ ดร.นิติพงษ์ ส่งศรีโรจน์

ด้วย นางขนารัศมี์ วงชารี รหัสนิสิต 58010961007 นิสิตระดับปริญญาเอก หลักสูตรปรัชญาดุษฎีบัณฑิต (ประ.ด.) สาขาวิชาการจัดการ คณะการบัญชีและการจัดการ มหาวิทยาลัยมหาสารคาม กำลังศึกษาวิทยานิพนธ์ เรื่อง "การมุ่งเน้นความเป็นผู้ประกอบการ ความสามารถในการดูดซับความรู้ และผลการปฏิบัติงานวิจัยเชิงประจักษ์อุตสาหกรรมเครื่องมือทางการแพทย์ของประเทศไทย" ซึ่งเป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปรัชญาดุษฎีบัณฑิต ดังนั้น เพื่อให้การดำเนินการเป็นไปด้วยความเรียบร้อยและบรรลุตามวัตถุประสงค์ คณะการบัญชีและการจัดการ มหาวิทยาลัยมหาสารคาม จึงใคร่ขอความอนุเคราะห์ท่านเป็นผู้เชี่ยวชาญตรวจสอบเครื่องมือวิจัยและข้อเสนอแนะเพื่อนำข้อมูลที่ได้ไปดำเนินการทำวิทยานิพนธ์ต่อไป ตามแบบสอบถามที่แนบมาพร้อมนี้

จึงเรียนมาเพื่อโปรดพิจารณา

(รองศาสตราจารย์ ดร.สุวรรณ หวังเจริญเดช)
รองคณบดีฝ่ายวิชาการ

คำสั่ง
☐ ทราบ
☐ ตามเสนอ
☐ อนุญาต
☐ อนุมัติ
☐ ลงนามแล้ว
☒ อื่นๆ.....

(ผู้ช่วยศาสตราจารย์ ดร.นิติพงษ์ ส่งศรีโรจน์)
คณบดีคณะการบัญชีและการจัดการ
มหาวิทยาลัยมหาสารคาม

ที่ ศธ 0530.10/ 1877

คณะการบัญชีและการจัดการ
มหาวิทยาลัยมหาสารคาม
ตำบลขามเรียง อำเภอกันทรวิชัย
จังหวัดมหาสารคาม
44150

6 สิงหาคม 2561

เรื่อง ขอความอนุเคราะห์เป็นผู้เชี่ยวชาญตรวจสอบเครื่องมือวิจัย

เรียน ผู้ช่วยศาสตราจารย์ ดร.ชลธิศ ดาราวงษ์

ด้วย นางชนารัศมิ์ วงชารี รหัสนิสิต 58010961007 นิสิตระดับบริญญาเอก หลักสูตรปรัชญาดุษฎีบัณฑิต (ปร.ด.) สาขาวิชาการจัดการ คณะการบัญชีและการจัดการ มหาวิทยาลัยมหาสารคาม กำลังศึกษาวิทยานิพนธ์ เรื่อง "การมุ่งเน้นความเป็นผู้ประกอบการ ความสามารถในการดูดซับความรู้ และผลการปฏิบัติงานวิจัยเชิงประจักษ์อุตสาหกรรมเครื่องมือทางการแพทย์ของประเทศไทย" ซึ่งเป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปรัชญาดุษฎีบัณฑิต ดังนั้น เพื่อให้การดำเนินการเป็นไปด้วยความเรียบร้อยและบรรลุตามวัตถุประสงค์ คณะการบัญชีและการจัดการ มหาวิทยาลัยมหาสารคาม จึงใคร่ขอความอนุเคราะห์ท่านเป็นผู้เชี่ยวชาญตรวจสอบเครื่องมือวิจัยและข้อเสนอแนะเพื่อนำข้อมูลที่ได้ไปดำเนินการทำวิทยานิพนธ์ต่อไป ตามแบบสอบถามที่แนบมาพร้อมนี้

คณะการบัญชีและการจัดการ มหาวิทยาลัยมหาสารคาม หวังเป็นอย่างยิ่งว่าคงได้รับความอนุเคราะห์จากท่านด้วยดี และขอขอบคุณมา ณ โอกาสนี้ด้วย

ขอแสดงความนับถือ

(รองศาสตราจารย์ ดร.สุวรรณ หวังเจริญเดช)
รองคณบดีฝ่ายวิชาการ รักษาการแทน
คณบดีคณะการบัญชีและการจัดการ
มหาวิทยาลัยมหาสารคาม

งานวิชาการระดับบัณฑิตศึกษา
คณะการบัญชีและการจัดการ มหาวิทยาลัยมหาสารคาม
โทรศัพท์ 0-4375-4333 ต่อ 3431
โทรสาร 0-4375-4422

ที่ ศธ 0530.10/ ๑๙๖

คณะการบัญชีและการจัดการ
มหาวิทยาลัยมหาสารคาม
อำเภอกันทรวิชัย
จังหวัดมหาสารคาม
44150

19 กรกฎาคม 2561

เรื่อง ขอความอนุเคราะห์ข้อมูลและสัมภาษณ์

เรียน ประธานบริษัทเมดิทอป จำกัด

ด้วย นางชนาวัฒน์ วงชารี รหัสนิสิต 58010961007 นิสิตระดับบริญญาเอก คณะการบัญชีและการจัดการ มหาวิทยาลัยมหาสารคาม กำลังศึกษาวิทยานิพนธ์ เรื่อง "การมุ่งเน้นความเป็นผู้ประกอบการความสามารถในการดูดซับความรู้และผลการปฏิบัติงาน: วิจัยเชิงประจักษ์อุตสาหกรรมเครื่องมือทางการแพทย์ของประเทศไทย" ซึ่งเป็นส่วนหนึ่งของการทำวิทยานิพนธ์หลักสูตรปรัชญาดุษฎีบัณฑิต (ปร.ด.) สาขาวิชาการจัดการและการศึกษาในครั้งนี้ได้เน้นให้นิสิตศึกษาข้อมูลด้วยตนเอง ดังนั้น เพื่อให้การจัดทำวิทยานิพนธ์เป็นไปด้วยความเรียบร้อยและบรรลุวัตถุประสงค์ คณะการบัญชีและการจัดการ มหาวิทยาลัยมหาสารคาม จึงใคร่ขอความอนุเคราะห์ให้ นางชนาวัฒน์ วงชารี เข้าสัมภาษณ์และขอข้อมูลเกี่ยวกับ ความเป็นมา ลักษณะของกิจการ แนวทางการพัฒนาผลิตภัณฑ์ และการเติบโตของกิจการภายใต้อุตสาหกรรมทางการแพทย์ ในวันเวลาตามที่ท่านจะเห็นสมควร

คณะการบัญชีและการจัดการ มหาวิทยาลัยมหาสารคาม หวังเป็นอย่างยิ่งว่าคงได้รับความอนุเคราะห์จากท่านในการให้ข้อมูลในครั้งนี้ และขอขอบคุณมา ณ โอกาสนี้

ขอแสดงความนับถือ

(รองศาสตราจารย์ ดร.สุวรรณ หวังเจริญเดช)
รองคณบดีฝ่ายวิชาการ รักษาการแทน
คณบดีคณะการบัญชีและการจัดการ
มหาวิทยาลัยมหาสารคาม

งานวิชาการระดับบัณฑิตศึกษา
คณะการบัญชีและการจัดการ มหาวิทยาลัยมหาสารคาม
โทรศัพท์ 0-4375-4333 ต่อ 3431
โทรสาร 0-4375-4422

ที่ ศธ 0530.10/1185

คณะการบัญชีและการจัดการ
มหาวิทยาลัยมหาสารคาม
อำเภอกันทรวิชัย
จังหวัดมหาสารคาม
44150

19 กรกฎาคม 2561

เรื่อง ขอความอนุเคราะห์ข้อมูลและสัมภาษณ์

เรียน ประธานบริษัทแปซิฟิค ไบโอเทค จำกัด

ด้วย นางชนารัศมิ์ วงชารี รหัสนิสิต 58010961007 นิสิตระดับบัณฑิตศึกษา คณะการบัญชีและการจัดการ มหาวิทยาลัยมหาสารคาม กำลังศึกษาวิทยานิพนธ์ เรื่อง "การมุ่งเน้นความเป็นผู้ประกอบการความสามารถในการดูดซับความรู้และผลการปฏิบัติงาน: วิจัยเชิงประจักษ์อุตสาหกรรมเครื่องมือทางการแพทย์ของประเทศไทย" ซึ่งเป็นส่วนหนึ่งของการทำวิทยานิพนธ์หลักสูตรปรัชญาดุษฎีบัณฑิต (ปร.ด.) สาขาวิชาการจัดการและการศึกษาในครั้งนี้ได้เน้นให้นิสิตศึกษาข้อมูลด้วยตนเอง ดังนั้น เพื่อให้การจัดทำวิทยานิพนธ์เป็นไปด้วยความเรียบร้อยและบรรลุวัตถุประสงค์ คณะการบัญชีและการจัดการ มหาวิทยาลัยมหาสารคาม จึงใคร่ขอความอนุเคราะห์ให้ นางชนารัศมิ์ วงชารี เข้าสัมภาษณ์และขอข้อมูลเกี่ยวกับ ความเป็นมา ลักษณะของกิจการ แนวทางการพัฒนาผลิตภัณฑ์ และการเติบโตของกิจการภายใต้อุตสาหกรรมทางการแพทย์ ในวันเวลาตามที่ท่านจะเห็นสมควร

คณะการบัญชีและการจัดการ มหาวิทยาลัยมหาสารคาม หวังเป็นอย่างยิ่งว่าคงได้รับความอนุเคราะห์จากท่านในการให้ข้อมูลในครั้งนี้ และขอขอบคุณมา ณ โอกาสนี้

ขอแสดงความนับถือ

(รองศาสตราจารย์ ดร.สุวรรณ หวังเจริญเดช)
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ที่ ศธ 0530.10/ ๑๑๕

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มหาวิทยาลัยมหาสารคาม
อำเภอกันทรวิชัย
จังหวัดมหาสารคาม
44150

19 กรกฎาคม 2561

เรื่อง ขอความอนุเคราะห์ข้อมูลและสัมภาษณ์

เรียน ประธานบริษัทไอแมด ลาบอราทอรี่ จำกัด

ด้วย นางชนารัศมิ์ วงชารี รหัสนิสิต 58010961007 นิสิตระดับปริญญาเอก คณะการบัญชีและการจัดการ มหาวิทยาลัยมหาสารคาม กำลังศึกษาวิทยานิพนธ์ เรื่อง "การมุ่งเน้นความเป็นผู้ประกอบการความสามารถในการดูดซับความรู้และผลการปฏิบัติงาน: วิจัยเชิงประจักษ์อุตสาหกรรมเครื่องมือทางการแพทย์ของประเทศไทย" ซึ่งเป็นส่วนหนึ่งของการทำวิทยานิพนธ์หลักสูตรปรัชญาดุษฎีบัณฑิต (ปร.ด.) สาขาวิชาการจัดการและการศึกษาในครั้งนี้ได้เน้นให้นิสิตศึกษาข้อมูลด้วยตนเอง ดังนั้น เพื่อให้การจัดทำวิทยานิพนธ์เป็นไปด้วยความเรียบร้อยและบรรลุวัตถุประสงค์ คณะการบัญชีและการจัดการ มหาวิทยาลัยมหาสารคาม จึงใคร่ขอความอนุเคราะห์ให้ นางชนารัศมิ์ วงชารี เข้าสัมภาษณ์และขอข้อมูลเกี่ยวกับ ความเป็นมา ลักษณะของกิจการ แนวทางการพัฒนาผลิตภัณฑ์ และการเติบโตของกิจการภายใต้อุตสาหกรรมทางการแพทย์ ในวันเวลาตามที่ท่านจะเห็นสมควร

คณะการบัญชีและการจัดการ มหาวิทยาลัยมหาสารคาม หวังเป็นอย่างยิ่งว่าคงได้รับความอนุเคราะห์จากท่านในการให้ข้อมูลในครั้งนี้ และขอขอบคุณมา ณ โอกาสนี้

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โทรศัพท์ 0-4375-4333 ต่อ 3431
โทรสาร 0-4375-4422

BIOGRAPHY

NAME	Mrs.Chanarus Wongcharee
DATE OF BIRTH	December 9,1978
PLACE OF BIRTH	Mahasarakham, Thailand
ADDRESS	404, Soi 29, Bann Noncharern, Wangnang, Muang, Mahasarakham
EDUCATION	2000 Bachelor Degree in Allied Health Science Chulalongkorn University, Bangkok, Thailand 2009 Master Degree in Business Administration Khonkean University, Khonkean, Thailand 2019 Doctor of Philosophy (Management) Mahasarakham University, Mahasarakham, Thailand
Research grants & awards	Wongcharee, C. (2016) High Commitment Work System (HCWS) and Leaders on Knowledge Sharing Best Conceptual Paper Award in IPSC2016, At Naresuan University, Thailand