The Effect of Information Technology Capability and Data Analytic Practices on Firms' Sustainability

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Abstract - **This study sets out to clarify the relevance of information technology capability and data analytics practice to firms' sustainability. Moreover, the innovation oriented and interfunctional coordination aspects serve as mediators in the framework. The subjects of this study are firms operating in different types of industries. The Structural Equation Model is a statistics-based one employed to evaluate two mediators, marketing strategy and team structure capability. Our results found that firms' information technology capability and data analytic practice support the sustainability of their operations.**

Keywords - **Data Analytics, Information Technology, Marketing Strategy, Team Structure, Sustainability**

I. INTRODUCTION

In today's business world, the forces that drive a company's sustainability are the utilization of information technology and data analytics, which are essential for effective operations on a daily basis. Information technology and the use of data from various sources currently permeate all business organizations and institutions in virtually every country. Information technology and the applicable data have been employed to take into account all aspects of politics, economics, society, and especially the ever-changing world of information and communication technology (ICT) [1]. ICT is now considered to be integral a country's sustainability and economic growth agendas. It is evident that ICT has been fundamental in developing worldwide social relationships and economic growth [1].

Specifically, for business organizations, ICT has facilitated their marketing strategy, team structure and organizational policies, procedures and processes. A few studies have focused on the link between ICT and sustainability [2]. It is evident that organizations differ in their ability to assimilate ICT and this has implications for their operations and making a profit or at least positive results [3]. These positive results for firms due to ICT can be determined in terms of the level of cooperation between various functions within an organization. However, the important factor concerning firms' sustainability is marketing strategy. In fact the link between ICT and firms' sustainability is mediated through a well-developed and implemented marketing strategy. ICT may affect a company's sustainability through team structure and how the functions within it are carried out. However, ICT is not alone in influencing sustainability; also required is the use of data analytics to support decision-making that leads to good business outcomes or benefits [4]. In considering firms' marketing strategy and team structure, the use of prompt data information from various sources is crucial. Thus, data analytics is important for management, and should be constantly monitored to ensure it leads to productive innovation changes and

team structures that in turn improve firms' sustainability.

This study concentrates on firms' adoption of ICT and the use of data analytics, and specifically how these impact on marketing strategy, team structure and business sustainability. It aims to encourage academics and policy-makers or practitioners to understand the link between information technology capability and data analytics, and thereby implemented sustainability practices that are commensurate with marketing strategy and team structure as mediators. It is essential for management teams to apply information technology in innovative ways and leads to better coordination between functions, so that sustainable operations are supported. Currently, research on this topic is limited only to developed countries so there is a gap in our knowledge concerning developing market economies [5-6]. For this reason the study examines what is happening in Thailand, which is undergoing rapid economic change in an increasingly globalized and competitive business environment.

A. Purpose of the Study

This study attempts to explain the effects of information technology on firms' sustainability through marketing strategy and team structure. To accomplish this, we employed the structural equation model to evaluate our empirical findings. Furthermore, we investigated both direct effect and indirect effects of data analytics practice on firms' sustainability via marketing strategy and team structure capability. The first objective is to uncover the direct and indirect effects of information technology on marketing strategy, team structure, and firms' sustainability. The second objective is to study the indirect effects of information technology on firms' sustainability. The third objective is concerned with the direct effects of data analytics practice on firms' marketing strategy, team structure, and sustainability. Finally, the fourth objective is to observe the indirect effects of team structure on firms' sustainability.

B. Significance of the Study

This study contributes to the important subject of firms' information technology capability and data analytics practices. The findings concerning marketing strategy and team structure of firms with reference to their business sustainability will help determine what sort of policy is required regarding innovation and coordination between internal functions of a firm. Businesses will be able to apply the results documented here so that information technology better integrates marketing strategy and team structure.

II. LITERATURE REVIEW

The framework of this study presents the relationships between multiple factors such as information technology capability of firms, data analytics practice, marketing strategy, team structure, and firms' sustainability. A review of other studies that explored this theme is presented here.

First, information technology is discussed on how it affects marketing strategy and team structure.

Second, the concept of data analytics is explained regarding how it impacts on marketing strategy and team structure.

Third and finally, the role of firms' sustainability is articulated.

A. Information Technology

It is very evident that business transactions are now almost solely conducted via computer networks and all aspects of such transactions are 'on line' [7-8]. Many firms have had to purchase information technology systems with Internet access for their business transactions. They can now do so at a considerably reduced cost. Having prompt communication and information access and delivery systems, supports marketing functions and help to increase business sales and profits [9]. Moreover, new applications such as Facebook, Twitter, Line, TripAdvisor, etc., have created internet communities and support new dimensions and opportunities for marketing communication [10]. Consequently, the acceptance

of information technology by employees is an important factor that helps organizations be much more competitive [11-12]. Management should be aware that implementing information technology with information systems should be done in such a way that it enhances collaboration and efficiency between internal functions. Modern information technology should in fact support business performance so that it is sustainable well into the future [13].

Modern organizations' operations depend much on information systems [14]. Firms should manage their information system effectively so that the employees can respond efficiently to any internal issues or requests. Improving the employees' capabilities to manage information technology is an important aspect of business operations [15] it will also promote employees' personal growth [16]. In considering customers, the development of information technology will support firms to collect and process data concerning them, and lead to a customer oriented business strategy [17]. In this way firms will benefit by understanding what their customers need. Furthermore customers can benefit from knowing what products fit their requirements, thus creating an environment in which good customer relations management can grow [18] and positively affect firms' performance and sustainability. On this basis we propose the following hypotheses:

H_1: Information technology has a direct effect on marketing strategy.

H_2: Information technology has a direct effect on team structure.

Currently, marketing strategy is generally supported by various sources of 'big' data such as global data, national data, and data in a specific marketing landscape. The revolution in big data and the fact it can be accessed quickly allows firms to: firstly, improve their decision-making; and secondly, give them a competitive advantage [19]. Data analytics constitute an important part of business intelligence and have been widely applied to appropriate decisions that management must make. Businesses leverage data analytics to manage their decision-making performance [20]. Data analytics is a process involving a mix of factors such as data mining, statistics, predictive analytics, and others applied to dispersed datasets to improve decision-making [21-22]. To study data analytics one should understand that it is composed of data, data aggregation, analytics, information exploration, and data governance [23]. There are five data analytics processes that can support managers in transforming big data from multiple sources into something that is tangible to the firm's business strategy.

To benefit from data analytics, management must focus more on linking strategy and business value, rather than concentrating on understanding the technological aspects of big data [24]. Despite technical studies being done on data analytics over a period of time, practitioners still do not understand how big data analytics can create better value for their business operations [25]. In determining of the relationship of data analytics to firms' marketing strategy, big data analytics can create knowledge fusion and consequently encourage new product development [26]. The marketing functions within an organization need information from both internal and external sources that need to be integrated before decisions are made concerning how to compete with business rivals. Firms need to employ suitably skilled personnel who can manage data analytics procedures and support all the relevant functions. This may also require continuous training of staff to update their skills given that technology is constantly changing. Research has been done on the impacts of data analytics on firms' agility and the support required for other types of information technology [27]. The following hypotheses are developed for consideration:

H_3: Data analytics has a direct effect on marketing strategy.

H_4: Data analytics has a direct effect on team structure.

B. Marketing Strategy

Marketing strategy can create sustainability for firms in several ways, for example in terms of demand-driven marketing management, 'green' or environmentally friendly marketing, and critical sustainable marketing [28]. Based on the Resource-Based View (RBV) theory, creating different products can lead to sustainable competitive advantage [29]. Firms' strategies that concentrate on market orientation can support activities to meet customers' needs and lead to better business performance [30-32]. Firms that are proactive in supporting customers' changing perceptions and needs will create new markets from which they can profit [33]. Therefore firms should apply a strategy of differentiating their products or goods and services from other competitors and look for an opportunity to generate a new market. In the area of marketing, sustainability has been investigated through several dimensions that are social, economic or in character [34]. Yet, very few studies have looked at how marketing strategy and sustainability are connected [34]. In considering the sustainability of a particular firm, continuous growth is considered as an indicator. Moreover, the financial results are used to measure growth of firms as an important aspect of sustainability. Subsequently, the following hypothesis is posited:

H_5: Marketing strategy has a direct effect on firms' sustainability.

C. Team Structure

Currently, businesses operate in a dynamic economic environment where globalization and rapid changes in technology affect what customers want. Internal functions of a business when conducted effectively will lead to goals being achieved. Effective cooperation within the business and where internal functions are clearly defined and implemented, will lead to better decision-making. Here the information structure is important for information sharing and the information structure designed jointly with decision strategies in mind will help staff work effectively in teams [35]. Interactions among the team members who are of high quality are associated with excellent team performance [36]. To reduce conflicts caused by mis-communication between functions, firms can apply cross-functional integration strategies and specifically for innovation projects. In this context, cross-functional integration refers to information sharing where research and development, marketing and manufacturing units or departments work together on a particular project [37]. We consider that better teamwork will result in successful firms' operations over the long-term. Thus, we posit the following hypothesis:

H_6: Team structure capabilities have a direct effect on firms' sustainability.

III. RESEARCH DESIGN AND METHODS

In line with the objectives of this study, which was to summarize the information technology capability and data analytic practice as two independent variables. In addition, marketing strategy and team structure capability playes as two mediators before measuring the independent variable that is dtermined in term of firms' sustainability. The population are manufacturing firms listed by the Thai' ministry of commerce, department of business development. A cross sectional survey by mail was utilized for collecting the data. The total number in the list was found 1,927 firms and the usable 202 subjects participated in this study. According to the sample size of the Structural Equation Model that need more than 10 times of cases in the parameters, or between 100-200 subjects [38-39].

A. Research Instrument and Variable Measurement

To test the hypotheses a survey-based methodology was employed. The instrument constructs were developed according to prior studies' theoretical and conceptual perspectives. Several items were created to verify the different aspects of the variables constructed for the framework. The specific questions concentrate on capability of firms in information technology including infrastructure and employees' skills or expertise. In measuring data analytics practices, the application of data will have implications for future business strategies. In determining team structure

capability which acts as a mediator, the questions concentrate on how data can support interfunctional coordination within firms. The second mediator - marketing strategy - was considered in terms of new products and new market opportunities. Referring to firms' sustainability, this study determines the growth of business operations as according to the variables of profit, market share, and customer satisfaction.

B. Measurement

The questions cover all variables in the framework and include 20 items measured on a 7-point scale ranging from 1 to 7. Composite measurement was derived as follows: 1) Information Technology Capability using three items, 2) Data Analytics Practice using four items, 3) Team Structure Capability using three items, 4) Marketing Strategy using three item, and 5) Firm Sustainability using six items.

C. Construct Validity

To ensure the completeness of the instrument, the construct validity and discriminant validity were tested. Convergent validity was measured by the value of confirmatory factor analysis (CFA) so that their factor loading should be greater than 0.6. The result was that average variance extracted (AVE) of all variables was above .5 (see Table I). Moreover, the discriminant validity was tested by examining the correlations, firstly, between the construct and secondly, the observed variables which should be less than 0.85.

TABLE I
FACTOR LOADING, CRITICAL RATIO, R2, COMPOSITE RELIABILITY, AVERAGE VARIANCE EXTRACTED

Variable	Factor Loading	R^2	Composite Reliability	Average Variance Extracted
Information Technology Capability (ITC)				
ITC1	.83	.69	.864	.681
ITC2	.89	.79		
ITC3	.75	.56		
Data Analytics Practice (DAP)				
DAP1	.66	.43	.889	.671
DAP2	.72	.51		
DAP3	.94	.88		
DAP4	.92	.85		
Team Structure Capability (TSC)				
TSC1	.93	.86	.951	.865
TSC2	.94	.88		
TSC3	.92	.84		
Outbound Distribution Management (ODM)				
MKS1	.73	.53	.795	.564
MKS2	.80	.65		
MKS3	.72	.51		
Firms' Profitability (FM)				
FST1	.79	.68	.922	..667
FST2	.84	.71		
FST3	.94	.88		
FST4	.92	.86		
FST5	.72	.51		
FST6	.65	.42		

D. Reliability Testing

All items that were observed variables in the framework were verified for their reliability. The results (Table II) indicate the outcome of Cronbach's alpha ranged between 0.792 and 0.909, which confirmed the instrument's reliability.

TABLE II
RELIABILITY STATISTICS

Variable	Cronbach's Alpha
Information Technology Capability	.859
Data Analytics Practice	.893
Team Structure Capability	.949
Marketing Strategy	.792
Firm Sustainability	.909

E. Subject and Data Collection

This study investigated a targeted sample of businesses listed by the Department of Business Development, Ministry of Commerce of Thailand. Specifically, these are diverse manufacturing firms in the areas of electronics, and consumer products that are electrical, machine, and automotive in character. The questionnaires were mailed to the respondent who are chief information officers and other persons who are in charge of the firms' IT task. The majority of respondents included 202 firms with assets worth up to 100 million baht, employing either less or more than 100 people are all Thai businesses.

F. Demographic and Descriptive Statistics

The authors investigated firms in different industries and are engaged in manufacturing. The demographic data reveals that the majority of respondents included 95 (47%) where firms had assets worth more than 100 million baht, 66 (32.7%) with assets worth 51-100 million baht, 35 (17.3%) with assets valued at 10-50 million baht, and 6 (3%) with assets of less than 10 million baht. The number of companies with between 100 and 500 employees was 100 (49.5%); those with between 501 and 1,000 employees was 42 (20.8%); companies with less than 100 personnel numbered 36 (17.8%), and there were 24 companies with more than 1,000 employees (11.9%). Most businesses (79) were machinery manufacturers (39.1%) followed by electronics manufacturers with 57 companies (28.2%). The descriptive statistics with respondents' answers are summarized below in Table III.

TABLE III
DESCRIPTIVE STATISTICS

Variable	$\bar{X}$	S.D.
ITC1 Your firm has a policy to develop IT infrastructure for a competitive advantage.	4.78	1.46
ITC2 Your firm's information system is a modern innovation and creates competitive advantage	4.45	1.37
ITC3 Your firm has an IT development and training program for the employees that they frequently attend	4.03	1.45
DAP1 Your firm concentrates on operations reports.	5.27	1.27
DAP2 Your firm concentrates on working and summarizing operation reports.	5.34	1.18
DAP3 Your firm has analyzed the risks that may occur in the future.	4.85	1.36
DAP4 You firm can anticipate what will happen in the future.	4.81	1.22
TSC1 The available data supports the work being done by the firm's internal functions.	4.92	1.25
TSC2 The available data supports work being finished on time.	4.97	1.28
TSC3 The available data helps internal communication.	4.95	1.21
MKS1 Your firm has a policy to continuously launch new products.	4.46	1.49
MKS2 Your firm launches products that are unique.	4.98	1.59
MKS3 Your firm looks for new market opportunities and entering a new market.	4.08	1.67
FST1 You firm has increased profits in the past three years.	4.45	1.33
FST2 Your firm has increased market share in the past three years.	4.38	1.29
FST3 Your firm is more competitive than other businesses in the industry.	4.57	1.34
FST4 There is a level of customer satisfaction with your firm's products.	5.28	1.04
FST5 There is a level of customer satisfaction with the firm.	5.28	1.06
FST6 There is a ratio of keeping customers loyal to the firm's products.	5.39	1.11

TABLE IV
CORRELATION MATRIX FOR VARIABLES IN MODELS

Variable Name	1	2	3	4	5
1. Information Technology Capability	**.82**				
2. Data Analytics Practice	.58	**.81**			
3. Team Structure Capability	.56	.79	**.93**		
4. Marketing Strategy	.60	.72	.64	**.75**	
5. Firm Sustainability	.41	.65	.64	.73	**.81**

Square Root AVE in diagonal

IV. FINDINGS

This section presents the empirical results that verify the relationships in the conceptual framework. We summarize the results as proving the structural equation model's fit. To ensure that the model does fit the requirements of the structural equation model that is based on

regression analysis, multicollinearity between independent variables was tested. The tolerance and variance inflation factor (VIF) served as the measurements for testing. The tolerance should be more than 0.1 while the VIF should be less than 10 (VIF = 1/ tolerance). It emerged that all tested variables had tolerance and VIF was such that no multicollinearity was found.

Regarding the model's fit, the results of the measurement model indicated the following: firstly, the Normed Chi-Squared fit index derived from Chi-Square/degrees of freedom is 1.359, indicating a good fit model; secondly, the value of Goodness of Fit, and The Adjusted Goodness of Fit are .916, and .877, respectively; thirdly, the Root Means Square Error of Approximation is .042; and fourthly, the Normed fit index and Comparative Fit Index value equal .949, and .986, respectively. All these findings confirm that this specific model has a good fit.

TABLE V
ASSESSING THE MODEL FIT INDICATORS

Chi-square/Degree of freedom (CMIN/df)	1.359
Goodness of Fit Index (GFI)	.916
Adjusted Goodness of Fit Index (AGFI) .877	.877
The Root Means Square Error of Approximation (RMSEA) .042	.042
Normed fit index (NFI)	.949
Comparative Fit Index (CFI)	.986

A. Results

Based on the stages of the structural equation model, results indicate that regarding the management of information technology related to other functions, Information Technology Capability has a positive effect on both Team Structure Capability and Marketing Strategy (β=.1962 with p-value <.01 and β=.205 with p-value <.01). Data Analytics Practice has a positive effect on both Team Structure Capability and Marketing Strategy (β=.663 with p-value <.001 and β=.517 with p-value <.001). Team Structure Capability does not have a positive effect on Marketing Strategy, while Marketing Strategy and Team Structure Capability both wield a positive effect on Firm Sustainability.

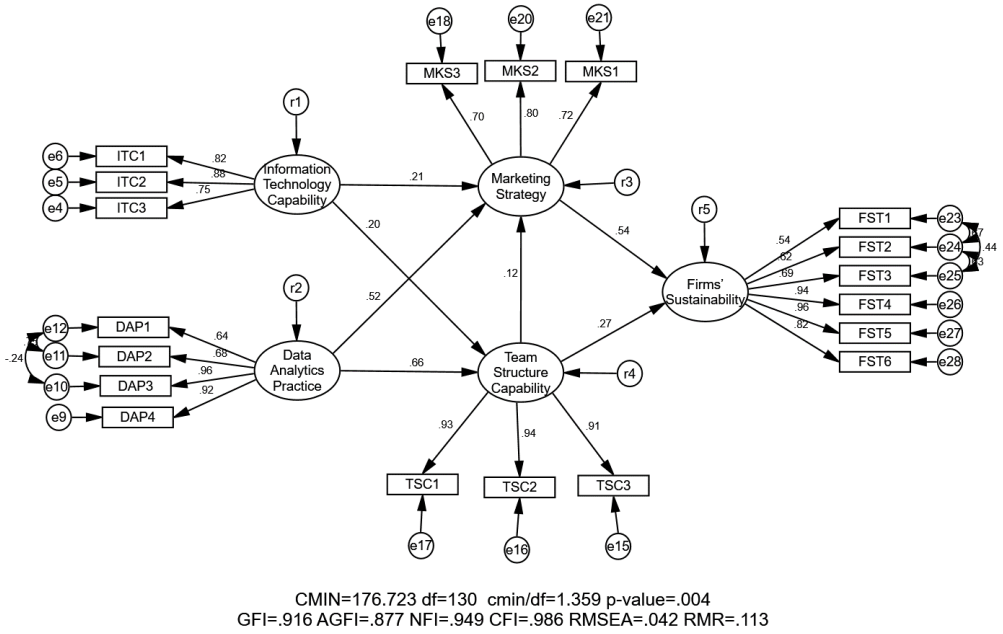
TABLE VI
HYPOTHESIS TESTING

			Estimate	S.E.	C.R.	p-value
Marketing Strategy	<---	Information Technology Capability	.205	.073	2.480	**
Team Structure Capability	<---	Information Technology Capability	.196	.060	3.00	**
Marketing Strategy	<---	Data Analytics Practice	.517	.106	4.633	***
Team Structure Capability	<---	Data Analytics Practice	.663	.067	9.891	***
Marketing Strategy	<---	Team Structure Capability	.122	.102	1.148	.251
Firm Sustainability	<---	Team Structure Capability	.266	.055	3.131	**
Firm Sustainability	<---	Marketing Strategy	.544	.075	4.909	***

*** p-value < .001 **p-value <.01 *p-value <.05

TABLE VII
STANDARDIZED DIRECT AND INDIRECT EFFECT

	Direct Effect				Indirect Effect				Total Effect			
	ITC	DAP	TSC	MKS	ITC	DAP	TSC	MKS	ITC	DAP	TSC	MKS
TSC	.196	.663							.196	.663		
MKS	.205	.517	.122		.024	.081			.229	.597	.122	
FST			.266	.544	.177	.501	.067		.177	.501	.332	.544



CMIN=176.723 df=130 cmin/df=1.359 p-value=.004
GFI=.916 AGFI=.877 NFI=.949 CFI=.986 RMSEA=.042 RMR=.113

Fig. 1 Research Model Results

V. CONCLUSION AND DISCUSSION

Information technology has evolved for many industries in recent decades. This study expands the findings of prior studies concerning specific factors where data analytics practices are applied to firms' marketing strategy and team structure. The findings and how they relate to sustainability are explained and the results found that all hypotheses were supported. With the application of information technology to marketing strategy increasing in recent times, it is evident that firms require certain types of data to fit their marketing strategy. Information technology can be employed in real time so that decision-making is immediate, effective and improves workers' capabilities in supporting and using the information. Likewise, the sharing of information between firms and customers was investigated in this study and particularly with reference to new product development and new markets as part of the marketing strategy. Team structure capabilities refer to applying data efficiently in that data support leads to a better work flow for superior results, work is completed on time, there is less conflict between departments, and better solution are found for problems. Information technology capability influences both firms' marketing strategy and team structure capability. Data analytics practices are concerned with reporting about operations, risk analysis, and strategies to use information more effectively. Also, although data analytics practices affect both marketing strategy and team structure capability, the findings here are that team structure capability does not affect marketing strategy. Consequently, it is marketing strategy and team structure capability that impact on firms' sustainability. A firm's sustainability is concerned with continuously rising profits, better market share, and higher levels of customer satisfaction.

A. Implications for Practice

The use of information technology has implications for firms. IT must be able to provide realtime information appropriately to employees and customers, and to achieve this goal, information sharing between firms and customers should be constant and updated. Moreover, firms have to ensure that information systems and straff training are ongoing to facilitate communication of information tht is internally or externally focused. This is crucial when managing the information technology successfully. IT staff must engage in continuous improvement that is congruent with the development of technology and respond quickly to customers' need. For data analytics it is important that firms are vigilant in

retaining data efficiency and the subsequent results. It is evident that data analytics do impact on both marketing strategy and team structure. In terms of marketing strategy, data analytics supports: firstly, marketing research, advertising and new market opportunities; and secondly, team structure capability in terms of better communication between internal functions, tasks completed on time, and routine workplace problems being resolved. Consequently, for policy-makers and/or government agencies and departments, a policy should be in place where the use of data analytics and IT capability are implemented in Thai businesses. Specifically, many small and medium-sized Thai firms will require government support for acquiring ICT in their operations if they are to competitive on the world stage.

B. Academic Contribution

This study provides important academic knowledge in applying information technology capability and data analytics practices to businesses' marketing strategies and team structures. Importantly, marketing strategy was considered in terms of introducing new products to the market and satisfying customers' changing needs. The study was conducted employing a holistic approach which rarely occurs in the literature. It is envisaged that this practice will increase in the near future.

C. Limitations and Future Studies

The major limitation of this analysis is that firms' sustainability was not determined by financial outcomes, but non-financial aspects instead. For other scholars who want to conduct similar research employing the factors appearing in this study, they are advised to apply financial factors to test the data. Moreover, data analytics and innovation strategies that are congruent with the marketing strategy constitute an important area of study that requires more detailed investigation.

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(Arranged in the order of citation in the same fashion as the case of Footnotes.)

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