

The Effects of Information Technology Capability on Firm Performance through Data Analytics

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บทคัดย่อ- สภาพแวดล้อมทางธุรกิจในปัจจุบันนี้ เทคโนโลยีสารสนเทศ (IT) มีความสำคัญต่อการดำเนินธุรกิจมากขึ้น อย่างไรก็ตามการวิเคราะห์ข้อมูลเชิงธุรกิจยังเป็นการสนับสนุนประสิทธิภาพในการทำงานของบริษัทให้ดีขึ้นด้วยอย่างไรก็ตามงานวิจัยนี้มีจุดมุ่งหมายเพื่อศึกษาความสามารถทางด้านเทคโนโลยีสารสนเทศ ด้วยการวิเคราะห์ข้อมูลเชิงธุรกิจ เพื่อเพิ่มประสิทธิภาพในการทำงานให้ดีขึ้น การสำรวจในงานวิจัยนี้จัดทำขึ้นโดยการรวบรวมข้อมูลจากอุตสาหกรรมการผลิตในประเทศไทย โดยมีกลุ่มตัวอย่างในงานวิจัยนี้ทั้งหมด 230 บริษัท ผลของการวิจัยพบว่าความสามารถทางด้านเทคโนโลยีสารสนเทศนั้นไม่มีผลโดยตรงต่อประสิทธิภาพการทำงานของ บริษัท แต่ความสามารถทางด้านเทคโนโลยีสารสนเทศจะส่งผลดีต่อประสิทธิภาพการทำงานของ บริษัทให้ดียิ่งขึ้น โดยการผ่านการวิเคราะห์ข้อมูลเชิงธุรกิจด้วย

คำสำคัญ: ความสามารถทางด้านเทคโนโลยีสารสนเทศ, การวิเคราะห์ข้อมูล, ประสิทธิภาพการทำงานของ บริษัท

Abstract- Modern business environment nowadays, information technology (IT) becomes more important for business operation. The data analytics also supports the better firm performance. This research aims to study the utilization of IT capability through data analytics to better firm performance. This survey conducts to collect data from the manufacturing industry in Thailand, and a total valid sample of 230 respondents. The finding of this research found that IT capability has no effect on firm performance, but positively effects to data analytics. Data analytics positively effects to firm performance.

Keywords- IT Capability, Data Analytics, Firm Performance

I. INTRODUCTION

Business sectors have more tools to operate their business successfully with efficiency and effectiveness. In a rapidly changed nowadays, there has been accepted that information technology (IT) became more important factor

for business. The typical basic factors like man, money, material and management would not be enough at this present time. According to Mithas, et al. [1] stated that the contributions of IT capability and firm performance provided data and information with accuracy, timeliness, reliability, and confidentiality to users. The customer performance and process management capability were the links between IT and firm performance. Lu and Ramamurthy [2] 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.

In the digital business environment, data management considered one of the prominent tools for business operation. When good data managed, it created a competitive advantage and increase productivity. Ularu, et al. [3] 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 [4]. Data analytics provided competitive advantage and firm performance [5]. However, some studies found that IT had positive effects on firm performance, while some found the negative effects, and also others found no effects [6, Dedrick, et al. [7], 8].

The resource-based view (RBV) perspective was the factor that helped to improve firm performance and competitive advantage. This paper focused RBV as the fundamental theory in order to make this research more reliable. Bharadwaj [9] 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 and market orientation influenced on firm performance. Melville, et al. [10] supported that researchers applied RBV to theoretically analyze for competitive advantage implications of information technology and other firm resources.

II. THEORETICAL BACKGROUND

A. Resource-Based View of the Firm (RBV)

The resource-based view (RBV) of the firm was the typical theory links between IT capability and firm performance in this paper. RBV initiated in the mid-1980s [11], 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 [9] explained that RBV of the firm was a

potential of firms to operate resource that valuable, rare, difficult to imitate and non-substitutable by other resources. In addition, Mata, et al. [12] also stated that RBV of the firm was based on two factors which are 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 [13] 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 were reputation, brand image, product quality, software patents, vendor relationships, and so no [9, 14]. However, Curado and Bontis [15] and [16] defined intangible resources as a highly valued and considered critical intellectual capital assets. Finally, personal-based resources included technical know-how and other knowledge assets such as organizational culture, employee training, loyalty, and so on [9].

B. Information Technology Capability (ITC)

The resource-based view (RBV) started to appear in IS research in the mid-1990s [14]. Most of research attempted to identify and defined either a single IS resource or sets of IS resources. According to Ross, et al. [17] 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, problem-solving orientation, *technology assets* such as physical IT assets, technical platforms, databases, architectures, standards, and *relationship assets* such as 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 [14] 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 [18]. However, Lu and Ramamurthy [2] found that there were three IT capabilities which were IT infrastructure capability, IT business spanning capability, and IT proactive stance. Bharadwaj [9] defined IT capability including IT infrastructure, human IT resources, and IT-enabled intangibles.

C. Business Data Analytics (DTA)

Business data analytics has been getting rapidly more popular than any other managerial paradigms in recent years [19]. Business analytics considered as the activities which explored and investigated the past and current business performance to get insight and drive business planning. Sun, et al. [20] defined business

analytics as an extended from of data analytics or a kind of application of data analytics including big data analytics in business. Song, et al. [21] Cook and Nagy [22] 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 [21]. 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? [19]. Descriptive analytics categorized, characterized, aggregated and classified data, and converted data into useful information for understanding and analyzing business decision, outcomes and quality [23]. Assunção, et al. [24] 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 [23]. Assunção, et al. [24] stated that predictive analytics attempted to predict the future by analyzing current and historical data. In addition, Cook and Nagy [22] 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 [19].
- *Prescriptive analytics* used descriptive analytics to optimize for the best possible outcome given the original data and results of the models and simulations [22]. It was also normative, addressing the question of what should be. Assunção, et al. [24] supported that prescriptive solutions assisted analysts in decisions by determining actions and assessing their impact regarding business objectives, requirements and constraints.

D. Firm Performance (FPM)

Firm performance concept identified as financial and non –financial. Some studies enhanced understanding of firm performance as customer satisfaction and market performance [25]. Tseng and Liao [26] studied on the performance measurement reflected two main perspectives which were subjective and objective concepts. Golden [27] stated that subjective concept was a primarily concerns with the performance of a business relative to its

competitors. The objective concept based on absolute measures of performance [28]. In the research of Tseng and Liao [26] identified firm performance as market performance, finance performance, and customer service. In the research of Han, et al. [29] identified business performance as assessed on growth and profitability. Cambra-Fierro, et al. [30] also opted customer satisfaction, customer loyalty, well-known branding, market share and economic profit as performance measurements. Javalgi, et al. [31] stated that as the firm becomes increasingly market orientation the positive strategic outcomes of customer relationship management including satisfaction, loyalty, retention and ultimately enhanced customer lifetime value are the final results. The firm performance in this study based on profitability, market share, customer satisfaction, and customer loyalty.

III. HYPOTHESES DEVELOPMENT

Hypotheses on the relationship between IT capability and data analytics influence on firm performance. Mithas, et al. [1] 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 [32] also found that IT did lead to better firm performance as measured by ROI, ROE and market value. However, Jaturat [16] found on his research that IT investment had positively affected to firm performance. MOUTHAN [33] 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.

Lu and Ramamurthy [2] who studied on the link between information technology capability and organization agility. IT capability consists 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. 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.

[Kamioka, et al. [34]] studied on the impact of user IT capability on big data analytics and firm performance. 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.

IV RESEARCH METHODOLOGY

A. Population and Sampling

This research aimed to study on manufacturing industry in Thailand which were electronics, electrical, machinery, automotive, and consumer products manufacturing. The business firms were listed in the Department of Business Development, Ministry of Commerce of Thailand. A random sample of 1,300 organizations was selected. The mailing survey and online questionnaires were tools for data survey. The number of respondents was 230 organizations.

B. Latent Variable and Observe Variables

The survey conducted the thirteen variables on a seven-point Likert scale questions. The IT capabilities (ITC) latent variable comprised of IT infrastructure (IT1), human IT resource (IT2), and IT-enabled intangibles (IT3). The business data analytics (BDA) latent variable comprised of descriptive analytics (BD1), predictive analytics (BD2), and prescriptive analytics (BD3). The firm performance (FPM) latent variable comprised of profitability (FP1), market share (FP2), customer satisfaction (FP3), and customer loyalty (FP4).

C. Convergent Validity and Discriminant Validity

The convergent and discriminant validity have been tested in prior to the evaluation with SEM. The convergent validity was measured with confirm factor analysis. The model with convergent validity when the factor loading value was more than 0.6 and the average variance extracted (AVE) was more than 0.5 [35]. The

factor loading values range from 0.67 to 0.95 while the AVE values from the study range from 0.654 to 0.712.

TABLE I. MODEL FIT INDICATORS

Chi-square/ Degree of freedom (CMIN/df)	2.181
Goodness of Fit Index (GFI)	0.955
Adjusted Goodness of Fit Index (AGFI)	0.902
The Root Means Square Error of Approximation (RMSEA)	0.072
NFI	0.969
Comparative Fit Index (CFI)	0.983

V. RESEARCH RESULTS

The assessment of the model fit indicators shows in table 1. The results of the measurement model indicated the Normed Chi-Squared fit index derived from Chi-Square/degrees of freedom (χ^2/df) is 2.181, indicating a good model fit between the data and hypothetical model [36]. The Goodness of Fit Index (GFI) value was 0.955 and the Adjusted Goodness of Fit (AGFI) value was 0.902. The Value of Root Means Square Error of Approximation (RMSEA) was 0.072. The Normed Fit Index (NFI) was 0.969, and Comparative Fit Index (CFI) value was 0.983. All these values were acceptable for model [37].

This study conducted a structural equation model (SEM) to determine the test of the proposed hypotheses. The results indicated ITC has no relationship with FPM (H1) at -0.094 ($p>0.05$). The H2: ITC positively affects to DTA at 0.857 ($p<0.05$). The H3: DTA positively affects to FPM at 0.697 ($p<0.05$). The figure 1 shows the results of the research model. The model also shows the reasonable predictive ability as it explained 62 percent of the variance in DTA and also 62 percent of the variance of FPM.

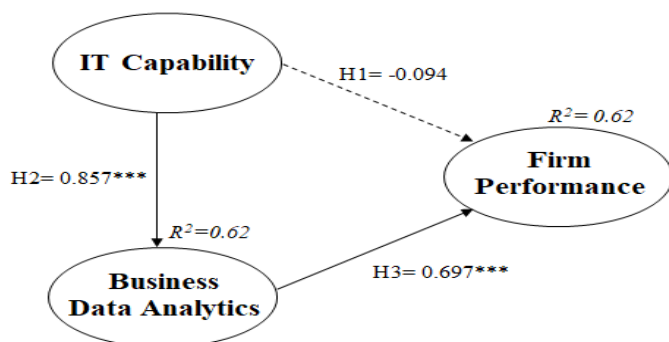


Figure 1. Research model results

VI. CONCLUSIONS AND DISCUSSION

The finding of this study found that ITC has no direct effects on FPM, while ITC has positive effects on

DTA. DTA also has positive effects on FPM. The result of ITC and FPM in this study was not supported the research of Mithas, et al. [1], Byrd and Davidson [32], and Jaturat [16]. However, this study support the study of Kamioka, et al. [34] who found the positive relationship between big data analytics and firm performance.

According to the results, firm performance improves when IT capability comprise with business data analytics. Only information technology cannot improve business performance. Firms are necessary to develop technology along with the data analytics. The information on customer needs, customer satisfaction and service quality should be monitored and reviewed to gain competitive advantage and better firm performance [38]. IT strategic utilization such as internet based technologies and e-commerce can positively influence firm performance.

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