THE EFFECTS OF IT CAPABILITY AND DATA ANALYTICS ON FIRM PERFORMANCE THROUGH MARKET ORIENTATION AND INNOVATION

WIJIT JARUNOPRATAM

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF
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RAJAMANGALA UNIVERSITY OF TECHNOLOGY THANYABURI
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Name-Surname	Mr. Wijit Jarunopratam
Program	Business Administration
Dissertation Advisor	Assistant Professor Natnarong Jaturat, Ph.D.
Academic Year	2017

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ABSTRACT

In the rapid change of business environment nowadays, businesses need to enhance the operation for gaining competitive advantages and improvement of firm performance. According to the concept of the resource-based view (RBV) perspective, IT capability and data management are considered as the prominent tools for the business operation. In addition, marketing concepts and innovation also help businesses to be more productive. This study investigated the effects of IT capability and data analytics on firm performance through market orientation and innovation in the manufacturing industry in Thailand.

This study used a mixed methods approach in which the data were collected and analyzed quantitatively and qualitatively. The quantitative method employed a cross-sectional and mail survey. The questionnaire was administered to collect the survey data which were analyzed by using the structural equation model (SEM) analysis. The qualitative method involved in-depth interviews with executives or IT leaders. There were 230 respondents from the mail survey. The empirical findings from this study were consistent with a number of studies in the literature. The findings revealed that IT capability and data analytics had effects on firm performance through market orientation and innovation. Market orientation also affected firm performance through innovation. The results conformed to the RBV perspective and emphasized the importance of IT capability and data analytics.

For further research, it is recommended to change the population to other business sectors. Data analytics can also be expanded to big data technology in the future. Moreover, it is useful to refine the conceptual model drawn from this research by building a different construct of IT capability and firm performance.

Keywords: resource-based view, IT capability, data analytic, market orientation, innovation, firm performance

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Wijit Jarunopratam

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CHAPTER 1
INTRODUCTION

1.1 Background and Statement of the Problem

Digital business environment has played more important roles in Thailand. The government's policy enhanced Thailand's competitiveness on the global level and has promoted to be Thailand 4.0. Therefore, businesses needed to adapt to the situation by enhancing efficiency and gaining competitive advantage and improve firm performance for business survival. The typical basic factors like man, money, material and management would not be enough at this present time. Most of business sectors had more tools to operate their business successfully with efficiency and effectiveness. In a rapidly changed business operation nowadays, there has been accepted that information technology (IT) has become more important factor for business. According to Mithas, Ramasubbu, and Sambamurthy (2011) stated that the contributions of IT capability and firm performance which were IT provided data and information with accuracy, timeliness, reliability, and confidentiality to users. The process management capability was also the links between IT and firm performance. However, Lu and Ramamurthy (2011) also supported that IT capability was a firm's ability to acquire, deploy, combine, and reconfigure IT resources in supporting business strategies and work processes.

Data management considered one of the prominent tools for business operation in the digital business environment. When good data managed, it created a competitive advantage and increase productivity. Ularu, Puican, Apostu, and Velicanu (2012) stated that data storing might not generate business value. Data analytics was a process of examining large data sets containing a variety of data types to help organizations analyze structured, semi-structured and unstructured data for valuable business information and insights (Rouse, 2012). Data analytics provided competitive advantage and firm performance (Olofson & Vesset, 2012). However, some studies found that IT had positively affected on firm performance, while some found the negative effects, and also others found no effects (Brynjolfsson & Hitt, 2000; Dedrick, Gurbaxani, & Kraemer, 2003; Nakata, Zhu, & Kraimer, 2008).

While, IT management has improved the efficiency of working, the marketing capabilities concepts to management could be more productive. According to Borges, Hoppen, and Luce (2009) claimed that IT strategies were positively influenced market orientation and enhanced the firm market orientation behaviors. Narver and Slater (1990) suggested that market orientation (MO) consisted of three behavior components which were customer orientation, competitor orientation, and inter functional coordination with two dimension criteria which were long term focus and profitability. Market orientation also described as a set of behaviors and processes (Kohli & Jaworski, 1990). However, Lagat, Frankwick, and Sulo (2015) suggested that innovation could affect market orientation and firm performance.

The innovation included new products or services, new production processes, or new administrative systems. Innovation was also an important management function because it linked to business performance (Han, Kim, & Srivastava, 1998).

According to the study of articles related to information technology, the resource-based view (RBV) perspective considered one of the factor that helped to improve firm performance and competitive advantage. This study focused RBV as the fundamental theory in order to make this research more reliable. Bharadwaj (2000) stated that RBV explicate the nature of a firm's IT capability and its relationship to firm performance. This theory examined the relationship between IT capability, data analytics, and market orientation influence firm performance. Melville, Kraemer, and Gurbaxani (2004) supported that researchers have applied RBV to theoretically analyze for competitive advantage implications of information technology and other firm resources. RBV was a potential of firms to operate resource that were valuable, rare, difficult to imitate and non-substitutable by other resources (J. Barney, 1991; Bharadwaj, 2000). In addition, Mata, Fuerst, and Barney (1995) also stated RBV was based on two factors which were resource heterogeneity and resource immobility. These two factors were affected to sustained competitive advantage.

However, the survey of Edureka (2017) found that 65.2 % of firm survey were using some form of analytics that helping their business needs. This survey also showed that 96 % of firm survey believed that analytics would become more important to their organization. The key factors for analytics were better decision making, better

enablement of key strategic initiatives, better relationships with customers, better sense of risk and better financial performance.

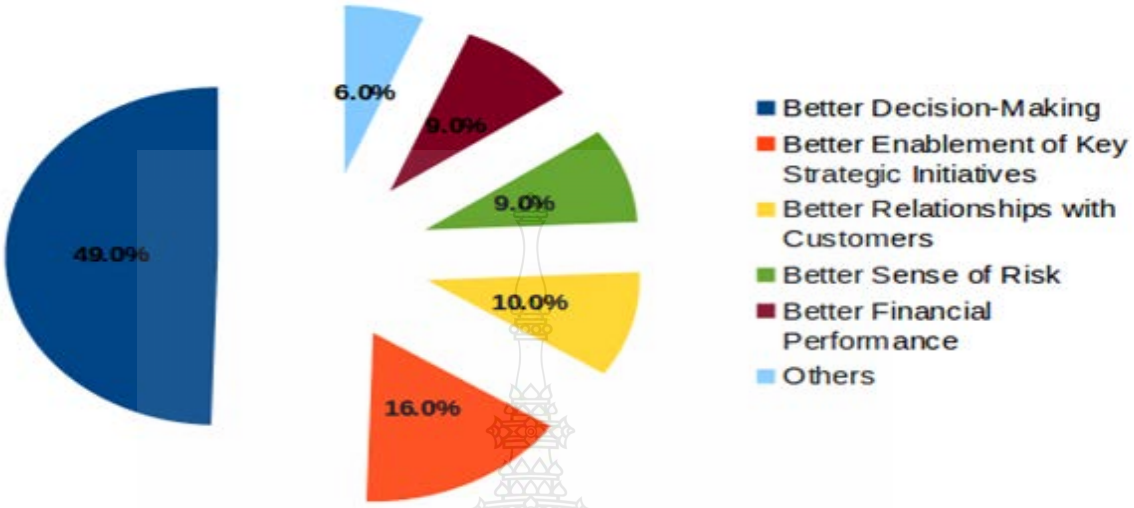

Figure 1.1 Key benefits of analytics (Edureka, 2017).

In the same research also showed some industries that being utilized data analytics. Those industries were banking, technology, healthcare, consumers, manufacturing, and energy. An appropriate data collection was necessary to the sense of urgency as to preserve all data generated and avoid the missing of any important data. It can be seen that, the modern business environment, information technology has paid important roles to improve firm performance. Marketing orientation also was supported to improve firm performance. As the result, the main focus of this research was to study the effectiveness of IT capability and data analytics to market orientation influences firm performance on the manufacturing industry in Thailand.

1.2 Purpose of the Study

The purpose of this research was to study and understanding IT capability and firm performance on the manufacturing industry in Thailand. This research focused on the Thai manufacturing industry because they have had substantial growth in the last three decades and have established themselves as the biggest income earners for the country (Das, Kumar, & Kumar, 2011). According to Phusavat and Kanchana (2007)

found that there were six criteria reflected competitive priorities and lead to firm performance of manufacturing firms in Thailand which were quality, customer focus, delivery, flexibility, know-how, and costs. It can be seen that, the Thai manufacturing industry needed to improve itself for better firm performance. This research extended understanding of RBV perspective, and also included data analytics, market orientation, and innovation to influence firm performance.

As the above discussion, this research focused on implementing IT capability, data analytics, market orientation, and innovation to improve firm performance. The objectives of this study were as follows:

1) To examine the effects of IT capability on firm performance.

2) To examine the effects of IT capability and data analytics on firm performance through market orientation and innovation.

3) To examine the effects of market orientation on firm performance through innovation.

1.3 Research Questions and Hypotheses

1.3.1 Research Questions

This research focused on the concept four variables that affects to firm performance. These variables were IT capability, data analytics, market orientation, and innovation. The following were research questions for this study.

1. How do IT capability and data analytics affect firm performance?
2. How do IT capability and data analytics affect firm performance through market orientation and innovation?
3. How market orientation affects firm performance through innovation?

1.3.2 Hypotheses

As the above research questions, this research proposes the following hypotheses.

1. Hypotheses on the relationship between IT capability and data analytics and the influence on firm performance.

Mithas et al. (2011) suggested that information management capability effects various measures of firm performance. They also supported that well developed IT

infrastructure and IT investment were the factors for business excellence. Byrd and Davidson (2003) also found that IT did lead to better firm performance as measured by ROI, ROE and market value. However, Jaturat (2011) found on his research that IT investment had positively affected to firm performance. Mouthaan (2012) emphasized that data analytics improves product and service leading to advantage for customers and firm performance. Proposed hypotheses are:

H1. IT capability positively affects firm performance.

H2. IT capability positively affects data analytics.

H3. Data analytics positively affects firm performance.

2. Hypotheses on the relationship between IT capability and data analytics and the influence on firm performance through market orientation and innovation as mediators.

According to Borges et al. (2009) found that IT capability had positively influenced on business performance with adequate market orientation. Lu and Ramamurthy (2011) also found that IT capability enabled market capitalizing agility and operational adjustment agility. Therefore, the proposed hypotheses are as follows:

H4. IT capability positively affects market orientation

H5. Data analytics positively affects market orientation.

3. Hypotheses on market orientation and innovation as mediators to affect firm performance.

This part focused on market orientation and innovation affecting on firm performance. Han et al. (1998) investigated that market orientation facilitates an organization's innovativeness which positively influenced business performance. Shoham, Rose, and Kropp (2005) explored the relationship between market orientation and firm performance. They found a positively relationship for both factors. Javalgi, Martin, and Young (2006) stated that market orientation has been linked to positive organizational performance. Kuntonbutr (2013) found that the relationship between market orientation and business performance through innovations had positively affected. Proposed hypotheses are:

H6. Market orientation positively affects firm performance.

H7. Market orientation positively affects innovation.

H8. Innovation positively affects firm performance.

1.4 Research Framework

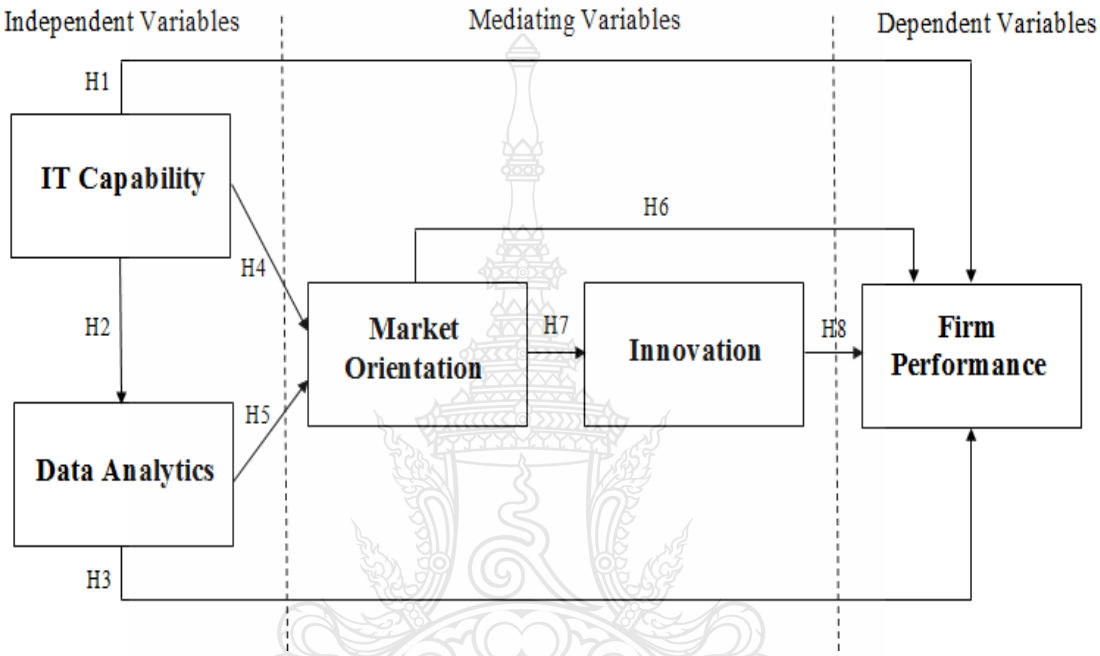

Figure 1.2 Research model.

1.5 Definitions of Terms

Definitions for key concepts involved in this research to provide understanding of vocabulary were as follows:

IT Capability : a firm's ability to acquire, deploy, combine, and reconfigure IT resources in support and enhancement of business strategies and work processes (Sambamurthy & Zmud, 1997).

Data Analytics: the activities which explore and investigate past and current business performance to get insight and drive business planning.

Market Orientation: considered as a customer needs and firm generates, disseminates, and responds to marketing information (Bhatt, Emdad, Roberts, & Grover, 2010).

Innovation: the generation, acceptance, and implementation of new ideas, processes, products, or services. Alternatively, innovation is viewed as a new idea, practice or object by an organization (Zaltman, Duncan, & Holbek, 1973).

Firm performance: The more effective the firm's operations are completed the more positive the firm performance is, which basically measured over a certain period of time (Mithas et al., 2011).

1.6 Limitations of the Study

There were a few limitations of this study as follows:

1. Due to the fast moving of technology , there would be the difficulty for the research to catch up all the element occurred.

2. As the period of time in doing this research may not be covered all new articles and textbook involving with IT capability, data analytics, market orientation and innovation.

1.7 Contribution of the Study

The contribution of this research has contributing values for theoretical and practical perspective. On the theoretical perspective, this research has adopted resource-based view of the firm (RBV) as a fundamental concept for the research. It examined the relationship between independent variables and dependent variables. It should contribute the literature on the IT capability, data analytics, and market orientation influence on firm performance within the RBV perspective. It also helped to have more understanding on RBV perspective for better business performance and competitive advantage.

On the practical side, this research prompted the important of firm performance through IT capability, data analytics, and market orientation for manufacturing industry in Thailand. The results of this research could helped organizations to develop their firm performance in order to sustained competitive advantage. Moreover, this research could be useful for other researches who study in the same area. They can apply the results of this research for the further study.

1.8 Scope of the study

This research studied the relationships between IT capability and data analytics with the mediating role of market orientation and innovation which impacted on firm performance on the manufacturing industry in Thailand. The target respondents were chief information officers or directors who willing to answer questionnaire and interview. Their responses were assumed to be valid and reliable. This study used a cross-sectional and mail survey methodology for data collection.

1.9 Organization of the Study

This study consisted of five chapters.

Chapter One: introduction, presented background and statement of the problem for this study, including purpose of the study, research questions and hypotheses, research framework, definitions of terms, limitation of the study, contribution of this study, and scope of the study

Chapter Two: review of literature organized in seven major sections. The first section provided the theoretical perspective of the resource-based view of the firm. The second section discussed on IT capability. The third section delineated on data analytics and also provided overview of big data, benefit of big data, and impact of big data on business value. Next sections discussed on market orientation, innovation and firm performance. Finally, the theoretical frameworks were discussed.

Chapter Three: research methodology, this chapter presented research methodology which studied the effects of IT capability and data analytics on firm performance through market orientation and innovation. This chapter comprised of four parts which were research design, quantitative methodology, qualitative methodology and sequence of analysis.

Chapter Four: research results, this chapter presented the results findings. The data from empirical survey analyzed and presented. This included the analysis of the constructs along with their reliability and validity. The hypothesis testing and summary of findings was reported to the extent that hypothesized relationships occurred. Both quantitative results and qualitative results were presented.

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

CHAPTER 2
REVIEW OF THE LITERATURE

2.1 Introduction

The review of the literature in this chapter was organized in seven major sections. The first section provided the theoretical perspective of the resource-based view of the firm. The second section discussed on IT capability. The third section delineated on data analytics and also provided overview of big data, and benefit of big data. Business analytics also included in this section. The following sections discussed on market orientation, innovation, and firm performance. Finally, the theoretical frameworks were discussed. The proposed hypothesized structure model of this paper was included.

2.2 Resource-Based View of the Firm

The resource-based view (RBV) of the firm would be the typical theory linked between IT capability and firm performance in this paper. RBV was initiated in the mid-1980s (Bridoux, 2004), with the appearance of a well-known strategic management research article published in 1984 by Birger Wernerfelt, namely a resource-based view of the firm. Bharadwaj (2000) explained that RBV of the firm was a potential of firms to operate resource that are valuable, rare, difficult to imitate and non-substitutable by other resources. In addition, Mata et al. (1995) also stated that RBV was based on two factors which were resource heterogeneity and resource immobility. These two factors affected to sustained competitive advantage. The important thing in this theory was resources of the firm which Grant (1991) defined the classifications of resources were tangible, intangible and personnel-based resources. Firstly, tangible resources were the financial capital and the physical assets of the firm such as plant, equipment, IT hardware, network infrastructure, and so no. Secondly, intangible resources are reputation, brand image, product quality, software patents, vendor relationships, and so no (Bharadwaj, 2000; Wade & Hulland, 2004). However, Curado and Bontis (2006) and (Jaturat, 2011) defined intangible resources as a highly valued and considered critical intellectual capital assets. Finally, personal-based resources include technical know-how

and other knowledge assets such as organizational culture, employee training, loyalty, and so on (Bharadwaj, 2000).

Wernerfelt (1984) also analyzed firms in term of resources rather than products on growth strategies. Many researches have been focused on the provision of RBV. However, R. Rumelt (1984) studied strategy and firm's unique resources and capabilities. While, J. Barney (1991) examined the link between firm resources and sustained competitive advantages with more contributions from various academics. RBV has been growing in popularity in the strategy literature (Fahy & Smithee, 1999).

The RBV perspective was the theoretical framework for the firm to achieved the sustained competitive advantage (Eisenhardt & Martin, 2000a), and RBV is one of accepted theories for competitive advantage (Spanos & Lioukas, 2001). The understanding of the relationships among firm distinctive internal resources, capabilities, and competitive advantage emerged and hence, RBV became dominant contemporary approach in the field of strategic management (Bridoux, 2004).

The basis of the RBV was that the successful firms found their future competitiveness on the development of distinctive and unique capabilities. It may often be implicit or intangible in nature (Teece, Pisano, & Shuen, 1997). Fahy and Smithee (1999) defined the principal contribution of RBV was a theory of competitive advantage by exploiting internal rather than external resources, therefore the RBV defined as an "inside-out" process of strategic management (Grant, 1991). R. Rumelt (1984) defined an essence of RBV by the firm's unique resources and capabilities. When firms had certain special characteristics of resource and capabilities, that could be important factors of sustainable competitive advantage and superior firm performance (J. Barney, 1991). The RBV's basic logic was a relatively simple one which based on an assumption that the desired outcome of managerial effort within the firm was competitive advantage which allowed the firm to earn economic rents or above-average returns (Fahy & Smithee, 1999). The value creating potential of firm's strategy depended on the underlying resources and capabilities which considered firm's unique ability (Conner, 1991). J. Barney (1991) claimed that when all the firms were equal in terms of resources there would be no profitability differences among them. Therefore, RBV is an efficiency-based explanation of firm performance differences.

The fundamentals of resource-based view based on J. Barney (1991), firm-specific resources had the following attributes: (1) it must be valuable; (2) it must be rare; (3) it must be inimitable; (4) it must be non-substitutable, otherwise known as VRIN or valuable, rare, inimitability and non-substitutability.

Valuable (V) allowed the firm to either outperform its competitors or reduce its own weaknesses (Amit & Schoemaker, 1993; J. Barney, 1991) and enabled a firm to employ a value-creating strategy, such as improving quality or enhancing attractive features to relatively differentiate to competitors or further reduce costs (Grant, 1991). This perspective suggested that firm's valuable and unique resources used to exploit opportunities and resisted the threats from the business environment (Dierickx & Cool, 1989). Therefore, it provided potential in getting to the markets as well as, making significant contribution of value to customers (Prahalad & Hamel, 1990). Mahoney and Pandian (1992) emphasized that valuable resource had the potential of yielding superior rates of return and enables firm to implement strategies to improve firm's efficiency and effectiveness.

Rare (R) referred to firm's resources must be needy so that they were valuable. Rare resources were less in supply, acquiring was limited or it only acquired by very few companies and they were not equally accessible or equally distributed among all the current and potential competitors (Madhani, 2009; Theriou, Aggelidis, & Theriou, 2009). The firm's resources must be considered rare in order to gain on competitive advantage. When few companies acquired the same resources, it produced in competitive parity (Rothaermel, 2012). With the relatively high levels of rareness, firms expected to attain an increased level of economics rents, through the deployment of their valuable resources (Ryman, 1999).

Inimitability (I) referred to the extent to that imitation or replication, which was difficult or not feasible. The firm's valuable resources must be difficult to copy or replicate by the competitors or other firms, which could be due to complexity of resources themselves or difficulties in acquiring the resources (Madhani, 2009) or from the factors such as social complexity (Dierickx & Cool, 1989). When a firm controlled its valuable resources, it considered as source of firm's competitive advantage (J. Barney, 1991). Ryman (1999) argued that firm must protect its valuable resources from

imitation by competitors, otherwise, competitive advantage could not be sustained overtime. Firm's competitive advantage could be sustained when competitors not be able to replicate these strategic resources or assets (Margaret A. Peteraf, 1993). Firm must be able to raise the barriers to the imitation of their strategic resources (R. Rumelt, 1984). Therefore, other firms could not be able to easily imitate these strategic resources up to the level that enables them compete with the firm who possess the valuable resources (Mahoney & Pandian, 1992; Margaret A. Peteraf, 1993).

Non-substitutability (N) implied that the resources could not simply be replaced or substituted by similar resources. The importance of non-substitutability was that even if a firm had resource which were valuable, rare and difficult to imitate, but if aspect of substitutability was lack of, there would not be considered source of competitive advantage (Dierickx & Cool, 1989). Resources were not substitutable if there were no replacement of an identical or adequate resource that could be used to replace the existing resource (Talaja, 2012). This barrier inhibits competitors' abilities to obtain or duplicate strategic resources, therefore, creates unequal distribution of resources and immobility of resources across competing firms in the business. This conducted to a differentiation of firm in a long run for the ability to generate rents (Oliver, 1997).

However, some studies referred the VRIN framework as VRIO, following observations from Porter (1991) on theoretical arguments and empirical evidence by Newbert, Kirchhoff, and Walsh (2007). The resources were not sufficient by itself to generate competitive advantage. Improving by subsuming non-substitutable to be under inimitable and adding "organization" as to exploit and deployment, thus framework is then VRIO.

Wernerfelt (1984) and J. B. Barney (1986) explained that the firm with specific resources had a defensible position in the market and allowed firm to utilize them for corporate strategy formulation which replicated by other competitors. Hence, in the RBV perspective, the two components which created firm's competitive advantage were resources and capabilities (Eisenhardt & Martin, 2000b).

However, there were more explanation on resources and capabilities. Maijoor and Van Witteloostuijn (1996) defined resources as assets (tangible and intangible)

which tied semi-permanently to the firm. The tangible resources referred to the fixed and current assets including financial capital, physical assets of the firm such as plant, equipment, land, other capital goods and stocks of raw materials debtors and bank deposits that have a fixed long run capacity (Wernerfelt, 1989). The tangible resources had the properties of ownership and their value was relatively easy to measure (Hall, 1989). The value of tangible resources assessed through conventional accounting mechanisms and usually reflected in the balance sheet valuation of companies (Fahy & Smithee, 1999). Grant (1991) claimed that tangible resources were transparent and relatively imitable and substitutable by competitors when compared with intangible resources, due to its nature of tangibility.

The intangible resources were of assets such as intellectual property includes trademarks and patents, firm reputation, brand image, product quality, company networks and databases (Hall, 1992; Williams, 1992). The possession of intangible resources account for the significant differences that observed between the balance sheet valuation and stock market valuation of publicly quoted companies (Grant, 1991; R. P. Rumelt, 1987). The intangible resources in comparison with tangible resources, was relatively more resistant to imitability and substitutability by competitors (Fahy & Smithee, 1999).

Grant (1991) supported that there were two assumptions underlie resource-based view. First, a firm's strategy started from its stable foundation which were resources and capabilities. Firm with focus more on utilizing these resources and capabilities had a better adjustment to external changes and had superior firm performance. Second, resources and capabilities were basis for firm's profitability. Therefore, firms with specific resources and capabilities would more successful than those without. The strategy based on inimitable resources made it difficult for competitors to imitate the value that firm's resources created.

Bharadwaj (2000) has been differentiated between resources and capabilities. Resources provided basic units of analyses, competitive advantage developed by pooling resources together to create organizational capabilities. While, capabilities referred to dynamic routines acquired from assembling, integrating and deployment of the valuable resources process through organizational management (Amit &

Schoemaker, 1993; Russo & Fouts, 1997; Schendel, 1994). Capabilities referred to an interaction-based which made products more difficult to imitate by competitors due to causal ambiguity. The RBV literature tended to favor capabilities as the most source of sustainable competitive advantage (Collis, 1994). Wernerfelt (1989) also suggested that capabilities had limited capacity in the short term due to learning and change difficulties within the firm, but still had potential and relatively unlimited capacity in the long term and continuously improved the effectiveness of the organization (Moingeon, Ramanantsoa, Métais, & Orton, 1998). Itami and Roehl (1991) argued that information based resources as invisible assets which essential for effective operation as a more visible resources and proved to be a real source of competitive power and important for a long term success.

Grant (1996) described the hierarchy of organizational capabilities that firm utilized functional capabilities to form collaborated unique capabilities which leaded to the firm's competencies. Haack (1997) claimed that RBV perspective's major drawback not just a comprehensive framework of how resources within the organization interacted with each other, but also created something new and unique. Moreover, J. Barney (1991) stated that the basic question on the RBV attempting to address concerned what combination on VRIN framework that resources and capabilities could lead to a competitive advantage. In addition, Margaret A. Peteraf (1993) suggested that RBV based on the fundamentally heterogeneous in terms of their resources and capabilities. It implied that firms with varying capabilities would be able to compete in the market place. However, Oliver (1997) also defined firm heterogeneity as relatively durable differences in strategy and structure across firms in the same industry that tend to produce economic rents and a sustainable competitive advantage.

In term of resource heterogeneity, Margaret A Peteraf and Barney (2003) suggested that it considered as a given collection of resources which satisfied the VRIN conditions and emphasized the different resources. Different levels of value creation obtained by resources across firms to bear on particular value-added tasks (Foss & Foss, 2004). Therefore, competitive advantage should be a result of discretionary rational managerial choices, selective resource accumulation, strategic leverage core competencies and deployment (Oliver, 1997).

As mention earlier that RBV was the typical theory for this research. Therefore, this part would elaborate more on the theory, in order to be more understanding in this research. Mata et al. (1995) stated that strategic management and information technology had their roles in creating sustained competitive advantage to business. However, Porter (1985) has been given the five competitive forces for any business. They were the entry of new competitors, the threat of the substitutes, the bargaining power of buyers, the bargaining power of suppliers, and the rivalry among the existing competitors (see Figure 2.1). Porter also explained further that the five forces determine business profitability because they influenced prices, costs, and required investment of the firm. *Buyers power* influences the product's prices, costs, and firm's investment. While *the threat of substitute* also influences the product's prices. *Bargaining power of suppliers* determine the costs of raw material. *The intensity of rivalry* influences prices as well as the costs. Prices and investment determine *the new entrants*.

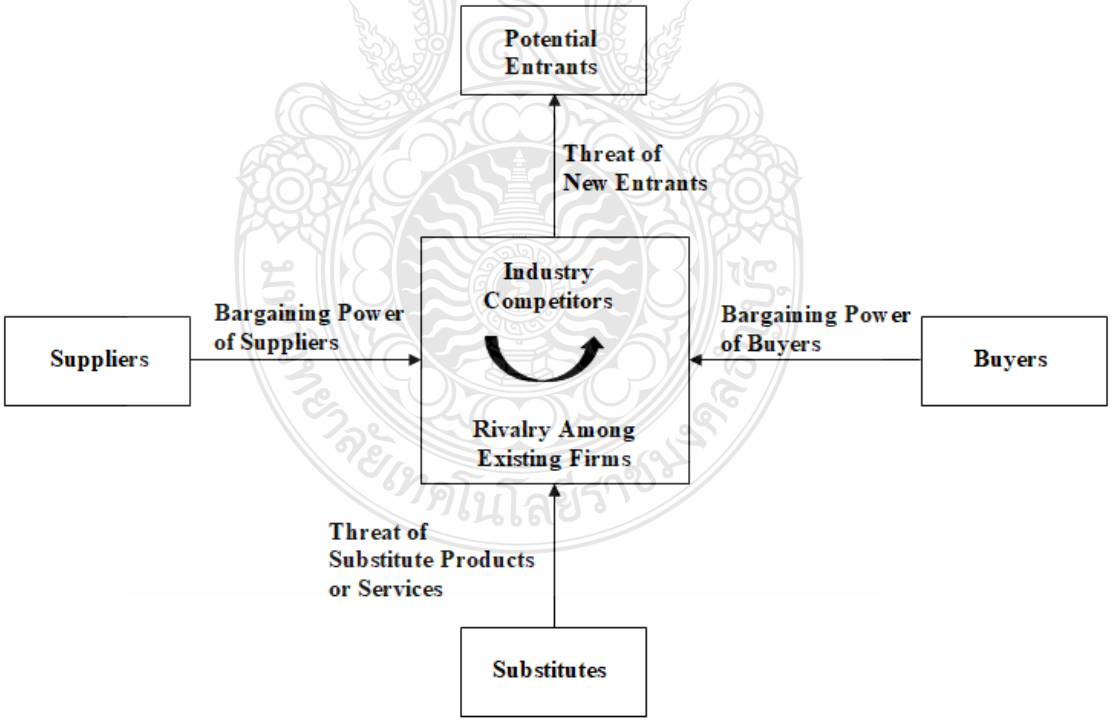

Figure 2.1 The five competitive forces model (Porter, 1985).

In addition, Porter also stated the two types of competitive advantage which are low cost and differentiation. The two basic types combined with the firm's scope of activities in order to achieve in cost leadership, differentiation and focus. The focus had on cost focus and differentiation focus. The relationship among those types showed in the Figure 2.2.

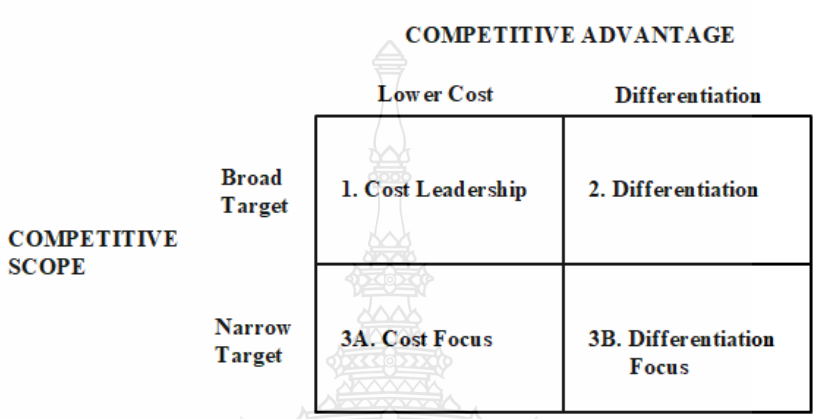

Figure 2.2 The three generic strategies (Porter, 1985).

Cost leadership or cost reduction was the way to lower the costs than competitors. Firms needed to gain a sustainable cost advantage or minimize their cost disadvantage. *Differentiation* was one of the two types of competitive advantage which a firm needed to be differentiated from its competitors. A firm that achieved and sustained differentiation would be above average status. *Focus* was the third generic strategy which different from others. It restricted competitive scope by selected focus group. The two types of focus were *cost focus* and *differentiation focus*. Cost focus attempted the cost advantage while differentiation focus attempted differentiation in it focus group.

As the above discussion, firms had the strategy for competitive advantage, which they choose the type of competitive advantage and scope that they wanted to attain. In order to get more understating on the connection between RBV and competitive advantage, Grant (1991) explained on a resource-based approach to strategy analysis which related to competitive advantage. Grant proposed five-stage procedure for strategy formulation, they were 1) analyzing the firm's resource-base 2) appraising

the firms capabilities 3) analyzing the profit-earning potential of firm's resources and capabilities 4) selecting a strategy and 5) extending and upgrading the firm's pool of resources and capabilities (see Figure 2.3).

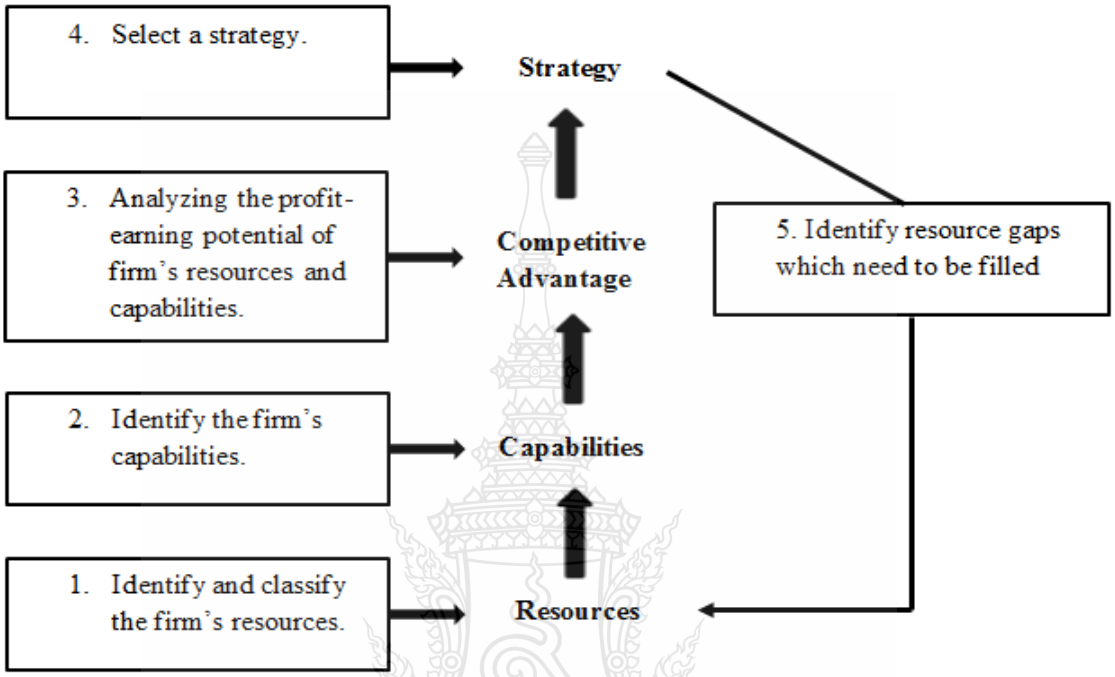

Figure 2.3 A resource-based approach to strategy analysis (Grant, 1991).

Form the above diagram, firms needed to set up objectives to what to do business and how to run business successfully. Due to customer needs and technology has been changing all the time, the resources and capabilities would be the primary source of profit for the firm. Resources considered as important inputs into the production process, they produced productive goods and services. Grant (1991) stated that a capability was the capacity for a team of resources to perform activity. Grant also added that while resources are the source of a firm's capabilities, capabilities are the main source of its competitive advantage. However, Wade and Hulland (2004) defined resources as assets and capabilities that would be available and useful in detecting and responding to market opportunities or threats.

2.3 IT Capability

This section discussed on the relationship of the resource-based view (RBV) and information technology capability. RBV started to appear in IS research in the mid-1990s (Wade & Hulland, 2004). Most of research has attempted to identify and define either a single IS resource or sets of IS resources. According to Ross, Beath, and Goodhue (1996a) divided IS into three IT assets which together with IT processes those contribute to business value. These three IT assets were *human assets* such as technical skills, business understanding, and problem-solving orientation. *Technology assets* were physical IT assets, technical platforms, databases, architectures, and standards. *Relationship assets* were partnerships with other divisions, client relationships, top management sponsorship, shared risk and responsibility. IT processes defined as planning ability, cost effective operations and support, and fast delivery.

Wade and Hulland (2004) defined resources as assets and capabilities that were available and useful in detecting and responding to market opportunities or threats. Assets and capabilities also defined as the set of resources available to the firm. As result, IT capability defined as firm's ability to acquire, deploy, combine, and reconfigure IT resources in support and enhancement of business strategies and work processes (Sambamurthy & Zmud, 1997). However, Lu and Ramamurthy (2011) indicated that there were three IT capabilities which are IT infrastructure capability, IT business spanning capability, and IT proactive stance.

In the digital networks and communication infrastructure, e-business played the roles a part of wider economic context. Turban, King, Lee, and Viehland (2002) found that e-business includes transactions carried out in electronic markets, services to consumers, collaboration with business partners and intra-organizational relationships. In addition, Currie and Parikh (2006) claimed that e-business web-based systems increasingly represent a competitive advantage for firms and had obtain great organizational changes. Borges et al. (2009) also supported that firms developed a strategic plan for IT to improve the company e-business capabilities.

This would be indicated that IT capability was critical factor for a firm to realize business value and sustain competitive advantage. However, this research

followed Bharadwaj (2000) which defined IT capability including IT infrastructure, human IT resources, and IT-enabled intangibles.

IT Infrastructure. Keen (1991) described IT infrastructure as a business resource for attaining long-term competitive advantage. Reed and DeFillippi (1990) has been also described that the unique characteristics of the IT infrastructures to be the abilities to identify and develop key applications, information sharing, supply chain management, and explore opportunities for synergy across business units. Businesses have to learn to utilize and redesign their infrastructure capabilities in order to significantly reduce the time and cost to build the system (Weill, 1993). The building of an integrated infrastructure takes time and effort and involves experiential learning (Bharadwaj, 2000).

The development of IT infrastructures on the entire organizations linked to key suppliers and customers. This process involved the distribution and management of hardware, software, and other support services (Ross, Beath, & Goodhue, 1996b). The IT infrastructure shared information delivery base on the business functionality (Keen, 1991). Bharadwaj (2000) also claimed that IT infrastructure helped firms to implement the right applications which made the inimitable cost and value of technological innovation.

However, Venkatraman (1991) proposed the role of IT infrastructure in the organization, viewed as one of these three characteristics: *1) independent* (i.e., IT infrastructure planning and management concerned to firm's business planning and management), *2) reactive* (i.e., IT infrastructure planning and management agreed to firm's business planning and management) or *3) interdependent* (i.e., IT infrastructure planning and management as part of firm's business planning and management). In addition, McKay and Brockway (1989) and Weill (1993) conceptualized and illustrated the three layers building block which helped IT to support business capabilities. At the base layer shared technological components such as hardware, operating software, communications, other equipment. The second layer concerned the human and organizational capabilities that needed to effectively leverage and utilization, which demonstrate the ability that combines and deploys those technological components into

a shared set of capabilities. The third layer was a set of shared IT services such as electronic data interchange or a full service network.

Human IT Resources concerned with technical and managerial IT skills which typically developed over time through the accumulation of experiences (Katz, 2009). The dimensions of human IT resources comprised of technical IT skills and the managerial IT skills, which were programming, system analysis and design competencies. This referred to the abilities of effective management of IS functions, coordination and user's interaction, as well as project management and leadership skills (Capon & Glazer, 1987; Copeland & McKenney, 1988). Bharadwaj (2000) also supported that firms with strong human IT resources had the following competences: 1) ability to integrate the IT and business planning process effectively, 2) ability to quickly develop reliable and cost effective applications for business needs, 3) ability to effectively communicate and coordinate with other business units, and 4) ability to anticipate future business needs of the firm with innovate value.

IT-Enabled Intangibles described the key organizational intangibles such as know-how, corporate culture, corporate reputation, and environmental orientation. Bharadwaj (2000) recognized IT-enabled intangibles as key drivers of superior performance, and defined IT-enabled intangibles into three key intangibles which were *customer orientation* (the ability to respond for the changing of demand from the customers) , *knowledge assets* (an embedded in the skills and experience of its employees which developed over time to become competencies), and *synergy* (the sharing of capabilities and resource between departments which enhance the efficiency and effective of the organization.

2.4 Data Analytics

In the digital business environment nowadays, data has been generated by social media and online services in a very big amount. However, data storing might not generate business value (Ularu et al., 2012). Watson (2014) indicated the three stages of data analytics which were decision support system (DSS), business intelligent (BI), and analytics (Figure 2.4).

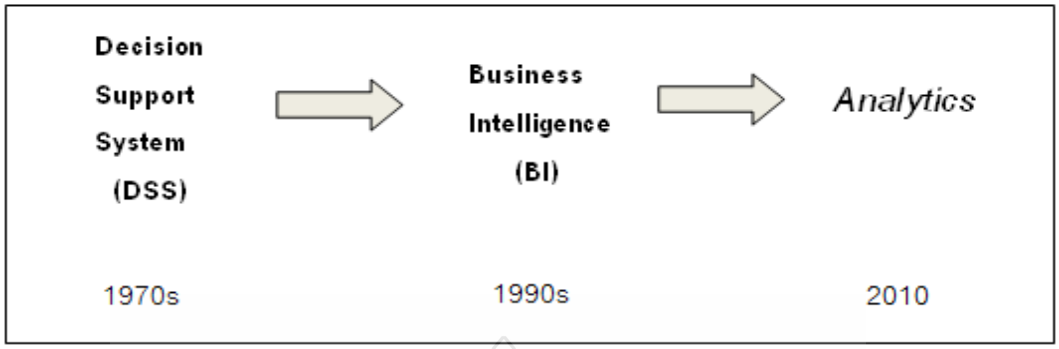

Figure 2.4 From DSS to BI to Analytics (Watson, 2014).

Similarly, Goes (2014) also supported that information system has been moving from data to information to knowledge to intelligence and to analytics. This explained that data considered as simply observations, information as a data in context, and knowledge as an information subject to experience which providing a deeper understanding (Erickson & Rothberg, 2015). The generation of knowledge and intelligence is supported decision making and organizational strategies. The Figure 2.5 showed an information systems framework. The three types of decision making consisted of structured, semi- structured and unstructured which employed for operational control, management control and strategic planning. The decisions above the line were structured. It was structure decision systems (SDS), and or management information systems (MIS). Decisions below the line were unstructured and supporting information systems called decision support systems (DSS).

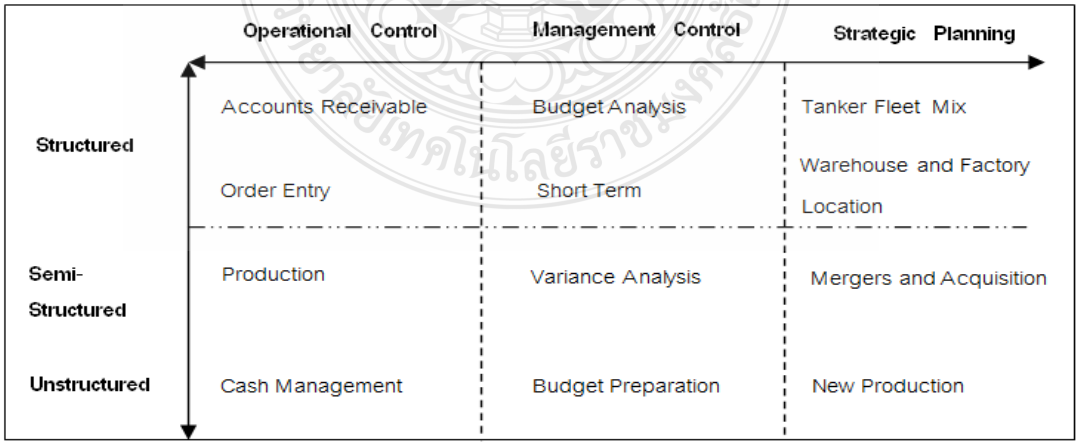

Figure 2.5 Information systems: a framework (Gorry & Morton, 1989).

H. Chen, Chiang, and Storey (2012) mentioned that business intelligence and analytics (BI&A) and other related area of data analytics have been increasingly important in business sectors and the academic for over two decades. Business intelligence (BI) became popular in the business and IT in the 1990s. Until late 2000s, business analytics was introduced to represent the key analytical component of BI (Davenport, 2006). Chen and his team also described that data analytics have been used to explain the data set in application. Data analytics spread out the scope of BI, and it is not a revolution but an evolution of traditional BI (Debortoli, Müller, & vom Brocke, 2014).

Data sets have been increasing too large for the traditional data-processing and this requires new technology to manage data sets (Power, 2014). Apache Hadoop one of the open source software framework could process large data sets (Olofson & Vesset, 2012; Power, 2014; Ularu et al., 2012; Watson, 2014). It reduced the complexity of data sets. As a result, business would be able to gain a competitive advantage by being early adopters of data analytics (Ularu et al., 2012). Porter (1985) supported that firm that could discover a better technology for performing an activity than its competitors thus gains competitive advantage. However, Goes (2014) mentioned that businesses looked for technology-based competitive advantage, while the public, academic, and scientific sectors tried to understand unprecedented opportunities.

2.4.1 Overview of Big Data

During the past two decades data has increased in a large scale in various fields (M. Chen, Mao, & Liu, 2014). The service of internet companies such as Google, Facebook, Baidu (a Chinese company), Alibaba, and so on have generated large amount of datasets. In the research of Runion (2015) found that the digital data significant growth of 23 % per year over that timeframe. There was more interestingly that they found computing capability grew at a faster rate with 58% per annum. This studied revealed that the digital data grew up from 25 % of analog data in 2000 to 94 % in 2007. It could be seen that digital data in the present business environment had increasingly in term of amount and more importantly.

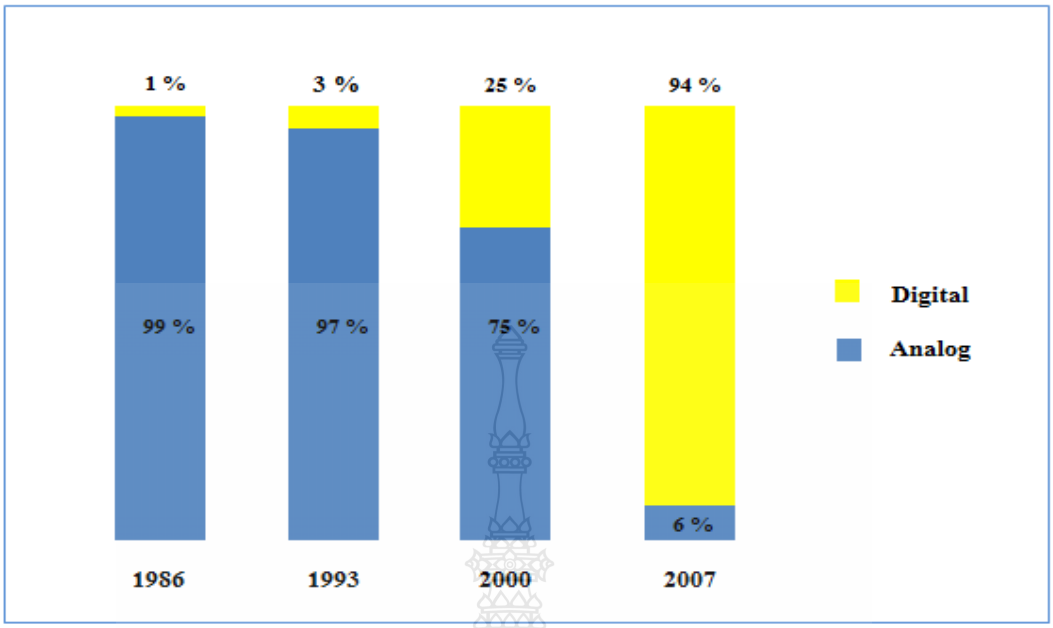

Figure 2.6 Comparison of percentage of analog and digital data from 1986 to 2007 (Runion, 2015).

In order to gain competitive advantage in a digital business environment, many organizations needed to maintain and analyzed large amounts of data in term of both structured and unstructured data (Olbrich, Alpar, Recanati, Etzion, & Garfield, 2014). The term big data occurred all around but the use of this term was not just a large amount of data (Baesens, Bapna, Marsden, Vanthienen, & Zhao, 2016). Ularu et al. (2012) claimed that big data term was first introduced by Roger Magoulas from O'Reilly media in 2005. Magoulas defined big data as a great amount of data which traditional data management techniques difficult to manage and process because of the complexity and size of this data. Besides, Manyika et al. (2011) referred to big data as data sets whose size was beyond ability of typical database software tools to capture, store, manage, and analyze. The International Data Corporation (IDC), an America market research, analysis and advisory firm, defined big data technology as a new generation of technologies and architectures designed to extract value economically from very large volumes of a wide variety of data by enabling high-velocity of capture, discovery, and/or analysis. According to Goes (2014) defined big data as the 4'Vs

which are volume, velocity, variety and veracity. The characteristics described as follows.

Volume: referred to the amount or quantity of data which gathered by company. Data volume continued to increase every day. Olofson and Vesset (2012) claimed that networking organizations produced petabytes or exabytes of data for their business. Kim (2015) also supported that the amount of data created and replicated will be more than 1.8 zettabytes (1.8 trillion gigabytes). This increased nearly nine times in five years (M. Chen et al., 2014). This data used to obtain important knowledge for organizations.

Velocity: referred to the speed at which data could be generated (Shim, French, Guo, & Jablonski, 2015). This era, data has been moving through the systems from batch processing to real-time streaming of data (Olofson & Vesset, 2012). It could be able to produce vast amount of data. Many activities needed immediate responses which fast processing will maximizes efficiency (Ularu et al., 2012).

Variety: referred to different types or formats of data. This data comprised of structured and unstructured data (Tan, Sun, & Liu, 2015). For example text, sensor data, audio, video click streams, log files and more (Ularu et al., 2012). Olofson and Vesset (2012) exhibited the example about the advanced weather/climate modeling that draws on 100 years of weather data with new physical models of ocean water behaviors.

Veracity: one of the main characteristic of big data. It referred to the validation of data for decision makers (Goes, 2014; Ularu et al., 2012) to ensure the data quality especially for the unstructured data (Tan et al., 2015). Data should be reliable, accuracy, truthfulness and precision (Shim et al., 2015).

However, several researchers enhanced additional characteristic of big data, such as value.

Value realized when and organization has carefully executed of big data strategy (Watson, 2014). Shim et al. (2015) supported that the ability to use data to extract information of value to organization. However, Olofson and Vesset (2012) argued that Value can be referred to cost of technology that data benefits to the organization.

However, the characteristics of big data would be changed when the time passed by. This meant that the characteristics of big data would not be stable in the future as long as the technology still improving.

2.4.2 Benefits of Big Data

This clarified the benefits of big data in the business digital environment. Power (2014) claimed that organizations those only collecting and keeping big data, there would not be created any business value for them. Big data was useful when it used in data analysis. Watson (2014) also supported that the benefits from big data could be the basis for organization competitive advantage. As a result, Karr (2014) addressed that big data helped company to make accurate decisions and predictions on business operation. It also enabled business to make better decisions leading to cost reduction, market expansion and sales effectiveness.

Ularu et al. (2012) addressed the areas of big data used effectively. They were 1) used information technology to improve security 2) improved customer service by using information from call center 3) improving services and products by knowing the potential customers preferences 4) detection of fraud in the online transactions 5) operated risk management by analyzing information. In the research of Brynjolfsson, Hitt, and Kim (2011) investigated the benefits of using data and analytics in decision making of the 179 large traded companies. It found that companies adopted data-driven decision making, the output and productivity was 5 percent to 6 percent higher than companies without data-driven decision making. This relationship also extended to other performance measurement such as asset utilization, return on equity, and market value. Moreover, Olofson and Vesset (2012) supported that big data analytics helped business to improve existing processes in order to launch new product line, and to improve interactions with customers.

Bughin, Chui, and Manyika (2010) claimed in the McKinsey Quarterly publication that big data analytics was one of the ten tech-enabled business trends to watch. Big data had the potential to drive a transformation in research, innovation, and marketing. It has been one of essential components of management decision making required new capabilities, as well as organizational and cultural change. Brown, Chui, and Manyika (2011) also stated in McKinsey Quarterly that big data helped mangers to

distinguish a cause from mere correlation, and reduced the variability of outcomes while improving financial and product performance.

Table 2.1 The prior research in benefits of big data.

	References	Summary of findings	Method	Benefits
1	Baesens et al. (2016)	Transformational issues of big data and analytics in network business	Survey and literature analysis	Technology and management
2	Tan, Sun and Liu (2015)	Technical context of big data application in the healthcare sectors	Literature analysis	Quality of healthcare services provision
3	Shim et al. (2015)	Big data projects define maximum return and most effectively.	Survey and literature analysis	Maximum return on investment
4	Kim (2015)	Contribution to provide a guideline for big data analytics	Survey and literature analysis	Empowering decision more flexibility
5	Watson (2014)	To illustrate various uses of big data analytics based on decision making culture.	Framework and conceptual model	New data management technology, platforms and approaches.
6	Kamiloka and Tapanainen (2014)	Relation on the systematic and extensive use of big data and top management understanding to the competitive advantage.	Qualitative and quantitative methods	Gain business competitive advantage.

Table 2.1 The prior research in benefits of big data. (Cont.)

	References	Summary of findings	Method	Benefits
7	Goes (2014)	Information revolution on business and academic sectors.	Framework and conceptual model	Gain leadership in the new environment.
8	Debortoli, Muller, and Brocke (2014)	Big data is an evolution of business intelligence	Framework and conceptual model	More reliable of knowledge and skills are required.
9	Bedeley (2014)	Big data uses in banking industry.	Literature analysis	Lower marketing and operational costs, and higher profitability.
10	DataStax (2013)	Powerful enterprise to manage big data effectively.	Framework and conceptual model	Gain business competitive advantage.
12	Olofson and Vesset (2012)	Big data technology movement and leverage to business advantage.	Survey and literature analysis	Improve existing business process and launch new product lines.
13	Ularu et al. (2012)	Developing big data strategy and technology to create new value of data.	Framework and conceptual model	Gain business competitive advantage.

2.4.3 Business Analytics

Business analytics has been getting rapidly more popular than any other managerial paradigms in recent years (Delen & Demirkan, 2013). Business analytics considered as the activities which explored and investigated the past and current business performance to get insight and drive business planning. Sun, Strang, and Firmin (2017) defined business analytics as an extended from of data analytics or a kind of application of data analytics including big data analytics in business, as shown in Figure 2.7.

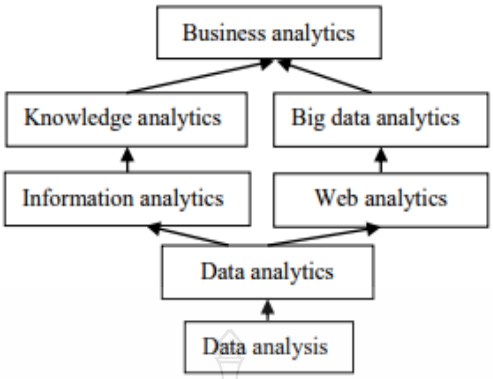

Figure 2.7 An ontology of business analytics (Sun et al., 2017).

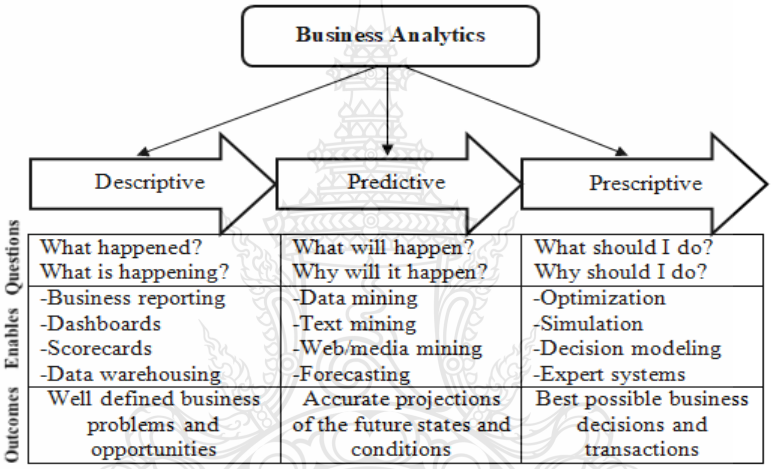

Figure 2.8 Categories of business analytics (Delen & Demirkan, 2013).

Song et al. (2013) Cook and Nagy (2014) stated the main phases on business analytics which were descriptive analytics, predictive analytics and prescriptive analytics.

Descriptive analytics commonly used and most well understood type of analytics. The main objective of descriptive analytics step was to help researchers figure out person's current status (Song et al., 2013). It consisted of activity history analysis. Descriptive analytics was more data-driven than the other models. It also called business reporting which used the data to answer the question of what happened and/or what is happening? (Delen & Demirkan, 2013). Descriptive analytics categorized, characterized, aggregated and classified data, and converted data into useful information for understanding and analyzing business decision, outcomes and quality (Raghupathi &

Raghupathi, 2013). Assunção, Calheiros, Bianchi, Netto, and Buyya (2015) stated that descriptive analytics created management reports. Data summarized might be in the form of meaningful charts and reports. It showed the identification of business opportunities and problems.

Predictive analytics slightly more advanced type of analytics and emphasized the use of information. Predictive analytics looked at the past performance in order to predict the future by examining historical or summarized data, detecting, and then read these relationships to forecast (Raghupathi & Raghupathi, 2013). Assunção et al. (2015) stated that predictive analytics attempted to predict the future by analyzing current and historical data. In addition, Cook and Nagy (2014) claimed that descriptive analytics typically encompassed conventional reporting, whereas predictive analytics attempted to use existing data to model and simulate the future. The main outcome of predictive analytics was an accurate projection of the future happenings and the reasoning (Delen & Demirkan, 2013).

Prescriptive analytics used descriptive analytics to optimize for the best possible outcome given the original data and results of the models and simulations (Cook & Nagy, 2014). It was also normative, addressing the question of what should be. Assunção et al. (2015) supported that prescriptive solutions assisted analysts in decisions by determining actions and assessing their impact regarding business objectives, requirements and constraints.

2.5 Market Orientation

Marketing involved to most people especially to the business sectors. Marketing defined as the task of finding and stimulating buyers for the business sectors' output. This involved product development, pricing, distribution, and communication (Kotler & Levy, 1969). The marketing management played to role to take business successfully. Marketing management defined as a decision-making or problem-solving process and relied on analytical frameworks from economics, psychology, sociology, and statistics (Webster Jr, 1992). Analysis for marketing management focused on demand (revenues), costs, and profitability and the use of traditional economic analysis to find the point at which marginal cost equals marginal revenue and maximized profit.

Van Raaij and Stoelhorst (2008) defined that the market orientation concept had its origin on a management philosophy known as the marketing concept. It defined as the organization wide generation of market intelligence pertaining to current and future customer needs, dissemination of the intelligence across departments, and organization wide responsiveness.

Market orientation has been viewed as customer needs and firm generates, disseminates, and responds to market intelligence (Bhatt et al., 2010). Borges et al. (2009) stated that a market oriented organization consisted with the concept of marketing. In addition, Gheysari, Rasli, Roghanian, and Norhalim (2012) defined market orientation as a succession of behaviors based on information and a culture of customer and competitor orientates inter-functional co-ordination. Gheysari et al. (2012) also mentioned that the significant roles in determining the success of an organization were the buyer power and the rivalry among competitors this related to the five competitive forces of Porter's model. Market orientation concepts also have been expanded to both concerns with regard to the customers, competitors and firm's environment. However, J. Green, Kenneth W and Inman (2007) claimed that customer focus was essential to the idea of market orientation rather than competitors. However, S. Slater, Narver, and MacLachlan (2000) stated that when an organization's market orientation produced value for customers that was rare and difficult to imitate. It considered a sustainable source of competitive advantage. The information on customer needs, customer satisfaction and service quality should be monitored and reviewed to gain competitive advantage and better firm performance (K. W. Green, Chakrabarty, & Whitten, 2007).

However, the use of internet technology to support market orientation brought a sustainable competitive advantage (Min, Song, & Keebler, 2002). Prasad, Ramamurthy, and Naidu (2001) also claimed that the integration of the internet technology with marketing activities increased the influence of market orientation and had positively impacted on performance. IT strategic utilization such as internet based technologies and e-commerce would positively influenced market orientation by supporting the marketing activities (Min et al., 2002; Overby, Bharadwaj, & Sambamurthy, 2006). According to Day (1999) suggested that technological leadership

was an essential condition for success. Min et al. (2002) also supported that internet technologies transformed a traditional market orientation into more efficient and effective market orientation. In the research of Borges et al. (2009) agreed that internet technology was necessary for gathering information on environmental changes, for sharing information and knowledge, and for developing market focused responses to support market orientation behaviors.

The concepts of market orientation had variety of ideas. Kuntonbutr (2013) found the concepts of market orientation contributed by Narver and Slater, and Kohli and Jaworski. Narver and Slater (1990) concluded that market orientation consisted of three behavioral components, they were customer orientation, competitor orientation, and inter-functional coordination with two decision criteria were long term focus and profitability. While, Kohli and Jaworski (1990) defined market orientation as the organization-wide generation, dissemination, and responsiveness to market intelligence. In addition, Martin, Martin, and Minnillo (2009) claimed that market orientation as the fundamental aspect of an organization's culture that defined competitive value, norms, artifacts, and behaviors that collectively created the opportunity for competitive advantage to the firms. To understanding of market orientation, this study would be elaborated the concept of Narver and Slater, as follows

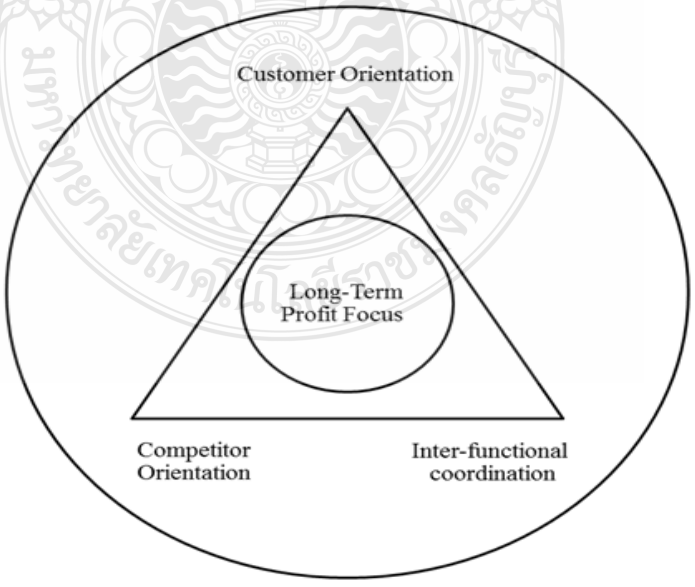

Figure 2.9 The market orientation (Narver & Slater, 1990).

Customer orientation defined as the understanding target customers in order to generate sustainable value for customers' needs, desires and present or potential perceptions (Cambra-Fierro, Hart, Fuster Mur, & Polo Redondo, 2011). It required sellers to understand buyers' value chain (Day & Wensley, 1988). Customer orientation supported a continuous, proactive disposition to meet customer's demands. Therefore, a focus on customer satisfaction brought up to the innovation (Peters, 1984). Narver and Slater (1990) supported that customer orientation as the sufficient understanding of buyers in order to create excellent products for them continuously. However, Christensen, Cook, and Hall (2005) found that customer orientation was important to marginal innovation since customer had difficulty to explain their needs. Customer orientation performed effectively by investigating the customer needs and responding to their needs with new innovations. However, the marketing concept concentrated on the customer first and then various factors followed the customer needs (Kuntonbutr, 2013).

Competitor orientation referred to the understand of short term strengths and weaknesses and long term capability and strategy of both current and future of competitors (Narver & Slater, 1990). Customer orientation and competitor orientation included the activities that involved in acquiring information about buyers and competitors in the target market and dissemination it throughout the businesses. The balanced mix of customer and competitor orientation was necessary for maintaining a competitive advantage in the marketplace (Day & Wensley, 1988). In addition, Cambra-Fierro et al. (2011) defined competitor orientation as the understanding and becoming familiar with the value alternatives in order to create the competitive advantage to guarantee long term market permanence. Competitors played their roles to identify firm strengths, and weaknesses, the present/future action, and strategies analyzed.

S. F. Slater and Narver (1994) created questions on competitor orientation that who were the competitors?, what technologies did they offer?, and did they represent an attractive alternative from the perspective of the targets customers. These three questions gave the intelligence competitor orientation. Han et al. (1998) claimed that the competitor orientation for firms to identify their own strengths and weakness. Those strengths and weakness were useful insights information for firms to compete with the competitors. Firms with a higher degree of competitor orientation for new product

performance would concentrated more on customer orientation. That was the evidence of interrelationships between customer orientation and competitor orientation (Kuntonbutr, 2013).

Inter-functional coordination coordinated utilization of company resources in crating superior value for target customers. The buyer's value chain afforded opportunity for a seller to create value for the buyer firm (Narver & Slater, 1990). Porter (1985) also supported that any individual in any function in a seller firm potentially contribute to the creation of value for buyers. However, Cambra-Fierro et al. (2011) claimed that inter-functional coordination required in order for information to flow effectively and reach responsible parties. Han et al. (1998) supported that inter-functional coordination helped to implement marketing concept properly, which the integration of other functions of business with marketing was necessary.

Kohli and Jaworski (1990) asserted that senior management often noted that various departments being concerned of the market intelligence was not sufficient. The coordinated effort among various functions was instrumental in the firm's responsiveness to customer needs. Furthermore, the inter-functional coordination illustrated the level of interaction and communication in the firms and was crucial for new product development (Im & Workman Jr, 2004).

2.6 Innovation

Innovation considered as an important function of management because it linked to business performance. The innovation also influenced market orientation to better firm performance (Han et al., 1998). Aldas-Manzano, Küster, and Vila (2005) included innovation as intermediate variable between market orientation and performance in their research. The research's results showed that market orientation and innovation were not isolated fields. Therefore, they were able to support a positive relationship between market orientation and performance. The several authors explained the definition of innovation, as follows.

Zaltman et al. (1973) defined innovation as the generation, acceptance, and implementation of new ideas, processes, products, or services. Alternatively, innovation viewed as a new idea, practice or object by an organization.

West and Farr (1989) defined innovation as the intentional introduction and application within a role, group or organization of ideas, processes, products or procedures, new to the relevant unit of adoption, designed to significantly benefits to the individual, groups, organizations or society.

Hamel (2006) described innovation as a marked departure from traditional management principles, processes and practices or a departure from routine organizational forms that significantly alters the way the work of management performed. However, Christensen (1997) defined innovation in crisis aspect that it was state of being disruptive to friendly environment.

This paper interpreted the findings in relation to the possible influenced on various aspects in dimension of innovation. The possible innovative alternatives were new products or service, and identify new market (Lagat et al., 2015; Schumpeter & Backhaus, 2003; Wang & Ahmed, 2004). Dobni (2008) and Wang and Ahmed (2004) also noted that innovation was multi-dimensional construct which included the dimensions of product, market, process, behavior and strategic innovation.

Product innovation has been a major interest factor for business. It could be a critical factor to product success which in turn is highly associated to sustainable business success. Wang and Ahmed (2004) defined product innovativeness as the novelty and meaningfulness of new products introduced to the market. Product innovation most often referred to the perceived newness, novelty, originality, or uniqueness of products (Henard & Szymanski, 2001). Danneels and Kleinschmidtb (2001) indicated the two perspectives of product innovation: 1) the customers' perspective for example the innovation attributes, adoption risk, and levels of change in established behavioral patterns regarded as forms of product newness. 2) the firm's perspective, environmental familiarity and project firm fit, and technological and marketing aspects viewed as dimensions of product innovation.

Kuntonbutr (2013) stated that various studies presented results concerning the relationship between market orientation and product innovation that created product performance which important to successful marketing. The product innovation also created a firm's performance and profit growth. The product innovation regarded as an important dimension. Langerak, Jan Hultink, and Robben (2004) found that market

orientation culture positively related to proficiency in strategic planning, idea generation, and idea screening which in turn influenced new product performance. On other hand, Wei and Morgan (2004) argued that a firm's market orientation directly affected new product performance. The firm's environment also affected market orientation.

Market innovation linked to the product innovation, and also studied as product-market innovation (Wang & Ahmed, 2004). The market innovation referred to innovation that related to market research, advertising and promotion (Andrews & Smith, 1996), and also identification of new market opportunities and entry to the new markets (Ali, Krapfel, & LaBahn, 1995). Ali et al. (1995) considered innovation as a market-based construct and defined innovation as the uniqueness of the product to the market.

Wang and Ahmed (2004) claimed that the market innovation was the new approaches for companies to enter and exploit the targeted market. For some companies, they entered a market or identify a new market niche and launch products with modern technology contents. However, the alternative approach would be based on existing products, but with adoption of new marketing programs to promote the products and services. Within both circumstances, the company took up against new competitors either in a new market, or an existing market segment. Wang and Ahmed (2004) also emphasized further that the product innovation maintained a focus on product newness whereas market innovation emphasized on the newness of market oriented approaches. Product and market innovation were prominent factors, and both of them also linked to each other.

Kohli and Jaworski (1990) indicated market orientation as an organizational culture which supporting behaviors and control how employee's think and act as it related to implementation of the marketing concept. Market orientation had key capabilities such as market sensing, customer linking, competitor sensing, customer service, technology development, new product/service development, and organizational communication (Dobni, 2008). The connection between market orientation and innovation concerned to cultural openness with organization's cultural attention needed

to recognize the need for innovation (Van de Ven, 1986). In addition, Marinova (2004) claimed that market oriented culture was also foundational in supporting innovation.

2.7 Firm Performance

Firm performance concepts identified as financial and non –financial which some studies enhance understanding of firm performance as customer satisfaction and market performance (S.-C. Chen & Quester, 2006). Tseng and Liao (2015) study on the performance measurement reflected two main perspectives which were subjective and objective concepts. Golden (1992) stated that subjective concept concerned with the performance of a business relative to its competitors. The objective concept based on absolute measures of performance (Chakravarthy, 1986). The research of Tseng and Liao (2015) identified firm performance as market performance, finance performance, and customer service. In the research of Han et al. (1998) identified business performance as assessed on growth and profitability. Cambra-Fierro et al. (2011) also opted customer satisfaction, customer loyalty, well-known branding, market share and economic profit as performance measurements. Javalgi et al. (2006) stated that as the firm became increasingly market orientation the positive strategic outcomes of customer relationship management including satisfaction, loyalty, retention and ultimately enhanced customer lifetime value as the final results.

The investigation on firm performance in this research was based on profitability, market share, customer satisfaction, and customer loyalty. The table 2.3 showed the prior researches on related firm performance factors.

Table 2.2 The prior researches on firm performance factors.

Titles/Authors	Profitability	Market Share	Customer Satisfaction	Customer Loyalty
Supply chain integration, information technology, market orientation and firm performance in container shipping firms (Tseng & Liao, 2015)	✓	✓	✓	✓
Toward a subjective measurement model for firm performance (Santos & Brito, 2012)	✓		✓	
Looking for performance: How innovation and strategy may affect market orientation models (Cambra-Fierro et al., 2011)	✓	✓	✓	✓
The impact of entrepreneurial orientation on firm performance: the role of CEO position tenure and industry tenure (Richard, Wu, & Chadwick, 2009)	✓	✓		
An empirical study on the impact of supplier performance on organizational performance: a supply chain perspective (Vivek & Ravindran, 2009)	✓	✓		
Marketing research, market orientation and customer relationship management: a framework and implications for service providers (Javalgi et al., 2006)	✓		✓	✓

Table 2.2 The prior researches on firm performance factors. (Cont.)

Titles/Authors	Profitability	Market Share	Customer Satisfaction	Customer Loyalty
Modeling store loyalty: perceived value in market orientation practice (S.-C. Chen & Quester, 2006)		✓	✓	
IT competency and firm performance: is organizational learning a missing link? (Tippins & Sohi, 2003)	✓	✓		✓
Market orientation and organizational performance: is innovation a missing link? (Han et al., 1998)	✓			

2.8 Theoretical Frameworks

This section presented research frameworks which related to this paper topic. The purpose conceptual framework of this paper showed later in the section. Starting with Lu and Ramamurthy (2011) who studied on the link between information technology capability and organization agility. The conceptual framework of IT capability and organization agility was showed in the Figure 2.10. IT capability consisted of IT infrastructure capability, IT business spanning capability, and IT proactive stance. There were two forms of organizational agility which were market capitalizing agility, and operational adjustment agility.

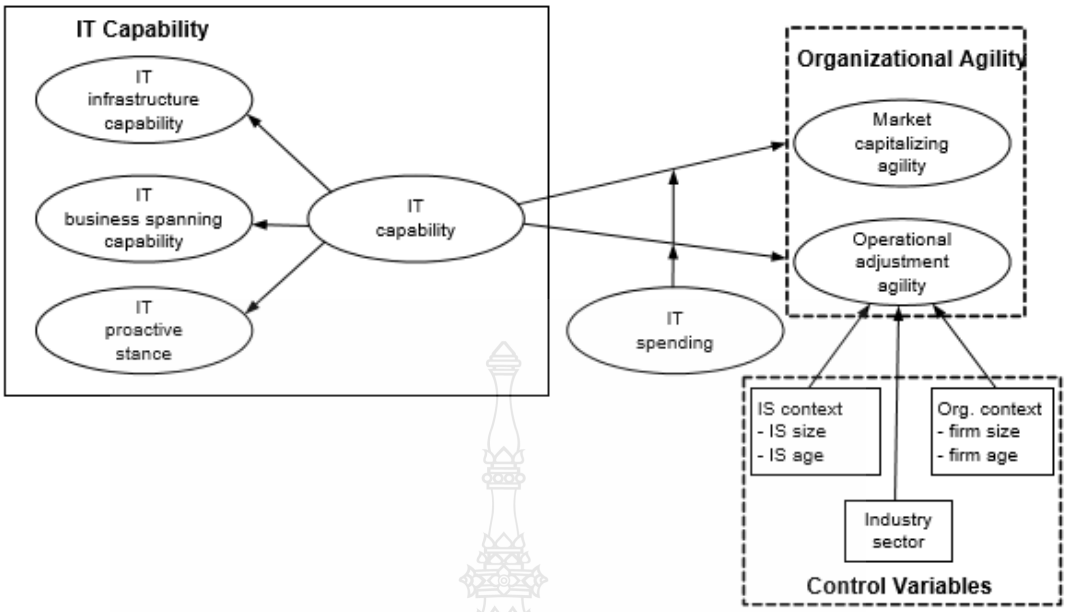

Figure 2.10 Research model by Lu and Ramamurthy (2011).

In the research defined IT capability as three dimensions which were IT infrastructure capability, IT business spanning capability, and IT proactive stance. IT infrastructure capability defined as a firm's ability to deploy a set of shareable platforms, capturing the extent to which the firm was good at managing data management services and architectures, network communication services, and application portfolio and services. IT business spanning capability defined as the ability of management to envision and exploit IT resources to support and enhance business objectives. IT proactive stance defined as a firm's ability to proactively search for ways to embrace new IT innovations or exploit existing IT resources to address and create business opportunities. Market capitalizing agility defined as a firm's ability to quickly respond and capitalize on changes through continuously monitoring and quickly improving product or service to address customers' needs. Operational adjustment agility defined as a firm's ability in its internal business processes to physically and rapidly cope with market or demand changes.

This research investigated on two research questions. First, did IT capability enhance or impede agility? The research found that IT capability enhances both types of agility. Second, how did IT capability complement other organizational resources,

namely, IT spending, to enhance agility? The result was significant positively affected of IT capability and IT spending on operational adjustment agility but not on market capitalizing agility. From the results of both questions found that IT capability had an influence on organizational agility. The research's results suggested that IT capability enabled market capitalizing agility and operational adjustment agility. The research finding revealed that IT capability was essential to achieve agility and that IT capability offered a possible resolution to the conundrum of contradictory effect on agility. While more IT spending did not lead to greater agility, spending it in such a way as to enhance and foster IT capabilities did.

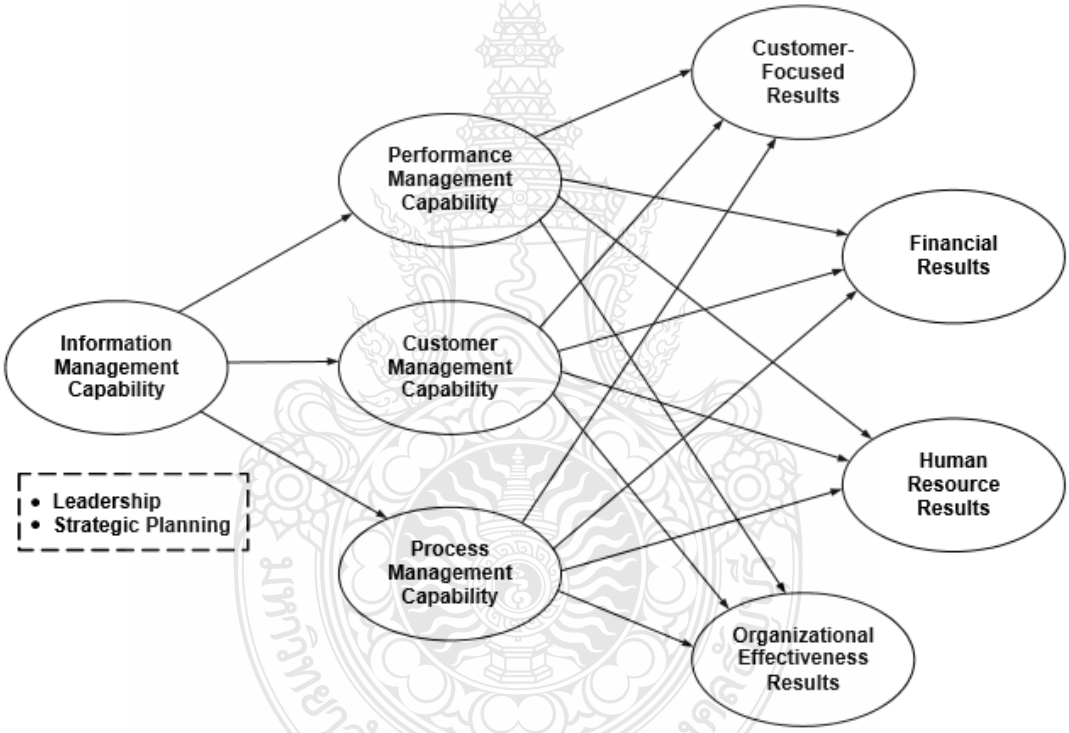

Figure 2.11 Research model by Mithas et al. (2011).

The Figure 2.11 showed the research on IT and firm performance. Mithas et al. (2011) studied on information management capability and firm performance. The research created on the business value of IT and quality management (QM) linking with information management capability and firm performance. The research proposed information management capability in three significant organizational capabilities: customer management capability, process management capability, and performance

management capability. The information management capability defined as the ability to provide data and information to users with the appropriate levels of accuracy, timeliness, reliability, security, confidentiality, connectivity, and success and the ability to tailor these in response to changing business needs and directions. Performance management capability defined as the ability to develop appropriate monitoring, evaluation, and control systems to observe business performance and guide managerial actions. Customer management capability defined as the ability to develop significant customer relationships and nurture customers both as consumers and innovation partners in new product development. Process management capability defined as the ability to develop processes with appropriate reach for guiding manufacturing, supply chain, software development, financial and other important activities.

The firm performance defined in the research as four elements. First, customer focused results defined as customer satisfaction, and product or service performance. Second, financial results defined as revenue, profits, market position, cash to cash cycle time, and earnings per share. Third, human resource results defined as employee satisfaction. Finally, organizational effectiveness results defined as time to market, level of innovation, and production and supply chain flexibility. The research results found that the three organizational capabilities had an influence on firm performance.

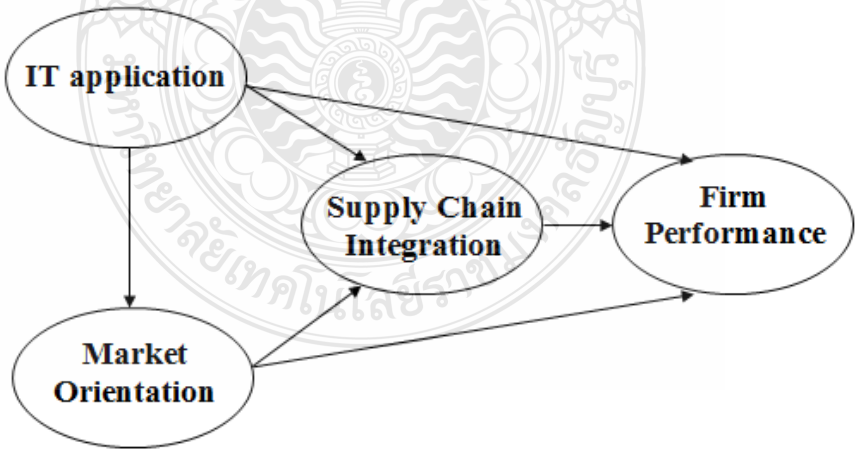

Figure 2.12 Research model by Tseng and Liao (2015).

Tseng and Liao (2015) studied on supply chain integration, information technology, market orientation and firm performance in container shipping firms. The research proposed the research model of IT application, market orientation, supply chain integration, and firm performance (see Figure 2.12). IT application defined as web site service, and technology adoption. The web databases application has been used for reviewing past transport records and performance and for preparing and predicting future container flow for supply chain partners. The purpose of IT application was to move messages and support with accurate information. Market orientation defined as information generation, information dissemination, and market responsiveness. The market orientation concept has known as the marketing concept. It defined as the organization wide generation of market intelligence pertaining to current and future customers' needs, dissemination of the intelligence across departments, and organization wide responsiveness to it. Supply chain integration defined as partner integration, internal integration, and customer integration. Supply chain has known as the connected of activities concerned with planning, coordination and controlling material, parts and finished goods from the raw materials stage to end users. This research defined firm performance as market performance, finance performance, and customer service.

The research adopted a resource-based view to investigate causal relationships between the supply chain integration, market orientation, information technology application and firm performance of container shipping firms in Taiwan. The data collected from 124 container shipping firms in Taiwan. The methodologies in this research were exploratory factor analysis, confirmatory factor analysis and structural equation modeling. There were seven findings of the study. First, the empirical results suggested that supply chain can improve with better supply chain integration. Second, the relationship between market orientation and firm performance was essential in order to achieve better market performance, finance performance, and customer service. Third, the relationship between IT application and firm performance found the differences in the business scales of respondents in the research. Fourth, the market orientation had positively impacted on supply chain orientation and supply chain management. It meant that highly market oriented firms usually attempt to collect

information related to the market environment and incorporate this information into decision making. Fifth, the relationship between IT application and supply chain found that significant benefits in container flow management existed when adopting technology services. Sixth, IT application positively affected on market orientation. This explained that adopt various web site services and information technology more easily understood customer preferences and adopt their service attributes to respond and changes in the market environment and customer needs. Finally, this research indicated that supply chain integration played a full mediating role in the relationship between IT application and firm performance.

In conclusion, the research found that IT application and market orientation positively influenced supply chain integration. It revealed that IT-based and market-oriented firms more easily integrate market information related to partners, departments and customers. Further, supply chain integration and market orientation positively affected on firm performance.

Han et al. (1998) studied on market orientation and organizational performance, and proposed the research model of market orientation, environmental conditions, organizational innovation and organizational performance (see Figure 2.13). Market orientation defined as a corporate culture, characterizes an organization's disposition to deliver superior value to the customers continuously. The creation of superior customer value allowed an organization wide commitment to continuous information gathering and coordination of customer needs, competitor's capabilities, and the provisions of other significant market agents and authorities. Organizational innovation referred to new product. Market orientation involved both improvement of product and facilitation of the administrative. Innovation defined as a broader scope and making the distinction between technology and administration related to innovation. In the framework, the investigating of market orientation affected to innovation.

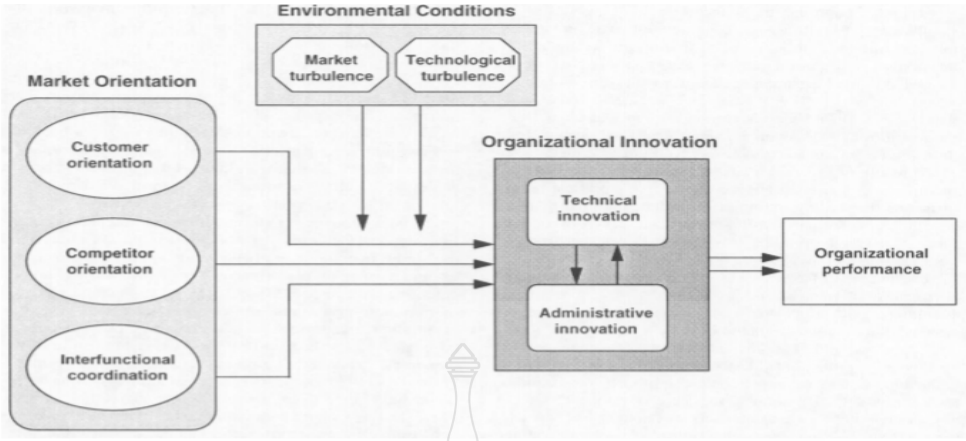

Figure 2.13 Research model by Han et al. (1998).

In this research, the market orientation consisted of customer orientation, competitor orientation, and inter-functional coordination. This research noted that innovation was an important management factor because it linked to business performance. Data collection was from banks in a mid-western state in USA. Innovation measured on technical and administrative innovation. The organizational performance measured by assessed on growth and profitability. This research found that market orientation facilitated and organization's innovativeness which positively influenced its business performance. The results indicated that all three components of market orientation were conducive to facilitating both technical and administrative innovations when level of technological turbulence in the business environment was relatively high.

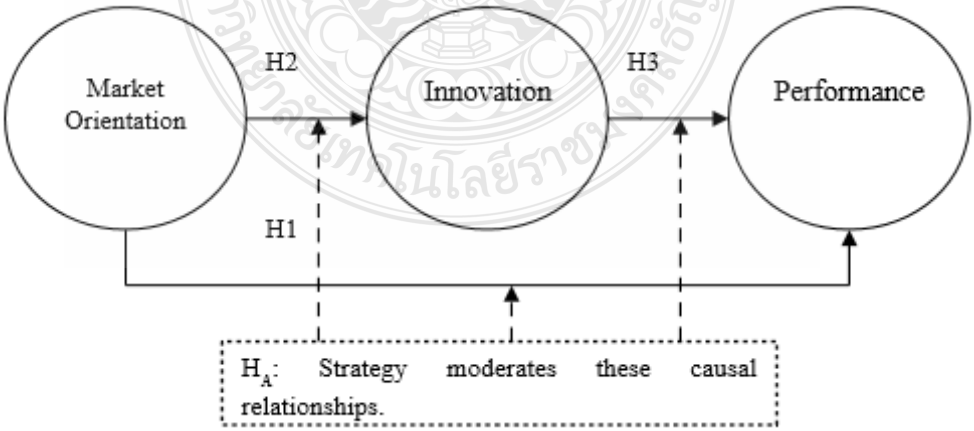

Figure 2.14 Research model by Cambra-Fierro et al. (2011).

Cambra-Fierro et al. (2011) studied on innovation and strategy affecting market orientation on firm performance. The research proposed the research model of market orientation, innovation and performance (see Figure 2.14). The research defined market orientation as three core dimensions. First, customer orientation referred to the understanding target customers in order to generate sustainable higher value for customer needs, desires and present or potential perceptions must be identified. Second, competitor orientation referred to the understanding and becoming familiar with the value alternatives in order to create the competitive advantage needed to assure long term market performance. Competitors must be identified and their strengths, weaknesses, and present or future actions and strategies analyzed. Third, inter-functional coordination provided for information flow effectively and reach responsible parties.

Data collection was from real estate sectors in Spain. The measurements of market orientation were on customer orientation, competitor orientation, and inter functional coordination. The innovation measured on the product types. This research opted customer satisfaction, customer loyalty, well-known branding, market share and economic profit as performance measurements. The research stated that market orientation can be considered to be an organizational resource according to the resource based view of the firm theory. This research found the effectively, relationships between market orientation, innovation and performance exist and moderated by the effect of strategy.

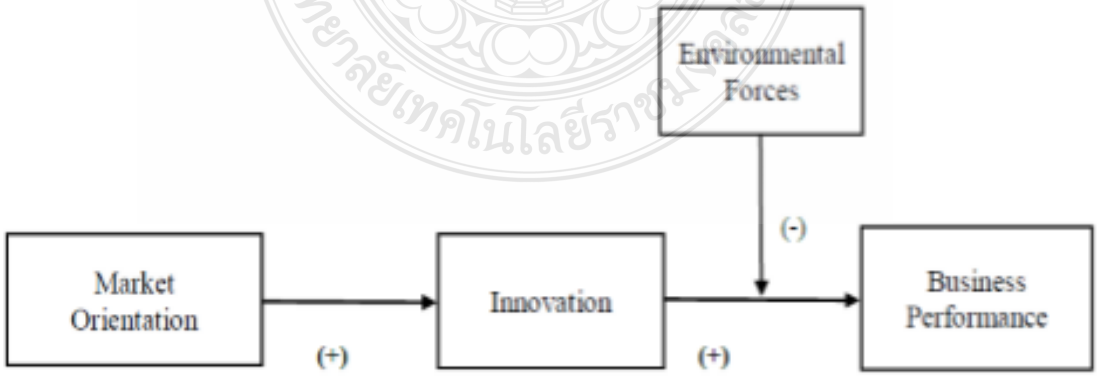

Figure 2.15 Research model by Lagat et al. (2015).

Lagat et al. (2015) studied on market orientation and firm performance in emerging markets. This research proposed the research model of market orientation, innovation and performance (see Figure 2.15). The survey was conducted with 147 managers from manufacturing firms throughout Kenya, and adopted product innovation as mediator variable. Firm performance measured by market share, percentage of new product sales to total sales, and ROI. The results indicated that market orientation positively affected innovation, innovation positively affected to performance, and various environmental forces negatively moderate the relationship between innovation and performance.

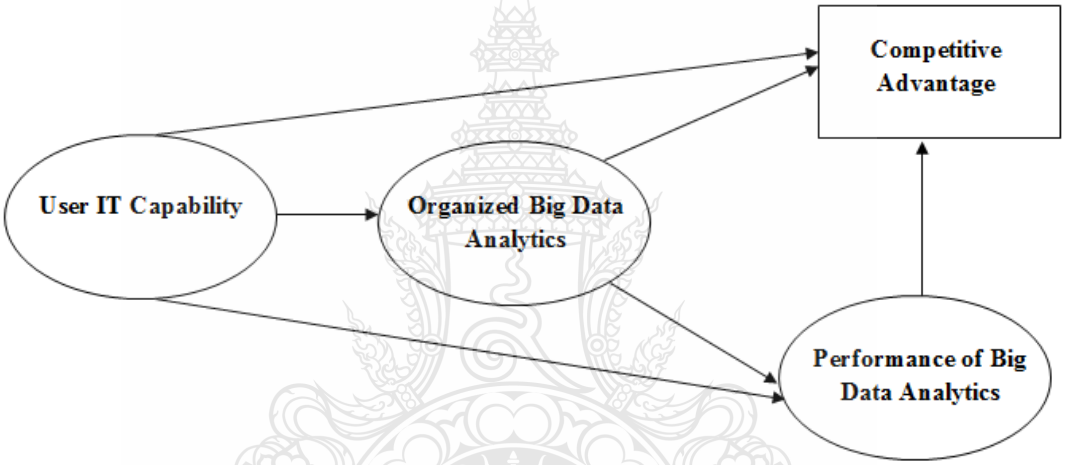

Figure 2.16 Research model by Kamioka, Hosoya, and Tapanainen (2017).

Kamioka et al. (2017) studied on the impact of user IT capability on big data analytics and firm performance (see Figure 2.16). IT capability has been a central topic for information system research. The IT capability focused mostly on the IT delivery side. The aspect of utilizing IT on the user side has not been a focal issue in either IT capability or user capability. Therefore, the research emphasized on user capability to utilize IT for business objectives.

The research investigated the impact of user IT capability on the performance of big data analytics and firm performance through the mediator of organized big data analytics by using survey data from 1,170 organizations in Japan. The findings found that the effect of user IT capability on the performance of big data analytics and firm competitiveness, mediated by the variable of organized big data analytics. The direct

effects showed valid irrespective of company size, although the levels of user IT capability, and organized big data analytics were higher in larger firms.

The studied from the above research found that IT capability could improve the performance of the organization. There were many components of IT capability, but this research focused on IT infrastructure capability, human IT resources, and IT-intangibles. In this research also brought data analytics to enhance the efficiency of the firm. At the same time, this study explored the relationship between market orientation and innovation that affected to the firm performance.

The differentiation of this study was the implementing of IT capability with data analytics and studied the relationship with market orientation and innovation affected to firm performance.

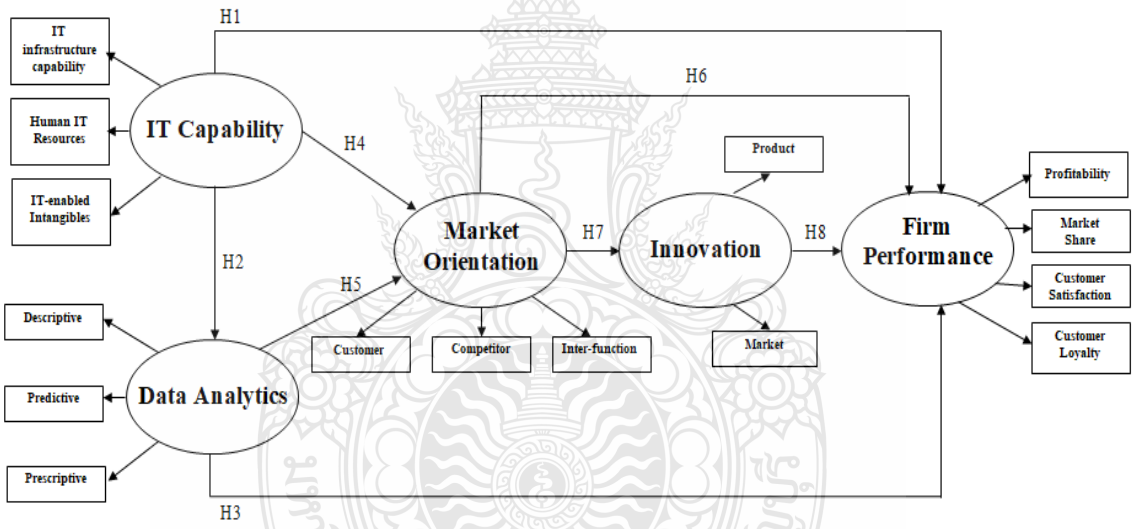

Figure 2.17 The proposed hypothesized structure model.

The prior research models as mentioned relevant to empirical studied and this research's objectives. The purposed conceptual framework of this paper showed in the Figure 2.17. IT capability and data analytics represented independent variables. Market orientation and innovation represented the mediator variables. Firm performance represented dependent variable.

IT capability variable consisted of IT infrastructure capability latent, human IT resources latent, and IT –enabled intangibles latent. Data analytics variable consisted of

descriptive latent, predictive latent, and prescriptive latent. Market orientation variable consisted of customer latent, competitor latent, and inter-function latent. Innovation variable consisted of new market latent and new product latent. Firm performance variable consisted of profitability latent, market share latent, customer satisfaction latent, and customer loyalty latent.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Introduction

The research methodology in this chapter presented research methodology that studies the effects of IT capability and data analytics on firm performance through market orientation and innovation. This chapter comprised of four parts which were research design, quantitative methodology, qualitative methodology and sequence of analysis.

3.2 Research Sample Appropriate to the Model

The statistic research model has been developed based on the propose research conceptual framework and hypotheses in chapter one (see Figure 3.1).

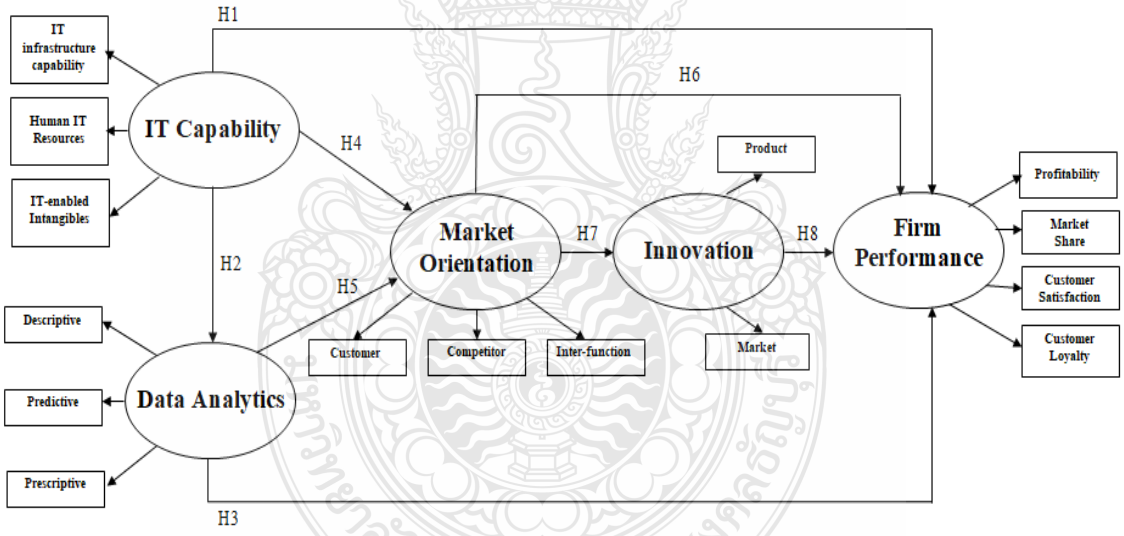

Figure 3.1 The proposed hypothesized structure model.

The structural equation modeling (SEM) technique has been used as statistical tools for the analysis of the data in this research. This model tested IT capability and data analytics affected to firm performance, while market orientation and innovation as mediator variables.

3.3 Research Design

This research mixed method research design between quantitative and qualitative methodology. The quantitative research was a cross-sectional, mail survey methodology. The questionnaire was an instrument for data survey. While, the qualitative research involved in-depth individual interviews with executives or IT leaders. The results of quantitative research included in the interview.

3.3.1 Quantitative Methodology

This method involved collecting, analyzing and integrating of the quantitative data. This research used a cross-sectional, mail survey methodology and a questionnaire as tools for data survey.

1) Determining Sample Size

This research aimed to study on manufacturing industry in Thailand which were electronics, electrical, machinery, automotive and consumer products manufacturing. The business firms listed in the Department of Business Development, Ministry of Commerce of Thailand were the research population. The sample size was calculated according to the rules of structural equation model (SEM). Bentler and Chou (1987) and Kline (2015) recommended the sample size 10 times as many cases as parameters (or ideally 20 times). The 5 times or less was insufficient for significance testing of model effects. Mitchell (1993) also claimed that in general a model should contained 10 to 20 times as many observations as variables. However, Hoyle (1995) suggested that to have confidence in the goodness of fit test, a sample size of 100 to 200 was recommended. The free parameter from the conceptual model was 23, thus the study targeted the initial sample size to be 230 samples from manufacturing in Thailand. The distribution of sampling from each group was on weighted proportional basis.

The total numbers of industry was 1,927 companies. The population and distribution of sample size was showed in table 3.1.

Table 3.1 The population and distribution of sample size.

Type of Businesses	Population (N)	Sample (n)
Electronics manufacturing	233	27
Electrical manufacturing	288	34
Machinery manufacturing	432	52
Automotive manufacturing	524	63
Consumer products	450	54
Total	**1,927**	**230**

2) Research Instrument

This questionnaire was a research instrument in this research. Questionnaire consisted of check-list questions with 7 points Likert scale, and personal details of respondents. The check-list questions divided into 5 sections as follows.

Section 1: The first part of the questionnaire was the questions about the IT capability. This part used check-list questions. Questions were as follows: Your business has a policy to develop an IT's infrastructure for business competition. Your business has modern IT innovation that can create a competitive advantage. Your business is constantly developing and training information technology staff. Your business is focused on having a person skilled in information technology. Your employees can improve their skills and experience to adapt to better performance. Your business is able to respond to changes in customer demand.

Section 2: The second part of the questionnaire was the questions about data analytics. This part also used check-list questions. Questions were as follows: Your business is focused on performance reporting. Your business is focused on the results of the performance reporting. Your business analyzes the risks that will occur in the future. Your business has forecasts and valid reasons for future events. Your business always develops and optimizes the original data and results. Your business has the choice of making business decisions and conducting business.

Section 3: In the third part, the questionnaire was on the market orientation. The questions were as follows: Your business is highly committed for satisfying necessities of customers. Your business surveys customer needs. Your business responds rapidly to competitor's action. The management of your business is adjusting its policies to match the competitor's strategy. Employees have the ability to access the information they use in their own departments and other departments. Your business unit is coordinated by the business strategy.

Section 4: This part of the questionnaire was about innovation. This part also used check-list questions. Questions were as follows: Your business has policy to launch newness products. Your business produces new product every year. Your business produces uniqueness product every year. Your business has a policy of promoting the marketing. Your business has market research, advertising and promotion activities. Your business finds new market opportunities and entry to the new markets.

Section 5: This part of the questionnaire was the questions about firm performance. This part also used check-list questions. Questions were as follows: Your business has a good financial performance. Your business is profitable over the past 3 years. Your business has a high market share over the past 3 years. Your company has a better competitive position than those of your competitors in the same industry. The level of customer satisfaction for your products. The level of customer satisfaction for your business. Customer retention's rate in your business. Your business is constantly communicating with customers on a regular basis.

All these questions used 7 points Likert scale (1 = the least agreement, 2 = less agreement, 3 = rather less agreement, 4 = neutral agreement, 5 = rather much agreement, 6 = much agreement, and 7 = the most agreement)

The last part of the questionnaire was the questions about the demographic information of respondents.

3) Measurement Variables

This research used the 7 point Likert scale. The 7 point Likert scale were as follows:

The most agreement	7 points
Much agreement	6 points

Rather much agreement	5 points
Neutral agreement	4 points
Rather less agreement	3 points
Less agreement	2 points
The least agreement	1 point

The scale levels of firm gave agreement that calculated from 7 - 1/7 = 0.85.

1.00 - 1.85 = The least agreement

1.86 – 2.70 = Less agreement

2.71 – 3.55 = Rather less agreement

3.56 – 4.40 = Neutral agreement

4.41 – 5.25 = Rather much agreement

5.26 – 6.10 = Much agreement

6.11 – 7.00 = The most agreement

The measurement of the agreement levels of IT capability measured from three variables which were IT infrastructure, human IT resource, and IT-enabled intangibles. The details and definition of each variable presented in table 3.2.

Table 3.2 Definition and measurement of independent variable (IT capability).

Variable	**Definition**	**Measurement**
IT infrastructure	Business resources for attaining long-term competitive advantage.	- Interval scale - 7 point Likert scale
Human IT resource	The technical and managerial IT skills.	- Interval scale - 7 point Likert scale
IT-enabled intangibles	Know-how, corporate culture, corporate reputation, and environmental orientation.	- Interval scale - 7 point Likert scale

The measurement of the agreement levels of data analytics measured from three variables which were descriptive analytics, predictive analytics, and prescriptive analytics. The details and definition of each variable presented in table 3.3.

Table 3.3 Definition and measurement of independent variable (data analytics).

Variable	**Definition**	**Measurement**
Descriptive analytics	Data-driven model called business reporting.	- Interval scale - 7 point Likert scale
Predictive analytics	Attempts to predict the future by analyzing current and historical data.	- Interval scale - 7 point Likert scale
Prescriptive analytics	Addressing the question of what should be.	- Interval scale - 7 point Likert scale

The measurement of the agreement levels of market orientation measured from three variables which were customer orientation, competitor orientation, and inter-functional coordination. The details and definition of each variable presented in table 3.4

Table 3.4 Definition and measurement of mediator variable (market orientation).

Variable	**Definition**	**Measurement**
Customer orientation	The understanding of sellers to buyers' value chain.	- Interval scale - 7 point Likert scale
Competitor orientation	The understanding of sellers to competitors.	- Interval scale - 7 point Likert scale
Inter-functional coordination	Coordinated utilization of company resources.	- Interval scale - 7 point Likert scale

The measurement of the agreement levels of innovation measured from two variables which were product innovation, and market innovation. The details and definition of each variable presented in table 3.5

Table 3.5 Definition and measurement of mediator variable (innovation).

Variable	Definition	Measurement
Product innovation	Perceived new, novelty, originality, or uniqueness of products.	- Interval scale - 7 point Likert scale
Market innovation	Related to market research, advertising and promotion.	- Interval scale - 7 point Likert scale

The measurement of the agreement levels of firm performance measured from four variables which were profitability, market share, customer satisfaction, and customer loyalty. The details and definition of each variable presented in table 3.6.

Table 3.6 Definition and measurement of dependent variable (firm performance).

Variable	Definition	Measurement
Profitability	Yielding a financial gain of the firm, considered by pricing to earnings.	- Interval scale - 7 point Likert scale
Market share	Sales volume of the firm's products in the market, measured in percentage of the total market .	- Interval scale - 7 point Likert scale
Customer satisfaction	The attribute of product versus cost paid for in term of satisfaction from the products and services provided.	- Interval scale - 7 point Likert scale

Table 3.6 Definition and measurement of dependent variable (firm performance) (Cont.)

Variable	Definition	Measurement
Customer loyalty	Customers retain on the products and services.	- Interval scale - 7 point Likert scale

3.3.2 Qualitative Methodology

The qualitative methodology provided the details of explanation and descriptions of the procedures, situation, communications, experiences and knowledge related to the questions raised in the study. Qualitative methodology has defined into three different level of data collection which were individual surveys, individual interviews, and expert panel interview. All of these level encouraged a deep level of responses in an open-ended environment in the data collection process (Hopp, 2005).

The individual interview considered one of the most powerful means for obtaining crucial research data, and also was an effective tool to learn about expert opinions, and explore reaction on important events. Hopp (2005) claimed that interviews challenging and rewarding forms of measurement as they provided the detailed of explanation and descriptions of the procedures, situation, communications, experiences and knowledge related to the questions raised in the study. Therefore, the qualitative methodology in this research has done through the in-depth interview with executives or IT leaders to confirm the results of quantitative methodology.

1) Population and Sample

The qualitative methodology population was the same as the quantitative methodology. This step defined the amount of research sample.

2) Research Instrument

The in-depth interview was basically the face to face conversation with executives or IT leaders. It was the open-ended questions. Therefore, the answers may be out of control. The answers phrased by the statement responses.

The following were the questions process of the in-depth interview which consisted as follows:

1) The agreement of participation

2) The company introduction

3) IT capability and data analytics questions

4) Market orientation and innovation in the company questions

5) Competitiveness and firm performance in the business environment questions

6) Open questions

7) Gratefulness

3.4 Validity and Reliability

Content validity testing conducted by assessing through questionnaire. The questionnaire reviewed and assessed by five experts, consisted of three scholars and two professionals from business sector based on the Index of Item-Objective Congruence (IOC) method. The results from the evaluation used to adjust and improved for the accuracy and validity of the questionnaire.

The Index of Item-Objective Congruence (IOC) used to evaluate the congruence between the test items and the objectives. The criteria were as follows:

$$IOC = \frac{\sum R}{N}$$

Where :

R = Expert's opinion which:

+1= the question is congruent with the objectives

0 = the question is uncertain to be congruent with the objectives

-1 = means the question is not congruent with the objectives

N = Number of experts

The questions that obtain the IOC between 0.5 – 1.0 were deemed acceptable. The assessment of the reliability of the variables used in the model was carried out through the analysis of Cronbach's alpha. Cronbach's alpha measured internal consistency and analyzed whether how closely a set of items used in the model related to each other (Cronbach, 1951). The theoretical value of the alpha ranges from zero to one, of which the higher value indicates better survey quality therefore more reliable. It suggested that Cronbach's alpha coefficient of 0.7 or higher considered acceptable (Carman, 2000).

3.5 Sequence of Analysis

This research used both methodologies which were quantitative and qualitative research. The sequence of analysis presented as follows:

1. Quantitative research

1.1 Survey pretesting

1) Content validity testing

- IOC (Index of Item-Objective Congruence)

2) Reliability testing, 30 tryout sampling

- Cronbach's alpha testing

3) Redesigning of the questionnaire if required

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

1.2 Statistics Analysis

1) Descriptive Statistic Analysis

- Mean, Frequency

2) Reliability testing

- Cronbach's alpha testing

3) Validity testing

- Confirm Factor Analysis (Convergent validity)
- SEM Method (Discriminate validity)

4) Multicollinearity Testing

- Testing non-relationship between variables
- The variance of inflation factor (VIF) value lower than 10

5) Structural Equation Modeling

5.1) Development of the model

5.2) Analysis of the model

5.3) Measure of fit

- Consider the Chi-square (x^2) test, x^2/df, degree of freedom, *p*-value, RMSEA, GFI
- If the model does not fit, modify the indices and re-analyze the model

5.4) If the model fits

-Analysis of the regression weight, p-value

-Analysis of direct/indirect relationship

6) Quantitative research reporting

2. Qualitative research

1) Individual interview

-Description content analysis

-Propose of the working hypotheses

2) Iteration of the interview

-Description content analysis

-Repeat until the working hypotheses are justified

3) Qualitative research reporting

3. Analysis of both quantitative research and qualitative research

4. Conclusion

CHAPTER 4
RESEARCH RESULTS

4.1 Introduction

This chapter presented the findings of research questions and hypotheses through statistical analysis from the data collected from respondents in the manufacturing industry in Thailand. This chapter organized into three sections. The first section covered instrument validation and pretesting. The second section discussed on quantitative results. This section presented response rate, demographics summary, descriptive statistics, the structural equation model which covered reliability testing, multicollinearity testing, construct validity testing, and discriminant validity testing. Construct research model and hypotheses testing also discussed in this section. The last section presented the qualitative results.

4.2 Instrument Validation and Pretesting

The questionnaire tested in term of content validity and reliability before data collecting for research sample.

4.2.1 Content Validity

The validation of the measurement on content validity evaluated by five experts consisted of three scholars which were Assistant Professor Dr. Staporn Tavornativarn, Assistant Professor Dr. Amnat Swantnatee, and Dr. Jakraphun Srisawat. There were two experts from business sectors which were Ms. Suchitra Worayoskovit (Senior Manager-IT, Li and Fung (Thailand) Ltd.) and Dr. Narongchai Kitrangsikul (Managing Director, Viktor Imex Co., Ltd.). The assessment used IOC (Index of Item-Objective Congruence) method to score each questions to be in accordance with theory, research objective, and accurate meaning. The testing results of Index of Item-Objective Congruence presented in table 4.1.

Table 4.1 Index of Item-Objective Congruence (IOC).

Variable	Latent	Experts' Responses					Total	Average
		1	2	3	4	5		
IT Infrastructure	ITC1_1	1	1	1	1	1	1	0.87
	ITC1_2	1	1	1	1	1	1	
Human IT Resource	ITC2_1	1	1	1	1	1	1	
	ITC2_1	1	1	1	1	1	1	
IT-enabled Intangible	ITC3_1	1	0	0	1	0	0.40	
	ITC3_2	0	1	1	1	1	0.80	
Descriptive Analytics	DTA1_1	0	1	1	1	1	0.80	0.87
	DTA1_2	1	1	1	1	1	1	
Predictive Analytics	DTA2_1	1	1	1	1	1	1	
	DTA2_2	1	1	1	0	0	0.60	
Prescriptive Analytics	DTA3_1	1	1	0	1	1	0.80	
	DTA3_2	1	1	1	1	1	1	
Customer Orientation	MKO1_1	0	1	1	1	1	0.80	0.87
	MKO1_2	1	1	1	1	1	1	
Competitor Orientation	MKO2_1	1	1	1	1	1	1	
	MKO2_2	1	1	1	1	1	1	
Inter-functional Coordination	MKO3_1	0	0	1	1	1	0.60	
	MKO3_2	0	1	0	1	1	0.80	
Product Innovation	INN1_1	0	1	1	1	1	0.80	0.87
	INN1_2	1	1	1	0	1	0.80	
	INN1_3	1	1	1	1	1	1	
Market Innovation	INN2_1	1	1	1	0	1	0.80	
	INN2_2	1	1	1	1	1	1	
	INN2_3	1	1	0	1	1	0.80	
Profitability	FPM1_1	1	1	1	1	1	1	0.90
	FPM1_2	0	1	1	1	1	0.80	
Market Share	FPM2_1	1	1	1	1	1	1	
	FPM2_2	1	1	1	1	1	1	
Customer Satisfaction	FPM3_1	0	1	1	1	1	0.80	
	FPM3_2	0	1	1	1	1	0.80	
Customer Loyalty	FPM4_1	1	1	1	1	1	1	
	FPM4_2	1	0	1	1	1	0.80	
Total IOC Average								0.88

After testing all questions, the result of the IOC score was 0.88 which accepted in the term of the content validity. However, some questions modified based on expertise's suggestions.

4.2.2 Reliability Testing (Trying Out)

The reliability was a measurement of consistency of the responses given by respondents. The questionnaires sent out to 30 samples. When questionnaires completed and returned, data testing analyzed by Cronbach's alpha method to assess reliability. The reliability coefficients presented in table 4.2

Table 4.2 Reliability statistic (Trying out).

Questions	Cronbach's Alpha
Part 1 : IT Capability (ITC)	
IT Infrastructure	.967
Human IT Resource	.967
IT-enabled Intangible	.964
Part 2 : Data Analytics (DTA)	
Descriptive Analytics	.965
Predictive Analytics	.964
Prescriptive Analytics	.967
Part 3: Market Orientation (MKO)	
Customer Orientation	.965
Competitor Orientation	.963
Inter-functional Coordination	.963
Part 4: Innovation (INN)	
Product Innovation	.964
Market Innovation	.965
Part 5: Firm Performance (FPM)	
Profitability	.964
Market Share	.965
Customer Satisfaction	.964
Customer Loyalty	.964

Table 4.2 showed Cronbach's Alpha's scores which higher than 0.9. The value at 0.70 or higher considered reliable. Therefore, the results indicated that the questionnaire for this research was reliability.

4.3 Quantitative Results

4.3.1 Response Rate

In order to prevent the low returns of the questionnaires, the researcher sent out 1,300 questionnaires by mailed to the relevant manufacturing firms which indicated in chapter three. The total returns of questionnaires were 230 firms and the response rate was 17.70%. The most returned was 24.3% from automotive manufacturing. The least returned rated was 5.7% from machinery manufacturing. The details of returns questionnaires were showed in the table 4.3.

Table 4.3 Firm respondent.

Type of Businesses	Sample Size	Sent Mail	Returned	Percentage of return
Electronics manufacturing	27	152	32	21.1%
Electrical manufacturing	34	192	38	19.8%
Machinery manufacturing	52	294	17	5.7%
Automotive manufacturing	63	357	87	24.3%
Consumer products	54	305	56	18.4%
Total	230	1,300	230	17.7%

4.3.2 Demographic Data

The questionnaires were sent out to respondents who were executives or IT leaders. The demographic data of the questionnaire consisted of the demographic data of the company and the demographic data of the answerer which showed in table 4.4 and table 4.5.

Table 4.4 Demographic summary of company.

Demographic	Frequency	Respondent percentage
Registered Capital (Million Baht)		
Less than 10 million	6	2.6%
10-50 million	42	18.2%
51-100 million	72	31.4%
More than 100 million	110	47.8%
Number of employees		
Less than 100	41	17.8%
100-500	119	51.7%
501-1,000	42	18.3%
More than 1,000	28	12.2%

Table 4.5 Demographic summary of answerer.

Demographic	Frequency	Respondent percentage
Educational qualification		
Vocational/Technical, High school and lower	8	3.4%
Undergraduate	163	70.9%
Postgraduate	59	25.7%
Working experiences		
1-5	48	20.8%
6-10	52	22.7%
11-15	47	20.4%
More than 15	83	36.1%
Position and responsibility		
Executives	21	9.2%
Department manager	70	30.4%
Division supervisor	95	41.3%
Others	44	19.2%

Registered capital (million baht)

The results showed that the respondents' firms which registered capital (million baht) more than 100 million was 47.8%, between 51 – 100 million was 31.4%, between 10 – 50 million was 18.2%, and less than 10 million was 2.6%.

Number of employees

The results showed that the respondents' firms which employees between 100 – 500 employees was 51.7%, employees between 501 – 1,000 employees was 18.3%, employees less than 100 employees was 17.8%, and employees more than 1,000 employees was 12.2%.

Educational qualification

The majority of educational qualification of respondents was undergraduate level (70.9%), following by postgraduate (25.7%).

Working experiences

The results showed that respondents who worked for more than 15 years was 36.1%, who worked between six to ten years was 22.7%, who worked between one to five years was 20.8%, and who worked between eleven to fifteen years was 20.4%.

Position and responsibility

Division supervisor (41.3%) was the majority of the position and responsibility of respondents, followed by department manager (30.4%).

4.3.3 Descriptive Statistics

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

4.3.3.1 IT Capability

The IT capability was the independent variable with three observed variables which were IT infrastructure, human IT resource, and IT-enabled intangible. The statistical results of the minimum, maximum, mean, and standard deviation presented in table 4.6.

Table 4.6 Descriptive statistics for IT capability.

Variable	Min	Max	Mean	Std. Deviation
IT Infrastructure				
ITC1_1	1	7	4.8696	1.45693
ITC1_2	1	7	4.5087	1.39162
Human IT Resource				
ITC2_1	1	7	4.1043	1.47393
ITC2_2	1	7	4.4957	1.45904
IT-enabled Intangible				
ITC3_1	1	7	4.6957	1.19075
ITC3_2	2	7	5.1652	1.26028

The item with the highest mean value was ITC3_2 respond to change in customer demand (M=5.1652, SD=1.26028) on IT-enabled intangible variable. The item with the lowest mean value was ITC2_1 developing and training information technology staff (M=4.1043, SD=1.47393) on human IT resource variable.

4.3.3.2 Data Analytics

The data analytics was the independent variable with three observed variables which were descriptive analytics, predictive analytics, and prescriptive analytics. The statistical results of the minimum, maximum, mean, and standard deviation presented in table 4.7.

Table 4.7 Descriptive statistics for data analytics.

Variable	Min	Max	Mean	Std. Deviation
Descriptive Analytics				
DTA1_1	1	7	5.2913	1.27365
DTA1_2	2	7	5.3609	1.19505
Predictive Analytics				
DTA2_1	1	7	4.9000	1.34570
DTA2_2	1	7	4.8826	1.22176
Prescriptive Analytics				
DTA3_1	1	7	4.9870	1.23797
DTA3_2	1	7	4.9478	1.21377

The item with the highest mean value was DTA1_2 focused on the results of the performance reporting (M=5.2913, SD=1.19505) on descriptive analytics variable. The item with the lowest mean value was DTA2_2 has forecasts and valid reasons for future events (M=4.8826, SD=1.22176) on predictive analytics variable.

4.3.3.3 Market Orientation

The market orientation was the mediating variable with three observed variables which were customer orientation, competitor orientation, and inter-functional coordination. The statistical results of the minimum, maximum, mean, and standard deviation presented in table 4.8.

Table 4.8 Descriptive statistics for market orientation.

Variable	Min	Max	Mean	Std. Deviation
Customer Orientation				
MKO1_1	1	7	5.9913	1.23977
MKO1_2	1	7	5.4783	1.34682
Competitor Orientation				
MKO2_1	1	7	5.1652	1.24984
MKO2_2	1	7	5.2826	1.28924
Inter-functional Coordination				
MKO3_1	1	7	4.9739	1.30140
MKO3_2	1	7	5.1043	1.12823

The item with the highest mean value was MKO1_1 highly committed for satisfying necessities of customers (M=5.9913, SD=1.23977) on customer orientation variable. The item with the lowest mean value was MKO3_1 the ability to access the information (M=4.9739, SD=1.30140) on inter-functional coordination variable.

4.3.3.4 Innovation

The innovation was the mediating variable with two observed variables which were product innovation, and market innovation. The statistical results of the minimum, maximum, mean, and standard deviation presented in table 4.9.

Table 4.9 Descriptive statistics for innovation.

Variable	Min	Max	Mean	Std. Deviation
Product Innovation				
INN1_1	1	7	4.5130	1.47091
INN1_2	1	7	4.5848	1.61221
INN1_3	1	7	5.0174	1.54966
Market Innovation				
INN2_1	1	7	4.6565	1.54109
INN2_2	1	7	4.1609	1.65739
INN2_3	1	7	4.8957	1.47984

The item with the highest mean value was INN1_3 produces uniqueness product (M=5.0174, SD=1.54966) on product innovation variable. The item with the lowest mean value was INN2_2 market research, advertising and promotion activities (M=4.1609, SD=1.65739) on market innovation variable.

4.3.3.4 Firm Performance

The firm performance was the dependent variable with four observed variables which were profitability, market share, customer satisfaction, and customer loyalty. The statistical results of the minimum, maximum, mean, and standard deviation presented in table 4.10.

Table 4.10 Descriptive statistics for firm performance.

Variable	**Min**	**Max**	**Mean**	**Std. Deviation**
Profitability				
FPM1_1	1	7	4.8174	1.29886
FPM1_2	1	7	4.4739	1.35965
Market Share				
FPM2_1	1	7	4.4304	1.29895
FPM2_2	1	7	4.6130	1.33243
Customer Satisfaction				
FPM3_1	2	7	5.3261	1.05015
FPM3_2	2	7	5.3174	1.08146

Table 4.10 Descriptive statistics for firm performance. (Cont.)

Variable	Min	Max	Mean	Std. Deviation
Customer Loyalty				
FPM4_1	2	7	5.4348	1.13022
FPM4_2	2	7	5.3957	1.17655

The item with the highest mean value was FPM4_1 customer retention's rate (M=5.4348, SD=1.13022) on customer loyalty variable. The item with the lowest mean value was FPM2_1 high market share over the past three years (M=4.4304, SD=1.29895) on market share variable.

4.3.4 Structural Equation Model

AMOS software for structural equation modeling, path analysis, and confirmatory factor analysis has been used in this research. The software provided visual and graphical features for model drawing and analyzing with quick computation for structural equation modelling (SEM) analysis.

4.3.4.1 Reliability Testing

Reliability testing was one of the requirements of structural equation model to observe the reliability of variables. The accepting of the reliability result was the Cronbach's alpha should be above 0.7. The results of Cronbach's alpha coefficient analysis as shown in table 4.11.

Table 4.11 Reliability statistics.

Variable	Item	Cronbach's Alpha Coefficient	Mean	SD
ITC	ITC1_1	0.967	4.8696	1.45693
	ITC1_2	0.967	4.5087	1.39162
	ITC2_1	0.967	4.1043	1.47393
	ITC2_2	0.967	4.4957	1.45904
	ITC3_1	0.967	4.6957	1.19075
	ITC3_2	0.967	5.1652	1.26028

Table 4.11 Reliability statistics. (Cont.)

Variable	Item	Cronbach's Alpha Coefficient	Mean	SD
DTA	DTA1_1	0.967	5.2913	1.27365
	DTA1_2	0.967	5.3609	1.19505
	DTA2_1	0.966	4.9000	1.34570
	DTA2_2	0.966	4.8826	1.22176
	DTA3_1	0.966	4.9870	1.23797
	DTA3_2	0.966	4.9478	1.21377
MKO	MKO1_1	0.967	5.9913	1.23977
	MKO1_2	0.967	5.4783	1.34682
	MKO2_1	0.966	5.1652	1.24984
	MKO2_2	0.966	5.2826	1.28924
	MKO3_1	0.967	4.9739	1.30140
	MKO3_2	0.966	5.1043	1.12823
INN	INN1_1	0.967	4.5130	1.47091
	INN1_2	0.967	4.5848	1.61221
	INN1_3	0.967	5.0174	1.54966
	INN2_1	0.967	4.6565	1.54109
	INN2_2	0.967	4.1609	1.65739
	INN2_3	0.967	4.8957	1.47984
FPM	FPM1_1	0.967	4.8174	1.29886
	FPM1_2	0.967	4.4739	1.35965
	FPM2_1	0.967	4.4304	1.29895
	FPM2_2	0.967	4.6130	1.33243
	FPM3_1	0.967	5.3261	1.05015
	FPM3_2	0.967	5.3174	1.08146
	FPM4_1	0.967	5.4348	1.13022
	FPM4_2	0.967	5.3957	1.17655

Note: ITC=IT capability DTA=data analytics MKO=market orientation INN=innovation FPM=firm performance

The Cronbach's alpha coefficient results for all the items used in the model ranged from 0.966 - 0.967, the mean values ranged from 4.1043 - 5.9913, and the standard deviation ranged from 1.05015 - 1.65739.

IT capability (ITC) variable consisted of six items which the overall Cronbach's alpha coefficient was 0.967, mean values ranged from 4.1043 – 5.1652, and standard deviation ranged from 1.19067 – 1.47393. This meant that the reliability of this variable was acceptable.

Data analytics (DTA) variable consisted of six items which the overall Cronbach's alpha coefficient was 0.966, mean values ranged from 4.8826 - 5.3609, and standard deviation ranged from 1.19505 - 1.27365. This meant that the reliability of this variable was acceptable.

Market orientation (MKO) consisted of six items which the overall Cronbach's alpha coefficient was 0.967, mean values ranged from 4.9739 - 5.9963, and standard deviation ranged from 1.12823 - 1.34682. This meant that the reliability of this variable was acceptable.

Innovation (INN) variable consisted of six items which the overall Cronbach's alpha coefficient was 0.967, mean values ranged from 4.1609 - 5.0174, and standard deviation ranged from 1.47091 - 1.65739. This meant that the reliability of this variable was acceptable.

Firm performance (FPM) variable consisted of eight items which the overall Cronbach's alpha coefficient was 0.967, mean values ranged from 4.4304 - 5.4348, and standard deviation ranged from 1.05015 -1.35965. This meant that the reliability of this variable was acceptable.

The total reliability statistics was 0.968 for 32 items. The Cronbach's alpha coefficient was above 0.7, indicated reliability and accepted for the analysis.

4.3.4.2 Multicollinearity Testing

The testing of multi-collinearity was an analysis for the non-relationship between variables. The tolerance must be more than 0.1 and the value of Variance Inflation Factor (VIF) must be lower than 10 (Hair, Black, Babin, Anderson, & Tatham, 1998). The analyzed tolerance values ranged from 0.118 - 0.449 and VIF values ranged from 2.229 – 8.452, indicated that there were no multicollinearity among variables. The

analyzed values were showed in table 4.12. The rest of multicollinearity of other variables showed in appendix B.

Table 4.12 Multicollinearity statistics testing with ITC1_1.

Construct	**Items**	**Collinearity Statistics**	
		Tolerance	**VIF**
ITC	ITC1_2	0.340	2.942
	ITC2_1	0.318	3.146
	ITC2_2	0.262	3.183
	ITC3_1	0.273	3.660
	ITC3_2	0.285	3.507
DTA	DTA1_1	0.167	5.974
	DTA1_2	0.148	6.736
	DTA2_1	0.168	5.962
	DTA2_2	0.167	6.001
	DTA3_1	0.151	6.601
	DTA3_2	0.172	5.805
MKO	MKO1_1	0.295	3.389
	MKO1_2	0.271	3.689
	MKO2_1	0.180	5.549
	MKO2_2	0.188	5.315
	MKO3_1	0.449	2.229
	MKO3_2	0.253	3.957
INN	INN1_1	0.379	2.637
	INN1_2	0.326	3.063
	INN1_3	0.361	2.767
	INN2_1	0.219	4.562
	INN2_2	0.228	4.390
	INN2_3	0.314	3.190
FPM	FPM1_1	0.287	3.482
	FPM1_2	0.233	4.290
	FPM2_1	0.196	5.100
	FPM2_2	0.226	4.428
	FPM3_1	0.137	7.306

Table 4.12 Multicollinearity statistics testing with ITC1_1. (Cont.)

Construct	Items	Collinearity Statistics	
		Tolerance	VIF
	FPM3_2	0.118	8.452
	FPM4_1	0.234	4.282
	FPM4_2	0.232	4.309

Note: ITC=IT capability DTA=data analytics MKO=market orientation INN=innovation FPM=firm performance

4.3.4.3 Construct Validity Testing

The construct validity consisted of convergent validity testing and discriminant validity testing. The convergent validity testing and discriminant performed to verify indicators those represented latent variable. While, the discriminant validity testing performed the observed variable those represented the same latent variable which did not associate with the observed variable of the other latent variables.

The evaluation of convergent validity was done through CFA. The observed variable considered a good representative of the construct with the factor loading value was higher than 0.6. Further, all average variance extracted (AVE) of all variables should be higher than 0.5, and the composite reliability (CR) of all variables should be higher than 0.6.

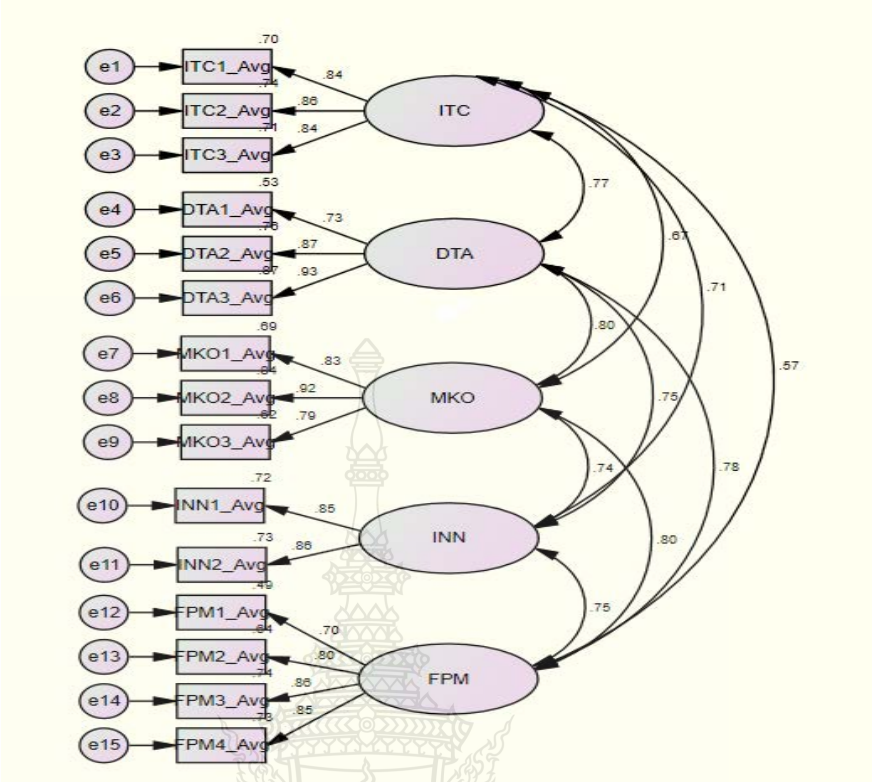

Figure 4.1 Factor loading.

Table 4.13 Factor loading, R^2, Composite Reliability, Average Variance Extracted of Independent Variable (ITC).

Variables	**Factor loading**	R^2	**Composite Reliability**	**AVE**
ITC			0.884	0.717
ITC1_Avg	0.84	0.70		
ITC2_Avg	0.86	0.74		
ITC3_Avg	0.84	0.71		

Note: ITC=IT capability

ITC variable had factor loading values ranged from 0.84 to 0.86, which were all higher than 0.6, and the R^2 values ranged from 0.70 to 0.74 which were within the acceptable range. Composite reliability at 0.884 indicated the acceptability of construct reliability. The acceptable AVE value must be higher 0.5. The AVE from the model was 0.717 also indicated acceptability of the construct reliability.

Table 4.14 Factor loading, R^2, Composite Reliability, Average Variance Extracted of Independent Variable (DTA).

Variables	Factor loading	R^2	Composite Reliability	AVE
DTA			0.883	0.718
DTA1_Avg	0.73	0.53		
DTA2_Avg	0.87	0.76		
DTA3_Avg	0.93	0.87		

Note: DTA=data analytics

DTA variable had factor loading values ranged from 0.73 to 0.93, which were all higher than 0.6, and the R^2 values ranged from 0.53 to 0.87 which were within the acceptable range. Composite reliability at 0.883 indicated the acceptability of construct reliability. The acceptable AVE value must be higher 0.5. The AVE from the model was 0.718 also indicated acceptability of the construct reliability.

Table 4.15 Factor loading, R^2, Composite Reliability, Average Variance Extracted of Mediating Variable (MKO).

Variables	Factor loading	R^2	Composite Reliability	AVE
MKO			0.885	0.720
MKO1_Avg	0.83	0.69		
MKO2_Avg	0.92	0.84		
MKO3_Avg	0.79	0.82		

Note: MKO=market orientation

MKO variable had factor loading values ranged from 0.83 to 0.92, which were all higher than 0.6, and the R^2 values ranged from 0.69 to 0.84 which were within the acceptable range. Composite reliability at 0.885 indicated the acceptability of construct reliability. The acceptable AVE value must be higher 0.5. The AVE from the model was 0.720 also indicated acceptability of the construct reliability.

Table 4.16 Factor loading, R^2, Composite Reliability, Average Variance Extracted of Mediating Variable (INN).

Variables	Factor loading	R^2	Composite Reliability	AVE
INN			0.845	0.731
INN1_Avg	0.85	0.72		
INN2_Avg	0.86	0.73		

Note: INN=innovation

INN variable had factor loading values ranged from 0.85 to 0.86, which were all higher than 0.6, and the R^2 values ranged from 0.72 to 0.73 which were within the acceptable range. Composite reliability at 0.845 indicated the acceptability of construct reliability. The acceptable AVE value must be higher 0.5. The AVE from the model was 0.731 also indicated acceptability of the construct reliability.

Table 4.17 Factor loading, R^2, Composite Reliability, Average Variance Extracted of Dependent variable (FPM).

Variables	Factor loading	R^2	Composite Reliability	AVE
FPM			0.880	0.648
FPM1_Avg	0.70	0.49		
FPM2_Avg	0.80	0.64		
FPM3_Avg	0.86	0.74		
FPM4_Avg	0.85	0.73		

Note: FPM=firm performance

FPM variable had factor loading values ranged from 0.70 to 0.86, which were all higher than 0.6, and the R^2 values ranged from 0.49 to 0.74 which were within the acceptable range. Composite reliability at 0.880 indicated the acceptability of construct reliability. The acceptable AVE value must be higher than 0.5. The AVE from the model was 0.648 also indicated acceptability of the construct reliability.

4.2.4.4 Discriminant Validity Testing

Discriminant validity testing was an evaluation to confirm that observed variable represented on the same latent variable and was not associated with other observed variable of the other latent variables. This meant that the construct was unique and captured some phenomena that were not similar to other constructs. The correlation coefficient should be ranged between 0.2 to 1.0 (Hair et al., 1998). From table 4.18 showed that the squared correlation values were ranged from 0.48 to 0.80. The testing result of squared correlation was accepted.

The discriminant validity testing was done through the comparison between AVE value and the correlation coefficient, the discriminant validity was assessed based on the following criteria from Fornell and Larcker (1981).

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

The testing results from table 4.18 showed that the values obtained supported the discriminant validity. The value of AVE for each variable was greater than the level of correction involving the variable.

Table 4.18 Comparison of square root AVE with correlation between constructs.

	ITC	**DTA**	**MKO**	**INN**	**FPM**
ITC	**0.84**				
DTA	0.77	**0.84**			
MKO	0.67	0.80	**0.84**		
INN	0.71	0.75	0.74	**0.85**	
FPM	0.57	0.78	0.80	0.75	**0.81**

Note: ITC=IT capability DTA=data analytics MKO=market orientation
INN=innovation FPM=firm performance

4.3.5 Construct Research Model

This section presented the analysis of the proposed model through SEM analysis in order to test the hypotheses and identify the answers for research questions.

4.3.5.1 Structural Model One

The structural model one or direct effects model examined the relationship between IT capability, and data analytics on firm performance which showed in Figure 4.2.

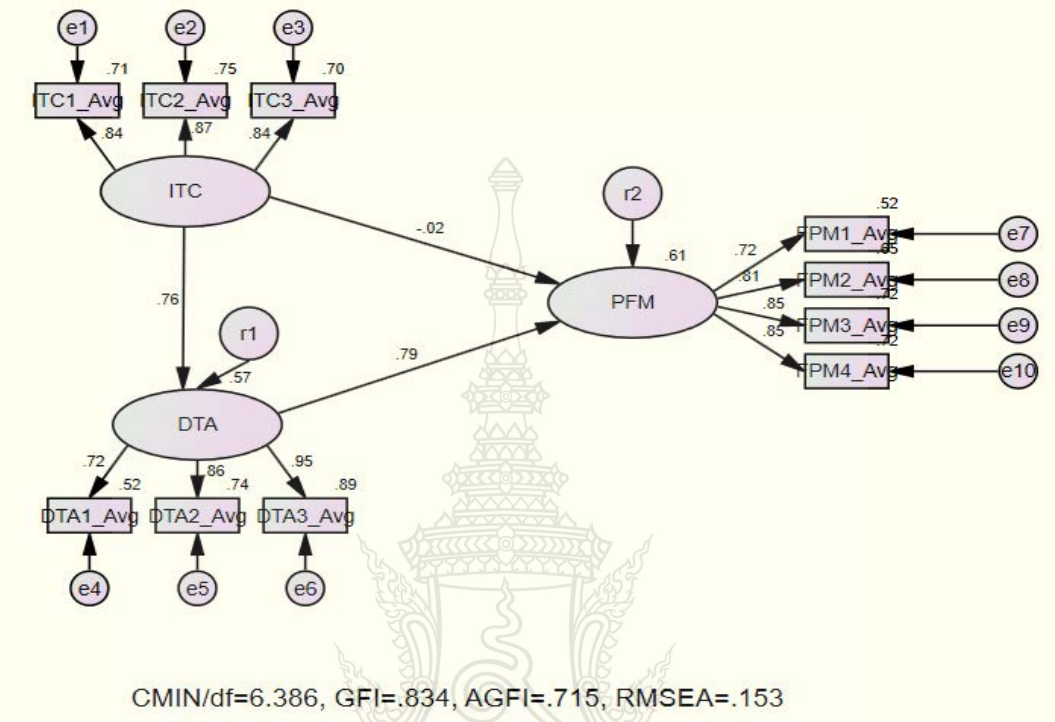

Figure 4.2 Standardized direct effects.

The structural model one investigated the direct effects of IT capability (ITC), and data analytics (DTA) on firm performance (FPM). The results of model fit showed in the table 4.19.

Table 4.19 Model fit analysis for direct effects.

Model Fit Criteria	**Value**	**Acceptable level**
Chi-Square	204.354	-
Degree of freedom	32	-
Chi-Square/df	6.386	< 3.0
p-value	0.000	$p > 0.05$
GFI	0.834	> 0.90
AGFI	0.715	> 0.80
RMR	0.094	close to zero
RMSEA	0.153	< 0.10

Table 4.19 Model fit analysis for direct effects. (Cont.)

Model Fit Criteria	Value	Acceptable level
NFI	0.885	> 0.90
CFI	0.900	> 0.90
Hoelter	52	> 75

The modification indices from table 4.21 adjusted to the model by adding covariance between residual errors as follows: e1 and e2, e1 and e3, e7 and e8, e7 and e10, e8 and e10, and e9 and e10. After the modification, the results were showed in Figure 4.3 and table 4.20.

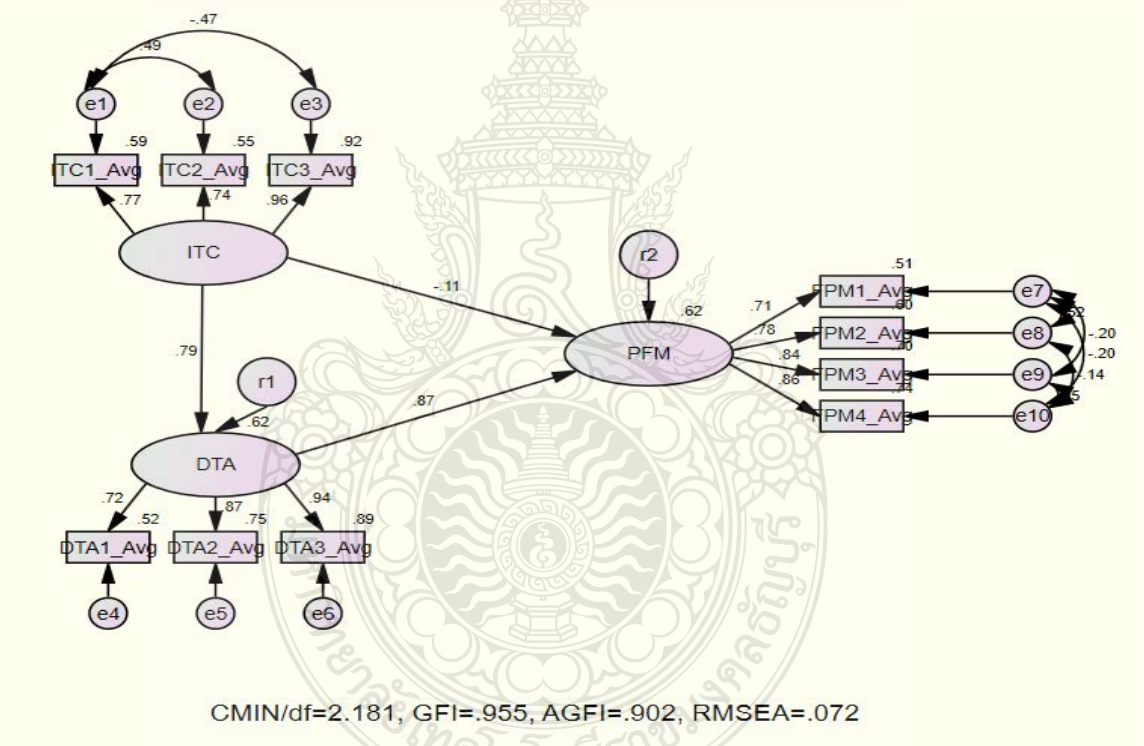

Figure 4.3 Standardized direct effects (modification).

Table 4.20 Model fit analysis for direct effects (with modification indices).

Model Fit Criteria	Value	Acceptable level
Chi-Square	54.518	-
Degree of freedom	25	-
Chi-Square/ df	2.181	< 3.0
p-value	0.001	$p > 0.05$
GFI	0.955	> 0.90
AGFI	0.902	> 0.80
RMR	0.074	Close to zero
RMSEA	0.072	< 0.10
NFI	0.969	> 0.90
CFI	0.983	> 0.90
Hoelter's	159	> 75

The analysis of structural model one, the results showed direct relationship between ITC and DTA at β = 0.857 (p<0.001). As for the relationship between DTA and FPM, it showed direct relationship at β = 0.697 (p<0.001). However, there was no direct relationship between ITC and FPM at β = -0.094 (p = 0.262).

Table 4.21 Hypothesis testing for direct effects.

			Estimate	S.E.	C.R.	*p*-value
H1: ITC	→	FPM	-0.094	0.084	-1.122	0.262
H2: ITC	→	DTA	0.857	0.087	9.866	***
H3: DTA	→	FPM	0.697	0.084	7.139	***

***p-value ≤ 0.001 (α 0.001)

4.3.5.2 Structural Model Two

The structural model two or indirect effects model examined the relationship between IT capability, and data analytics with firm performance through market orientation, and innovation as the mediating variables which showed in Figure 4.4.

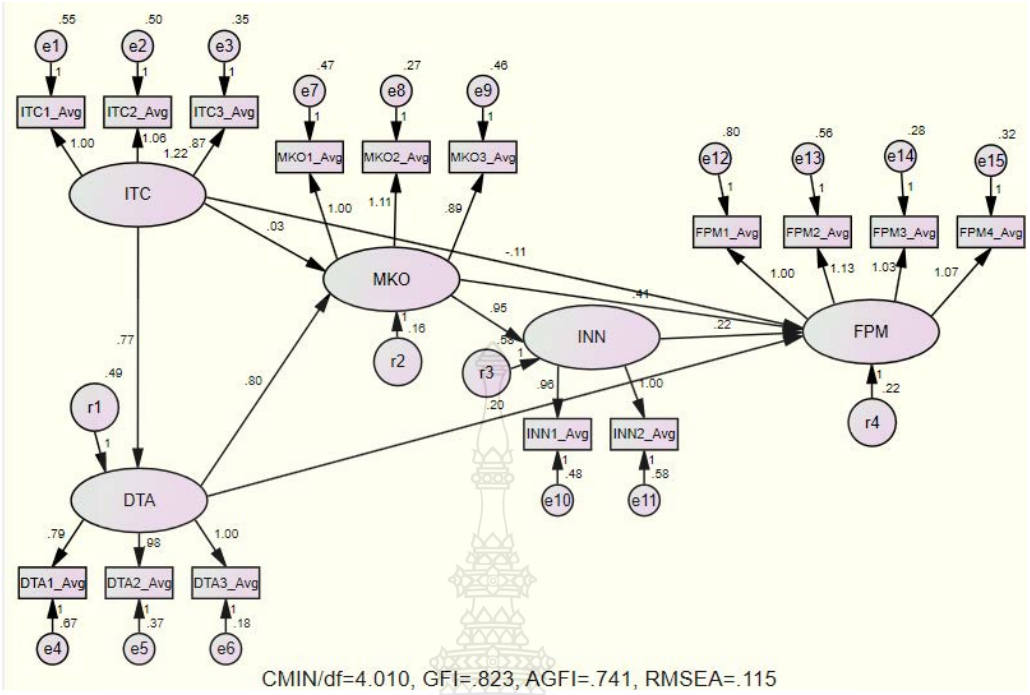

Figure 4.4 Standardized indirect effects.

The structural model two investigated the direct effects of ITC, and DTA on FPM and the indirect effects of ITC, and DTA on FPM through MKO, and INN as the mediating variables. The results of model fit showed in the table 4.22.

Table 4.22 Model fit analysis for indirect effects.

Model Fit Criteria	Value	Acceptable level
Chi-Square	328.806	-
Degree of freedom	82	-
Chi-Square/ df	4.010	< 3.0
p-value	0.000	$p > 0.05$
GFI	0.823	> 0.90
AGFI	0.741	> 0.80
RMR	0.096	close to zero
RMSEA	0.155	< 0.10
NFI	0.886	> 0.90
CFI	0.911	> 0.90
Hoelter	73	> 75

The modification indices from table 4.22 adjusted to the model by adding covariance between residual errors as follows: e1 and e2, e1 and e3, e7 and e8, e7 and e9, e12 and e13, e12 and e14, e12 and e15, e13 and e15, and e14 and e15. After the modification, the results were showed in Figure 4.5 and table 4.23.

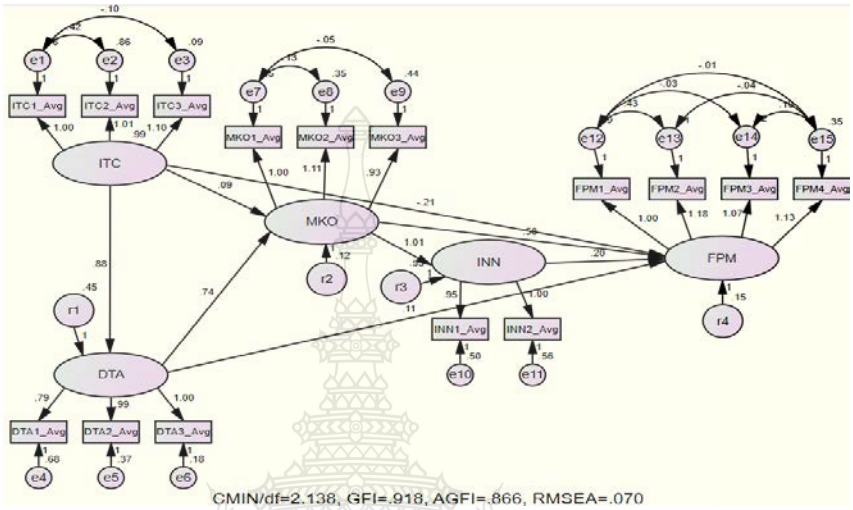

Figure 4.5 Standardized indirect effects (modification).

Table 4.23 Model fit analysis for indirect effects (with modification indices).

Model Fit Criteria	**Value**	**Acceptable level**
Chi-Square	156.067	-
Degree of freedom	73	-
Chi-Square/ df	2.138	< 3.0
p-value	0.000	$p > 0.05$
GFI	0.918	> 0.90
AGFI	0.866	> 0.80
RMR	0.078	Close to zero
RMSEA	0.070	< 0.10
NFI	0.946	> 0.90
CFI	0.970	> 0.90
Hoelter	138	> 75

The analysis of structural model two indicated that IT capability (ITC) had negative direct effect to firm performance (FPM) (β = -0.208, p = 0.009), and IT capability (ITC) positively direct affected to data analytics (DTA) (β = 0.088), but there

was not relationship between IT capability (ITC) and market orientation (MKO) (β = 0.094, p = 0.194).

There was not relationship between data analytics (DTA) and firm performance (FPM) (β = 0.107, p = 0.554), but data analytics (DTA) positively direct affected to market orientation (MKO) (β = 0.741). However, market orientation (MKO) positively direct affected to firm performance (FPM) (β = 0.582, p = 0.021), and also positively direct affected to innovation (INN) (β = 1.009). Finally, innovation (INN) also positively direct affected to firm performance (FPM) (β = 0.199, p = 0.005). The results of significance for the model two were present in table 4.24 and 4.25.

Table 4.24 Hypothesis testing for indirect effects.

				Estimate	**S.E.**	**C.R.**	***p*-value**
H1:	ITC	→	FPM	-0.208	0.080	-2.616	**
H2:	ITC	→	DTA	0.887	0.088	9.928	***
H3:	DTA	→	FPM	0.107	0.181	0.591	0.554
H4:	ITC	→	MKO	0.094	0.072	1.299	0.194
H5:	DTA	→	MKO	0.741	0.078	9.511	***
H6:	MKO	→	FPM	0.582	0.252	2.306	*
H7:	MKO	→	INN	1.009	0.095	10.596	***
H8:	INN	→	FPM	0.199	0.071	2.812	**

***p-value $\leq$ 0.001 (α 0.001)
** p-value $\leq$ 0.01 (α 0.01)
* p-value $\leq$ 0.05 (α 0.05)

Table 4.25 Standardized Direct, Indirect and Total Effect among variables.

		Direct Effect				Indirect Effect				Total Effect			
	R^2	ITC	DTA	MKO	INN	ITC	DTA	MKO	INN	ITC	DTA	MKO	INN
ITC	-	-	-	-	-	-	-	-	-	-	-	-	-
DTA	.63	.793	-	-	-	-	-	-	-	.793	-	-	-
MKO	.87	.098	.854	-	-	.678	-	-	-	.776	.854	-	-
INN	.62	.000	.000	.790	-	.614	.675	-	-	.614	.675	.790	-
FPM	.78	-.253	.144	.677	.296	.821	.779	.234	-	.568	.923	.911	.296

The structural model exhibited reasonable predictive ability and explained 63 percent of the variance in DTA, 87 percent of the variance in MKO, 62 percent of the variance in INN and 78 percent of the variance in FPM.

4.3.5.3 Summary of Structural Model Analysis

According to the model one, the research found that IT capability did not have direct affect to the firm performance, but data analytics positively direct affected to the firm performance.

The model two indicated that IT capability positively indirect affected to firm performance with market orientation and innovation as the mediators. However, data analytics did not have indirect affect to firm performance with market orientation and innovation as the mediators. The comparison of the path coefficients between model one with model two as shown in table 4.26.

Table 4.26 Comparison between direct and indirect effects.

							Model1(β)	**Model 2 (β)**
ITC	→	FPM					-0.094	-0.208**
ITC	→	DTA					0.857***	0.887***
DTA	→	FPM					0.697***	0.107
ITC	→	MKO	→	INN	→	FPM	-	0.568
DTA	→	MKO	→	INN	→	FPM	-	0.923

***p-value $\leq$ 0.001 (α 0.001)
** p-value $\leq$ 0.01 (α 0.01)
* p-value $\leq$ 0.05 (α 0.05)

4.3.6 Hypotheses Testing

According to the three research questions were raised in the chapter one: how do IT capability and data analytics affect firm performance, how do IT capability and data analytics affect firm performance through market orientation and innovation, and how market orientation affects firm performance through innovation. The proposed hypotheses were as follows:

H1. IT capability positively affects firm performance.

H2. IT capability positively affects data analytics.

H3. Data analytics positively affects firm performance.

H4. IT capability positively affects market orientation.

H5. Data analytics positively affects market orientation.

H6. Market orientation positively affects firm performance.

H7. Market orientation positively affects innovation.

H8. Innovation positively affects firm performance.

This research considered the total effect according to table 4.25 as the results of the study. It showed the results of the relationship between ITC and FPM (H1) was direct relationship at $\beta = 0.568$ ($p<0.05$). The relationship between ITC and DTA (H2) the result showed direct relationship at $\beta = 0.793$ ($p<0.05$). The relationship between DTA and FPM (H3) the result showed direct relationship at $\beta = 0.923$ ($p<0.05$). The relationship between ITC and MKO (H4) the result showed direct relationship at $\beta = 0.776$ ($p<0.05$). The relationship between DTA and MKO (H5) the result showed direct relationship at $\beta = 0.854$ ($p<0.05$). The relationship between MKO and FPM (H6) the result showed direct relationship at $\beta = 0.911$ ($p<0.05$). The relationship between MKO and INN (H7) the result showed direct relationship at $\beta = 0.790$ ($p<0.05$). The relationship between INN and FPM (H8) the result showed direct relationship at $\beta = 0.296$ ($p<0.05$).

The summary of hypotheses testing showed in table 4.27.

Table 4.27 Hypotheses testing results of total effect.

Hypotheses	Results
H1. IT capability positively affects firm performance.	Supported
H2. IT capability positively affects data analytics.	Supported
H3. Data analytics positively affects firm performance.	Supported
H4. IT capability positively affects market orientation.	Supported
H5. Data analytics positively affects market orientation.	Supported
H6. Market orientation positively affects firm performance.	Supported
H7. Market orientation positively affects innovation.	Supported
H8. Innovation positively affects firm performance.	Supported

4.3.6.1 Hypothesis H1 Testing

H1. IT capability positively affects firm performance.

The analysis of relationship between IT capability (ITC) and firm performance (FPM), the results indicated that there was no positive relationship between ITC and FPM. The results indicated that the path coefficient between ITC and FPM was -0.208, standard error (S.E.) was 0.080, critical ratio (C.R.) was -2.616 and *p*-value was 0.009. The path coefficient and the *p*-value indicated highly significant relationship between ITC and FPM, which also suggested the ITC positively affected to FPM. Therefore, this indicated that hypothesis H1 was supported.

4.3.6.2 Hypothesis H2 Testing

H2. IT capability positively affects data analytics.

The analysis of relationship between IT capability (ITC) and data analytics (DTA), the results indicated that there was positive relationship between ITC and DTA. The results indicated that the path coefficient between ITC and DTA was 0.887, standard error (S.E.) was 0.088, critical ratio (C.R.) was 9.928 and *p*-value was less than 0.001. The path coefficient and the *p*-value indicated highly significant relationship between ITC and DTA, which also suggested the ITC positively affected to DTA. Therefore, this indicated that hypothesis H2 was supported.

4.3.6.3 Hypothesis H3 Testing

H3. Data analytics positively affects firm performance.

The analysis of relationship between data analytics (DTA) and firm performance (FPM), the results indicated that there was no positive relationship between DTA and FPM. The results of the path coefficient between DTA and FPM was low (β = 0.107), standard error (S.E.) was 0.181, critical ratio (C.R.) was 0.591 and the *p*-value was 0.554 which was greater than 0.05. The factor loading values for each item of observed variables (predictive analytics, prescriptive analytics, and descriptive analytics) were 0.52, 0.76, and 0.87. It found that the *p*-value for this relationship was greater than 0.05. This meant that the result did not have statistically significance and indicated that hypothesis H3 was not supported.

This might predicted that the observed variables of DTA (predictive analytics, prescriptive analytics, and descriptive analytics) could not have direct influence with firm performance in Thai manufacturing industry.

4.3.6.4 Hypothesis H4 Testing

H4. IT capability positively affects market orientation.

The analysis of relationship between IT capability (ITC) and market orientation (MKO), the results indicated that there was no positive relationship between ITC and MKO. The results of the path coefficient between ITC and MKO was low (β = 0.094), standard error (S.E.) was 0.072, critical ratio (C.R.) was 1.299 and the *p*-value was 0.194 which was greater than 0.05. The factor loading values for each item of observed variables (IT infrastructure, human IT resource, and IT-enabled intangibles) were 0.56, 0.54, and 0.93. It found that the *p*-value for this relationship was greater than 0.05. This meant that the result did not have statistically significance and indicated that hypothesis H4 was not supported.

This might predicted that the observed variables of ITC (IT infrastructure, human IT resource, and IT-enabled intangibles) could not have direct influence with market orientation in Thai manufacturing industry.

4.3.6.5 Hypothesis H5 Testing

H5. Data analytics positively affects market orientation.

The analysis of relationship between data analytics (DTA) and market orientation (MKO), the results indicated that there was positive relationship between DTA and MKO. The results indicated that the path coefficient between DTA and MKO was 0.741, standard error (S.E.) was 0.078, critical ratio (C.R.) was 9.511 and *p*-value was less than 0.001. The path coefficient and the *p*-value indicated highly significant relationship between ITC and DTA, which also suggested the DTA positively affected to MKO. Therefore, this indicated that hypothesis H5 was supported.

4.3.6.6 Hypothesis H6 Testing

H6. Market orientation positively affects firm performance.

The analysis of relationship between market orientation (MKO) and firm performance (FPM), the results indicated that there was positive relationship between MKO and FPM. The results indicated that the path coefficient between MKO and FPM was 0.582, standard error (S.E.) was 0.252, critical ratio (C.R.) was 2.306 and *p*-value was 0.021. The path coefficient and the *p*-value indicated highly significant relationship between MKO and FPM, which also suggested the MKO positively affected to FPM. Therefore, this indicated that hypothesis H6 was supported.

4.3.6.7 Hypothesis H7 Testing

H7. Market orientation positively affects innovation.

The analysis of relationship between market orientation (MKO) and innovation (INN), the results indicated that there was positive relationship between MKO and INN. The results indicated that the path coefficient between MKO and INN was 1.009, standard error (S.E.) was 0.095, critical ratio (C.R.) was 10.596 and *p*-value was less than 0.001. The path coefficient and the *p*-value indicated highly significant relationship between MKO and INN, which also suggested the MKO positively affected to INN. Therefore, this indicated that hypothesis H7 was supported.

4.3.6.8 Hypothesis H8 Testing

H8. Innovation positively affects firm performance.

The analysis of relationship between market orientation (INN) and firm performance (FPM), the results indicated that there was positive relationship between INN and FPM. The results indicated that the path coefficient between INN and FPM was 0.199, standard error (S.E.) was 0.071, critical ratio (C.R.) was 2.812 and *p*-value

was 0.005. The path coefficient and the *p*-value indicated highly significant relationship between INN and FPM, which also suggested the INN positively affected to FPM. Therefore, this indicated that hypothesis H8 was supported.

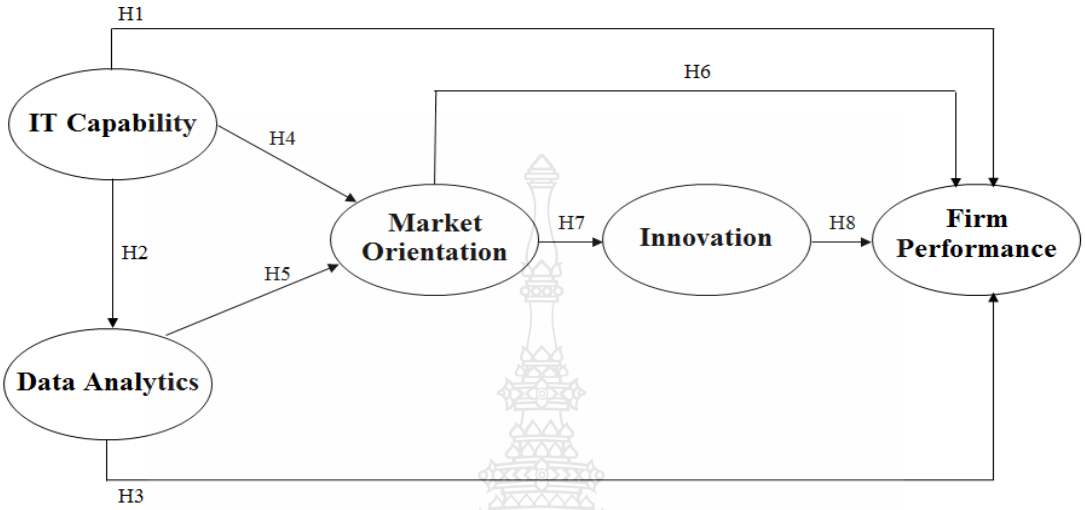

Figure 4.6 Results of total effect tested hypotheses.

The Figure 4.6 illustrated the tested research model. The solid line indicated all hypotheses have been supported to the research observation (H1: H2: H3: H4: H5: H6: H7 and H8).

4.4 Qualitative Results

This section discussed on the qualitative results which did through the in-depth interview with executives or IT leaders in order to confirm quantitative results. The qualitative methodology population was four companies which selected from the questionnaires' respondents. They were manufacturer and exporter of electronic components, manufacturer of aluminum alloy wheels, manufacturer and distributor of heat exchanger for engines, and plastic parts manufacturer and conductor.

The in-depth interview was face to face conversation with executives or IT leaders. It was the open-ended questions. The questions related to the research questions for this study were as follows:

- How does IT capability affect firm performance?
- How does data analytics affect firm performance?

- How do IT capability and data analytics affect firm performance through market orientation and innovation?

- How market orientation affects firm performance through innovation?

However, there were some additional questions in order to confirm the factors of variables that used in this research, for examples:

- What types of IT capability related to your company?
- What kinds of marketing activities can support your company?
- What are the innovations in your company?
- How your company measures the firm performance?

The following were the questions process of the in-depth interview which consisted as follows:

1) The agreement of participation
2) The company introduction
3) IT capability and data analytics questions
4) Market orientation and innovation in the company questions
5) Competitiveness and firm performance in the business environment questions
6) Open questions
7) Gratefulness

The results of all interviews presented in appendix D.

After interviewing all respondents, working on the research hypotheses showed as follows:

1. Hypothesis on the relationship between IT capability and data analytics and the influence on firm performance. The results of the interviews showed that some of the respondents agreed that IT capability had the influence on firm performance. It helped employees to work more efficiency and more effective. However, some of the respondents disagreed that IT capability had influence on firm performance. The reason was IT infrastructure did not affect much on performance but employee needed to improve their working skills. About the data analytics, all of the respondents agreed the data analytics had the influence on firm performance. The company needed data analytics to improve production process, decision making for management, and

investment. As the results of the interview on this hypothesis showed that it was comply with the quantitative methodology results. The hypotheses testing results of total effect showed that H1, H2, and H3 were supported to hypotheses.

2. Hypothesis on the relationship between IT capability and data analytics and the influence on firm performance through market orientation and innovation as mediators. All of respondents agreed that IT capability and data analytics had influence on firm performance through market orientation and innovation. All those factors supported firm to work more efficiency and more effective. There was also the risk management to evaluate customers and competitors. As the results of the interview on this hypothesis showed that it was comply with the quantitative methodology results. The hypotheses testing results of total effect showed that H4, and H5 were supported to hypotheses.

3. Hypothesis on market orientation and innovation as mediators to affect firm performance. Most of respondents agreed that market orientation and innovation as mediators affected to firm performance. The competitor analysis helped company to improve product planning. The information on the production cost helped company to set the product price lower than competitors. However, some respondents had no information on this hypothesis. As the results of the interview on this hypothesis showed that it was comply with the quantitative methodology results. The hypotheses testing results of total effect showed that H6, H7 and H8 were supported to hypotheses.

The interviews included the questions to confirm the factors of all variables in this research. It found that most of the factors of all variables were suitable. However, there were some interesting factors from the interviews which did not include in this research. For example, the IT application and software should be considered to put in IT capability variable. IT application and software could be part of the IT capability to improve firm performance. The factors of the firm performance in this research were profitability, market share, customer satisfaction, and customer loyalty. Others than that there were some factors of the firm performance from the interview which were unit to stock, delivery on time, Cpk (process capability index), and the reduction of NG (no good) product. All these new finding factors could able to present in the future research.

CHAPTER 5
CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter separated into six parts. Part one contained a discussion of the findings entitled summary of the research findings. Part two tilted research questions and answers. This section showed the results of the hypotheses testing for the research questions. Part three, discussion for the research finding explained the results from both quantitative and qualitative results. Part four discussed the limitation of the study and explained some limitation of the study. Part five, implications of the study discussed on theoretical contribution and managerial implications. Finally, the future research provided the new factors for the future consideration.

5.2 Summary of the Findings

This study assessed the benefits of a holistic approach concerning the implementing of IT capability, data analytics, market orientation, and innovation to improve firm performance. Therefore, this study examined the effects of IT capability on firm performance, and the effects of IT capability and data analytics on firm performance through market orientation and innovation. Moreover, the effects of market orientation on firm performance through innovation were investigated. The resource-based view (RBV) of the firm was the theory linked between IT capability, data analytics and firm performance. Market orientation and innovation preformed as the mediators in this study.

The overall returned of questionnaires were 230 firms, and the response rate was17.70 % from manufacturing industry in Thailand. The respondents were IT management team or executive management of the firm. Their education level were mostly undergraduate, with more than 15 years of working experiences. Mostly, the firm's respondents mostly had employees between 501 to 1,000 employees, and the registered capital more than 100 million baht.

This research applied structural equation model (SEM) analysis which had the capacity to address structural relationships through the estimation of the multiple and

interrelated variables. The empirical findings from this study had consistency with relevant studies in the existing literature. The results were conformed to the RBV perspective and emphasized the importance of IT capability and data analytics. The high level of significance from this study gave high credibility to the empirical results obtained.

5.3 Research Questions and Answers

This research focused on the concept four variables that affected to firm performance. These variables were IT capability, data analytics, market orientation, and innovation. The following were research questions for this study.

1. How do IT capability and data analytics affect firm performance?
2. How do IT capability and data analytics affect firm performance through market orientation and innovation?
3. How market orientation affects firm performance through innovation?

The eight hypotheses were developed and tested to classify the above research questions, the answers were provided in table 5.1.

Table 5.1 The results of hypotheses testing for research questions.

Research Questions	Hypotheses	Results
1	H1. IT capability positively affects firm performance.	Yes
	H2. IT capability positively affects data analytics.	Yes
	H3. Data analytics positively affects firm performance.	Yes
2	H4. IT capability positively affects market orientation.	Yes
	H5. Data analytics positively affects market orientation.	Yes

Table 5.1 The results of hypotheses testing for research questions. (Cont.)

Research Questions	Hypotheses	Results
3	H6. Market orientation positively affects firm performance.	Yes
	H7. Market orientation positively affects innovation.	Yes
	H8. Innovation positively affects firm performance.	Yes

5.4 Discussion for the Research Questions

This section provided research discussions, and conclusions related to the research questions.

5.4.1 Discussion of Research Question One: How do IT capability and data analytics affect firm performance?

The first research question referred to effect of IT capability and data analytics on firm performance. IT capability comprised of IT infrastructure capability, human IT resources, and IT-enabled intangible whereas data analytics comprised of predictive analytics, prescriptive analytics, and descriptive analytics. The firm performance consisted of profitability, market share, customer satisfaction, and customer loyalty. The hypothesis one was supported which indicated that IT capability had a positive affected on firm performance. This result complied with findings from Mithas et al. (2011) which suggested that information management capability affected various measures of firm performance. Furthermore, IT infrastructure and IT investment were the factors for business excellence. Likewise, Byrd and Davidson (2003) and Jaturat (2011) also found that the investment of IT did lead to better firm performance. The *hypothesis two* supported that IT capability positively affected data analytics. This result complied with Kamioka et al. (2017) who investigated the impact of user IT capability on the performance of big data analytics and firm performance through the mediator of organized big data analytics. The research found the positive relationship between user IT capability and big data analytics. In addition, the hypothesis three also supported that data analytics positively affected firm performance. The result was congruent with

Mouthaan (2012) who found that data analytics could improve products and services leading to advantage for customers and firm performance.

Moreover, the results from the interviews by qualitative methodology on these hypotheses complied with the quantitative methodology results. Most of respondents agreed that IT capability and data analytics affected on firm performance.

5.4.2 Discussion of Research Question Two: How do IT capability and data analytics affect firm performance through market orientation and innovation?

The second research question referred to how IT capability and data analytics affect firm performance through market orientation and innovation. Market orientation comprised of customer orientation, competitor orientation, and inter-function orientation whereas innovation comprised of product and market innovation. The hypothesis four posited that the IT capability positively affected to market orientation, and hypothesis five also posited that data analytics positively affected to market orientation. These hypotheses were both supported in this study. The results complied with Borges et al. (2009) who found that IT capability positive influence business performance with sufficient market orientation. Lu and Ramamurthy (2011) also found that IT capability enabled market capitalizing agility and operation adjustment agility.

According to the interviews, the results showed that IT capability and data analytics had affected firm performance through market orientation and innovation. All of respondents agreed on these hypotheses.

5.4.3 Discussion of Research Question Three: How market orientation affects firm performance through innovation?

The third research question referred to how market orientation affected firm performance through innovation. Hypothesis six supported the concept that market orientation positively affected to firm performance. Hypothesis seven supported that market orientation positively affected innovation. Finally, the hypothesis eight also supported that innovation positively affected firm performance. These results complied with Han et al. (1998) who found that the market orientation facilitated an organization's innovativeness which positively influenced business performance. Shoham et al. (2005) investigated the relationship between market orientation and firm

performance, and found a positive relationship for both factors. Javalgi et al. (2006) stated that market orientation has been linked to positive organization performance. (Kuntonbutr (2013)) also found positive relationship between market orientation and business performance through innovations.

The results from the interviews were supported by these hypotheses, however, the interviews revealed different factors influence firm performance. These were unit to stock, delivery on time, Cpk (process capability index), and the reduction of NG (no good) products.

5.5 Limitation of the Study

There were some limitations associated with the process of this study. They were as follows:

1. The factors and variables in this research were from the review of the relevant literature. Due to the comprehensive and broad classification of IT capability, data analytics, and firm performance, the items selected and used in the data collection might not be good representation of these factors and may have produced bias results.

2. IT capability and data analytics consisted of various components, the selected variables in this research might positively impact on firm performance. However, future research might examine other dimensions of IT capability and data analytics influences on firm performance.

3. The manufacturing industry is large and covers many ranges of product segments. This research studied only four segments in the manufacturing industry which would give specific insight for each specific segment.

4. The target groups for the questionnaire were expected to send good information but some respondents did not send valuable information. Future research might consider an average score from more than one respondent of the same company.

5.6 Implications of the Study

This study was undertaken to better understand the firm performance on the manufacturing industries in Thailand. In the literature review showed the theory development and theory practice to operate most effectiveness on firm performance.

In considering theoretical results, this research adopted resource-based view (RBV) of the firm as the grounded theory. RBV has the potential to manage resource that are valuable, rare, difficult to imitate, and non-substitutable by other resources. It was also part of the theoretical framework for the firm to achieve the sustained competitive advantage and improve firm performance. IT capability factors in the research consisted of IT infrastructure capability, human IT resources, and IT enabled intangibles. While, data analytics consisted of predictive, prescriptive and descriptive data. Both IT capability and data analytics as parts of RBV of the firm provided data and information with accuracy, timeliness, reliability, and confidentiality to user, and process management capability were link between IT and firm performance. This research examined the relationship between IT capability, data analytics, market orientation, and innovation to firm performance. The results suggested that these components had potential to improve profitability, market share, customer satisfaction, and customer loyalty.

The findings of this study had some important managerial implications for Thai manufacturing industries in developing their operation to a better performance. These are as follows:

1. Firms should develop IT infrastructure as a business resource for attaining long-term competitive advantage. The unique characteristics of IT infrastructures helped to identify and develop key applications. Firms needed to learn to utilize and redesign the infrastructure capability in order to reduce the time and operation cost.

2. Developing of technical and managerial IT skills was necessary for the employees. Firms with strong human IT resources had the ability to integrate the IT and business planning process, quickly develop reliable and cost applications for business needs, effectively communicate and coordinate with other business unit, anticipate with future business needs, and support the Thailand 4.0 model.

3. Effective data analytics in firms can create inter functional coordination to enhance efficiency in their operations which helps them to achieve their goals more effectively.

4. Management reports identified business opportunities and theses can be applied towards identifying threats to the strategic plan. Therefore, the predictive of

data in the past performance supported the organization plan in the future. That is concerned with opportunity and threats.

5. The development of original data produced prescriptive solutions support management for the better decision making.

5.7 The Future Research

This research studied Thai manufacturing industries. The study validated a structural model which indicated that IT capability had a positive relationship with firm performance, and was mediated by market orientation and innovation. In addition, data analytics also had positive relationship with firm performance which was mediated by market orientation and innovation. Based on the results of this study, there are some interesting future research questions. The following questions are suggested.

1. This study focused on the participants who are in manufacturing industries. Other scholars could extend their studies to other areas of industry such as services and trading. These sectors also need a quick response to the competitive environment.

2. Currently, the use of big data technology in Thailand is limited to specific firms. Big data, however, will be more crucial to the competitive environment in the near future. Future researchers can extent their study from data analytics to big data technology that will contribute to the uses of this area.

3. The limitation of this study comes from the measurement of non-financial data. Other researchers can apply financial data to clarify the results of firm performance for a better measurement.

4. In term of academic contribution, this study lead to other constructs links between IT capability, innovation, and firm performance.

5. The role of top management should be studied concerning policy, resource allocation, and culture.

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Biography

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Declaration

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