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Dimensions Influencing Business Intelligence Usage in Thailand SMEs

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***Abstract*—Today, many companies are interested to being Business Intelligence (BI) to use. There are many factors that influent BI usage. This research studied BI environments and how they affect companies' BI usage. Information Evolution Model (IEM) is used to explain BI environments and also to state the level of companies' BI maturity. Information Evolution Model considers BI environment in 4 dimensions, which are Human capital, Knowledge process, Infrastructure and Culture. Technology Acceptance Model (TAM) is used to explain BI usage. This study focused on Thailand SMEs.**

Keywords-Business Intelligence, Decision Support Systems, Culture, Human Capital, Knowledge Process, Infrastructure

I. INTRODUCTION

Computers become an important tool in industry since mid 1990. Many companies tried to bring IT to support their business processes [14]. Even though it is expensive to invest IT, it is worth become IT provides competitive advantages to companies [16]. IT is now developed rapidly and it is very efficient. This makes IT products' price down. IT now becomes Infrastructure Technology for each company. To make IT be an important competitive tools, companies must consider not only hardware and software, but also how to use data and information [14]. So managers have to focus on how to get good information. One way to get good information to support doing business activities is Business Intelligence [13].

Nowadays many companies are interested in BI as a tool for analyzing data to be information and knowledge. These information and knowledge are used to support every business activities [12, 15]. BI is used in all sizes of companies because BI can be applied in all job types, processes and problems [10].

SMEs in Thailand have the largest portion in overall industry segment about 99.8%. They are very important for driving Thailand's economy [2, 9]. It is important to use BI for supporting business activities, so it can increase efficiency and productivity of SMEs. This makes significant economic growth [9].

CIO insight in 2003 found that these are an upward trend of BI usage. It also found that BI is used in large companies more than in small companies.[9] Only 2 of 3 companies is successful in BI usage and many companies were not satisfied using it [8]. The results of this research were contrasts with the growth of BI, so it is interesting to study the factors that influent the BI usage. Also in this study, the level of BI usage in SMEs was reported.

II. LITERATURE REVIEW

SAS in 2006 studied about drives of BI usage and developed them as Information Evolution Model. The model describes the way in which organization use information to advance business and can help top managers to identify and measure their organization's current level of BI maturity [7]. The model consists of four critical dimensions:

1) Human capital: The organization's people and the quantifiable aspects of their capabilities, recruitment, training, and assessment.

2) Knowledge process: Policies, best practices, standards, and governance that define how information is generated, validated, and used; how it is tied to performance metrics and reward systems; and how the company supports its commitment to strategic use of information.

3) Infrastructure: The hardware, software, and networking tools and technologies that create, manage, store, disseminate, and apply information.

4) Culture: Organizational and human influences on information flow—the moral, social, and behavioral norms of corporate culture (as evidenced by the attitudes, beliefs, and priorities of its members) related to information as a long-term strategic asset.

The Model is unique in that it recognizes the complex relationships among these dimensions, and characteristics in each dimension have five level of maturity:

1) An operational level, characterized by individual data "ownership" and control, applied to tackle day-to-day functional issues.

2) A consolidation level, where individual-level perspective is replaced by departmental- or functional-level standards, metrics, and perspective.

3) An integration level, which consolidation into an enterprise-wide view.

4) An optimization level, in which the organization is closely aligned with its markets and gains market leadership by applying predictive insights about customers, suppliers, and business partners.

5) An innovation level, in which sustainable growth and most revenue potential is fueled by continuing creativity and renewal

To evaluate the level of BI, SAS was developed self assessment instrument. This investment was tested for

validity and reliability. In this study this instrument is adapted for study the BI status of Thailand SMEs

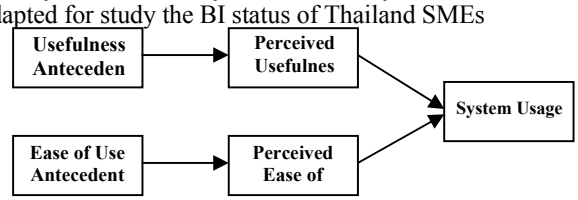

Figure 1. The Technology Acceptance Model

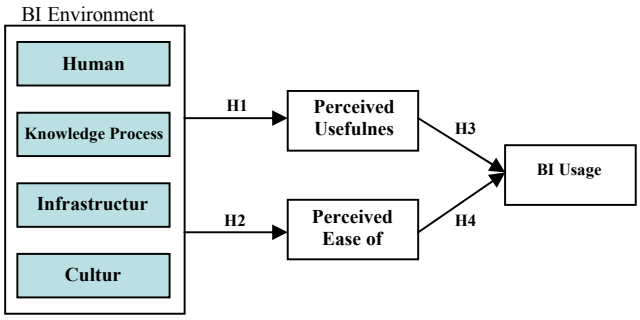

Figure 2. The research framework

IT usage was depended on technology acceptance [5]. BI is technology-based application [3]. TAM developed by Davis is widely used to test technology acceptance [11]. This instrument was tested for validity and reliability several times [1]. Figure 1 presents TAM. It represents Perceived usefulness and Perceive ease of use as antecedents of technology usage.

From two models discussed above, the research framework is developed to study the influence of BI environment on Bi usage as shown in figure 2.

The research hypothesizes are:

H1: BI environment influences perceived usefulness
H2: BI environment influences perceived ease of use
H3: Perceived usefulness influences BI usage
H4: Perceived ease of use influences BI usage

III. METHODOLOGY

A. Instrument Construction

A questionnaire was developed to collect data from Thailand SMEs. It contained questions about Information Systems for business operation. This part of questionnaire was adopted from "Information Revolution: using the information evolution model to grow your business" [7] and testing 3-likert scale to measure the level of BI usage. It also contained questions about BI environment in companies that influent the usage of BI. This part of questionnaire was adapted from "Information Revolution: using the information evolution model to grow your business" [7]., where the questions were grouped based on Information Evolution Model's dimensions, which are Human capital, Knowledge process, Infrastructure and Culture. The last part of questionnaire was adapted form "A Technology acceptance model for empirically testing new-user information systems: theory and results" [6]. The questions were in 5-likert scales.

Before collecting the data, a pilot test is conducted. The result from pilot test confirmed the content validity and reliability of the instrument.

B. subject

The questionnaires were sent to SMEs listed in office of Small and Medium Enterprise's database via emails. 131 filled questionnaires were received. The response rate is 8.5%, which is acceptable [4].

C. Data Analysis

The correlation analysis by using multiple regressions according to the research framework as follows;

BI usage = Perceived Usefulness + Perceived Ease of Use

Perceived Usefulness = Human capital+ Knowledge Process + Infrastructure + Culture

Perceived Ease of Use = Human capital+ Knowledge Process + Infrastructure + Culture

IV. DEMOGRAPHIC AND DESCRIPTIVE STATISTICS

Table 1 indicates that most respondents were 21-30 years old in range with 47.5%, following by 31-40 years old in range with 33.6%. The respondents were generally well educated. Most had at least bachelor degree. Most companies are in service sector. The result indicated that one company can be in more than one business type. The data in this table showed that the characteristics of samples are closed to that of the populations.

Table 2 (A) indicates that most companies have BI at level 1, even some of them are at level 5. Table 2 (B) indicates the details of BI maturity in each Information Evolution Model's dimensions. For Human Capital dimension, most companies are at level 1, also as knowledge process and culture. Only Infrastructure where most companies are at level 2.

TABLE II. (A)

BI status overview		
Maturity	***frequency***	***percent***
Level 1: Operational	54	41.22
Level 2: Consolidation	32	24.43
Level 3: Integration	9	6.87
Level 4: Optimization	26	19.85
Level 5: Innovation	10	7.63

TABLE III. (B)

BI maturity						
		Maturity level (percent)				
Dimensions	***Questions***	***level 1***	***level 2***	***level 3***	***level 4***	***level 5***
Decision making	How to your company's business decision making?	68.7	40.5	22.1	24.4	22.9
Human capital	How to the company's staffs work?	51.9	30.5	41.2	22.9	31.3
Knowledge process	Which level of your company's knowledge process?	61.1	43.5	31.3	30.5	13.7
	How is your company linking their information?	38.9	36.6	37.4	23.7	22.9
Culture	What is your company's culture?	42	33.6	26	32.8	16.8
Infrastructure	Where is most information resides in?	52.7	27.5	21.4	40.5	20.6
	How to your company integrates applications or tools in information systems?	38.2	48.1	22.9	25.2	19.8
	How to your company accesses information?	45	46.6	37.5	26.7	13.7

Table 2 (C) shows that BI usage in business activities has average level at 1.98, which means companies use IT or data collected from IT to support some of their business process or a part of each business process.

Table 4 (A) indicates that only perceive usefulness can explain the deviation of BI usage with $R^2 = 0.058$ which support H3 but does not support H4 at significant level 0.05. It implies that users might not know that information systems used everyday contains BI and they might use BI only when they have needs. Table 4 (B) indicates that only culture has an influence on perceive usefulness. However, only 44% of deviation of perceived usefulness can be explained by culture which support a part of H1 at significant level 0.05. No BI environment dimensions influences perceived ease of use.

Table 3 shows that companies realize that the usefulness of BI at a high level. Also they realize that BI is easy to use at a high level.

Also the managers have to motivate their employees to self-improvement.

TABLE IV. (A)

Two multiple regression: BI usage = Usefulness + Ease of use		
	usage	
	scale 1-3	
	Coefficients	***p<values***
Usefulness	0.157*	0.006
R^2	0.058	
t	2.81	

TABLE IV. (B)

Multiple regression: Usefulness = Human capital + Knowledge process + culture + infrastructure		
	Coefficients	***p<values***
Culture	0.12*	0.016
R^2	0.044	
t	2.433	

* 0.05 significance level

TABLE II. (C)

BI usage in business Activities		
Core metrics	***Mean***	***s.d***
Cash flow	2.39	0.639
Accounts payable	2.31	0.689
Accounts receivable	2.32	0.671
Headcount	2.33	0.661
Cost of goods sold	2.18	0.677
Orders	1.98	0.679
Gross margins	2.12	0.713
Total revenue	2.32	0.648
Total expense	2.37	0.672
Net income	2.37	0.672
Inventory on hand	2.2	0.728
Financial growth	2.02	0.728
Customer satisfaction	1.84	0.7
Internal process efficiency	1.77	0.708
Employee growth and learning	1.79	0.679
Target market penetration	1.78	0.636
Productivity	1.84	0.677
Waste rate	1.78	0.636
Long-term profitability	1.88	0.702
Sales growth rate	2.04	0.706
Cost-to-sales ratio	1.98	0.696
Revenue by employee	1.74	0.686
Time to market	1.82	0.699
Adoption rate of new products	1.79	0.679
Value of the innovation portfolio	1.75	0.705
External alliances	1.86	0.677
Patents	1.69	0.722
Ideas in pipeline	1.71	0.718
Value of new opportunity areas	1.76	0.703
Time from idea to launch	1.72	0.726

TABLE III. (A)

Descriptive statistics for TAM usefulness		
Subject	***Mean***	***s.d***
My job would be difficult to perform without electronic BI	3.46	1.083
Using BI give me greater control over my work.	3.76	0.937
Using BI improves my job performance.	3.77	0.957
The BI system addresses my job-related needs.	3.65	0.902
Using BI saves me time.	3.79	0.926
BI enables me to accomplish tasks more quickly.	3.66	0.997
BI supports critical aspects of my job.	3.64	0.945
Using BI allows me to accomplish more work than would otherwise be possible.	3.58	0.976
Using BI reduces the time I spend on unproductive activities.	3.71	0.996
Using BI enhances my effectiveness on the job.	3.75	0.979
Using BI improves the quality of the work I do.	3.65	1.015
Using BI increase my productivity.	3.58	0.936
Using BI takes it easier to do my job.	3.61	0.899
Overall, I find the BI system useful in my job.	3.72	0.897

TABLE IV. (B)

Descriptive statistics for TAM ease of use		
Subject	***Mean***	***S.D.***
I often become confused when I use the BI system.	2.84	1.094
I make errors frequently when using BI.	2.57	1.023
Interacting with the BI system is often frustrating.	2.53	1.105
I need to consult the user manual often when using BI.	2.87	1.048
Interacting with the BI system requires a lot of my mental effort.	3.06	1.128
I find it easy to recover from errors encountered while using BI.	3.04	0.98
The BI system is rigid and inflexible to interact with.	2.82	1.026
I find it easy to get the BI system to do what I want it to do.	3.4	0.865
The BI system often behaves in unexpected ways.	2.92	0.989
I find it cumbersome to use the BI.	2.63	1.017
My interaction with the BI system is easy for me to understand.	3.29	0.827
It is easy for me to remember how to perform tasks using the BI system.	3.13	0.872
The BI system provides helpful guidance in performing tasks.	3.36	0.886
Overall, I find the BI system easy to use.	3.23	0.882

TABLE I.

Demographic information		
Subject	***Subhead***	***Percent***
Gender	Male	47.3
	Female	52.7
Age	21-30 year-old	47.3
	31-40	33.6
	41-50	14.5
	51-60	3.8
	upper than 60	0.8
Education level	High school or lower	0.8
	Diploma/Certificate	1.5
	Bachelor degree	41.2
	Master degree	0
	Advance diploma	56.5
Business type	Manufacturing	29
	Service	55.7
	Wholesale	24.4
	Retail	32.1
Employees in organization	lower than 15 employees	29.8
	15 – 25 employees	11.5
	26 - 50 employees	13
	51 - 100 employees	6.9
	100 – 200 employees	38.9
Organization's income per year (bath)	lower than 1 million	13.7
	1 – 10 million	16.8
	10 - 50 million	16
	50 - 100 million	11.5
	higher than 100 million	42

V. CONCLUSION

At present time, SMEs in Thailand are at every level of BI maturity. However, most of SMEs have BI maturity at level 1. From the results in the research, only culture has an effect on BI usage. As BI must be supported by IT, so organization culture has major impact on usage of BI as mentioned [17]. There are many organization culture dimensions, such as, flexibility, communication, absence of conflict and orientation towards innovation that help promoting IT usage [18, 19]. Today many organizations use BI as a tool for supporting their business management [20]. Also IT is an important part in every business process. IT helps enhance business potential in every business [17]. BI can be used to support decision making. Every organization tends to use BI to support doing their business, considering from number of packaged application bought [20]. These evidences show that organization culture has an influence on BI usage in organizations. For SMEs in Thailand, the decision is made centralized by the business owner mostly. Employees are not given much authority to make any decision. They do not feel as a part of organization where

they have to improve themselves to make their organization grows or to create things for improving their organization [2]. Other BI dimensions are considered as a basis of business management [7].

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