Discovering and Analyzing the Prerequisites for Successful Implementation of ERP System in Thailand

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***Abstract*—**The aim of this study is to explore and determine factors affecting the satisfaction level of companies in Thailand using ERP systems. Most of the prior researches have suggested budget constraints and level of IT maturity in organizations as core reasons for failure of ERP implementation. This paper will enhance that to include factors such as, (1) organization aspects (2) technological aspects and (3) cultural aspects. We have collected data from vast business domains for a total of 65 Thai companies which resulted in the following assumptions: larger companies adoption of ERP systems are more significant than SME's, lack of ERP capability and low IT development inhibits adoptions of ERP systems, and the immaturity of Thai organizational cultural scenario to accept changes imposed by ERP systems. This study offers solutions using statistical inference of data to reach several conclusions. We have unveiled the prerequisites and provisions for improving implementation strategies of ERP systems in Thailand.

***Keywords*—** ERP, IT maturity, Organizational Size, Thailand

I. Introduction

ENTERPRISE Resource Planning (ERP) is a system developed to integrate all aspects of an organization's business processes to serve business requirements [10]. ERP is recognized as a new management technology that provides an organization with an integrated solution to operate business [11]. With ERP software, all separated functions in a firm such as finance, marketing, manufacturing, human resource, and planning could be tied into a single system. This in turn provides the seamless work flow for the entire organization [12]. ERP can be successfully implemented in an organization that understands its business requirements, timeline expectations, and clearly defined client-vendor relationship. With its capability to combine business processes and information system into one integrated system, the ERP systems have become a popular IT solution in many organizations [13]. As it is widely known, recent literature has highlighted numerous cases of failure amongst companies that implemented ERP systems. Organizations in Thailand are less geared-up to embrace change and follow Change Management principles in business process workflow compared to organizations in developed nations. In the current business world, change is inevitable.

Zafar [9] in his study declares that resistance to change is negatively related to achievement of predetermined goals and user satisfaction.

This study shows that there are huge cultural differences between the country from which the effort is led (in most cases from Europe or North America) and the country to which the implementation is rolled out (in this case – Thailand). The most successful models involve key individuals from every location in the ERP development process as early as possible. However, failure of such has been identified in many organizations in Thailand. The problems underlying the disappointing results of ERP implementation are multiplied manifold. They are not only related to technical implementation, e.g., inadequate definition of functional requirements, underestimating the difficulties related to legacy closing, errors in the choice of ERP software, etc., but also to organizational implementation, e.g., lack of commitment on the part of top management, lack of involvement of end-users and their consequent resistance to change, etc. [1]. However, there has not been clear understanding on cultural issues and user readiness considering ERP as a business transformation project, and not as an IT project alone. Numerous studies in the ERP field suggests that inadequate IT Infrastructure, governmental policies, small size of companies, lack of IT/ERP experience, and low IT maturity seriously affect the adoption decision in Thailand and other developing countries [2].

Relevant studies show that the SME operators have struggled to obtain funding from the creditable banks or to register with the stock exchange. Registering with the stock exchange allows the SME to reap the many benefits of acquiring sources for long-term capital, enhancing positive public image, becoming a catalyst for attracting foreign partnership, being perceived with management accountability and professionalism, raising employee morale, and upholding credibility in tax privileges on dividends [14].

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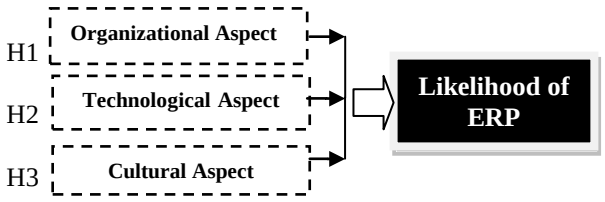

Fig. 1 Research Model

Hence, this study has empirically tested the aforementioned criteria using diagnostic approach and data collection techniques to infer the results, which indicate that less internal resistance, involvement of users in decision making process from an early stage, top management support, vendors understanding of cultural tendencies and language differences, and representation of both client and vendor at each stage of implementations lead to better success rate of ERP implementation within organizations in Thailand.

II. Literature Review

A. Larger company's adoption of ERP systems is more considerable whereas the Small and Medium size companies feel more comfortable with the use of legacy systems:

As Jau-Rong Chen [3] also points out that the processes of ERP implementation refers to the actions, reactions, and interactions of the various interested parties as they seek to make a commitment to allocate corporate resources. The context includes the outer context, which refers to the national economic, social, and political contexts of an organization, and the inner context, which refers to the ongoing strategy, structure, culture, management, and political process of an organization. These dimensions help shape the process of ERP implementation. Large companies in Thailand mostly adopt ERP systems for a variety of reasons; these include replacing legacy systems, system simplification and improvement, process and operations development, reducing costs of information systems, and competitive pressures. While most of the head offices operate from outside the region, the work processes have standardized rules and business practices embodied into the organization.

Small and medium sized enterprises (SMEs) in Thailand face a dilemma of having to work with legacy systems, and partially still being dependent on paper based methods of accomplishing tasks. The reasons for low adoption of ERP systems in SME appear to be as follows: ERP systems are very expensive and these companies don't have the budget to acquire the know-how of fully utilizing such systems. Business processes are not standardized across all departments and offices. The complexities of business legacy systems must be successfully managed. Customizing an ERP system has been associated with increase IT costs, longer implementation time, and inability to benefit from vendor's software maintenance and upgrades [4]. Therefore, we can formulate the following hypothesis:

H1: ERP implementation has a positive correlation with the organizational size.

B. Lack of ERP experience and low IT Maturity within small and medium organizations in Thailand inhibits adoption of ERP systems.

In general, awareness of ERP software is very low in Thailand. Very few local organizations have adopted ERP solutions with sufficient number of modules that leads to a successfully integrated environment. The alignment of IT planning with subsequent knowledge sharing to achieve organizational objective has consistently been among the top concerns for IT Managers and Business Executives. For example, researchers (Madapusi and D'Souza, 2005; Wei et al., 2005) suggest that misalignment can hamper a firm's effort to effectively control and coordinate its business activities [5]. As a representative of ABC company states, "The pre-implementation strategy includes activities such as business planning, clearly laid out work procedure, complete gap analysis, user acceptance, and most importantly high level of IT maturity for an organization to lead the business transformation. The luxury of simplifying complex work flow is not an option available to SME in Thailand that lack ERP experience and pose an overall low IT Maturity score." The SME either do not have sufficient resources or are not willing to commit considerable portion of their resources due to implementation time being longer and high fees being associated with it. Hence, the cost of ERP package can also be taken as crucial issue towards successful implementation of ERP. The compatibility of technology and company's need must be carefully addressed as ERP project involves a complex transition from legacy information systems and business processes to an integrated IT infrastructure [6]. Therefore, we can formulate the following hypothesis:

H2: Organizational size has a strong positive correlation with the IT Maturity level of the company.

C. Cultural tendency of Thailand evident at organizational level is not ready to accept the culture imposed by ERP software.

Thailand has a centralized labor-intensive system of management where managers rely on various types of paper-based reports, manual authorization, unstructured decision making, changing roles, etc. Thailand as whole has not developed a uniform level of business norms and practices compared with the West. ERP systems demand modern management concepts and value using online services and highly structured processes, data, and roles. A representative of XYZ company states, "The implementation success in developing countries does not really depend on the fact that they are a 'developing status', but rather that there are huge differences in national cultures between the country from which the effort is led, in most cases the western countries, and the country to which the implementation is rolled out." Increasingly due to integrative nature of ERP systems and their ability to incorporate 'best business' practice, many large corporations are using these systems to underpin their international expansion. The systems can facilitate the control and coordination of various international operations in real time. This coordination and control can occur through the implementation of standardized business practices,

independent of location, language, time and currency [7]-[8]. Therefore, we can formulate the following hypothesis:

H3: A cultural variation between vendors and users within an organization has a strong impact on internal resistance and decision-making process.

III. Research Methodology

To analyze the hypotheses, we used statistical inference to analyze the subjective reasons for those failures and identify the critical success factors (CSF) for the successful implementation in Thailand. The organization size is based on the number of employees and the business size has been categorized as small (<250), medium (<500), and large (>1000). Data were obtained and analyzed in the following manner.

A. Data Collection

This study takes a qualitative and exploratory approach that entails in-depth relationship with organization size, IT maturity, budget constraints, organization culture, and internal resistance. In order to use that relationship to analyze the likelihood of ERP implementation within those organizations, semi-structured interviews with business experts, and over 325 questionnaires were sent to 65 organizations. The questionnaires were sent to companies in Thailand within varying industries including Financial institutions, FMCGs, Oil & Gas, Consulting, Retailers, Manufacturers, Educational institutions, Merchants, etc. The experts were IT consultants, Managers, Business Analysts, ERP program managers, and other IT specialists. We received 71% responses (231 responses) from those questionnaires. Assuming a sampling error of +/- 3%, we have been able to conservatively use 221 of those responses (95 Small, 65 Medium, and 61 Large) to diagnose hypotheses 1, 2 and 3. We considered a random sample of companies within the Stock Exchange of Thailand (SET 100), multinational companies operating within Thailand, and Thai SMEs.

IV. Data Analysis

With sample size n > 60, we used the sample mean (Equation 1) and sample standard deviation (Equations 2 and 3; standard error of the sample mean) of the relationship between (1) organization size and number of firms within those categories to have ERP already implemented *(H1);*(2) organization size and the mean derived for IT maturity within those sized firms *(H2);* and (3) IT score of respondents and the frequency that score was given by respondents of specific firms *(H3)* to understand the range within which the population data would fit in.

$$\overline{X} = \left(\sum_{i=1}^{n} \frac{x_i}{n} \right) \quad (1)$$

$$S_x = \frac{\sigma_x}{\sqrt{n}} \quad (2)$$

$$\sigma_x = S_x \sqrt{n} \quad (3)$$

Using sample standard deviation (S_x) to compute the population standard deviation (σ_x)]. The reliability of data was determined through the 95 percent Confidence Interval (Equation 4).

$$= \overline{X}_{97.5} - \overline{X}_{2.5} ;$$

$$= \left[\mu_x + \left(\frac{Z\sigma_X}{\sqrt{n}} \right) \right] - \left[\mu_x - \left(\frac{Z\sigma_X}{\sqrt{n}} \right) \right] ; \quad Z = 1.960$$

$$= \left[\mu_x + \left(\frac{1.960\sigma_x}{\sqrt{n}} \right) \right] - \left[\mu_x - \left(\frac{1.960\sigma_x}{\sqrt{n}} \right) \right] \quad (4)$$

Where $\overline{X}_{97.5}$ is the upper bound of the confidence interval and $\overline{X}_{2.5}$ is the lower bound of the confidence interval; Z = 1.960 is computed by converting the interval probability to the normal standard distribution.

Table I shows the chi-square test results. It shows the values -17.63 and 21.75 in IT rating of small organizations and large organizations, respectively. The former falls out of the confidence interval range, denoting that the companies do not have proper standard and IT procedures and thereby score low on IT rating. However, the latter shows the high score on IT rating and satisfies the variation of confidence interval. This clearly indicates technological maturity within an organization with standardized procedures and workflow.

IV. Results

Using Chi Square test, we tested all the observations to reject (Type 1 Error) the Null Hypothesis, thereby proving our hypothesis by showing a significant difference between observed frequencies and expected numbers at each organization category of small, medium, and large. Chi square ($\chi 2$) for all Small (S), Medium (M), and Large (L) organizations at 0.05 significance level with degree of freedom (df)=4 is more than 9.49, and at 0.01 significance level with df=4 is more than s3.28 as shown in Table 1.

Table II gives the quantitative explanation that proves the date supporting each hypothesis. The frequency of responses for each rating is shown in Fig. 2.

Table I show that the chi square test was employed to estimate the statistical hypothesis test to reject the null hypothesis. This proves the adoption of ERP systems in large companies (H1), while IT maturity and lack of ERP experience inhibits adoption of ERP systems in SME's.

TABLE I
CHI SQUARE TEST

	NO. OF OBSERVATION (O)				EXPECTED FREQUENCY (E)			O-E				$(O-E)^2/E$		
RATING	S	M	L	TOTAL	S	M	L	S	M	L		S	M	L
1	7	0	0	7	3.01	2.06	1.93	3.99	-2.06	-1.93		5.29	2.06	1.93
2	54	14	3	71	30.52	20.88	19.60	23.48	-6.88	-16.60		18.06	2.27	14.06
3	22	27	4	53	22.78	15.59	14.63	-0.78	11.41	-10.63		0.03	8.35	7.72
4	9	14	19	42	18.05	12.36	11.59	-9.05	1.65	7.41		4.54	0.22	4.73
5	3	10	35	48	20.60	14.12	13.25	-17.63	-4.12	21.75		15.07	1.20	35.71
Total	95	65	61	221							$\chi 2$	42.99	14.10	64.15

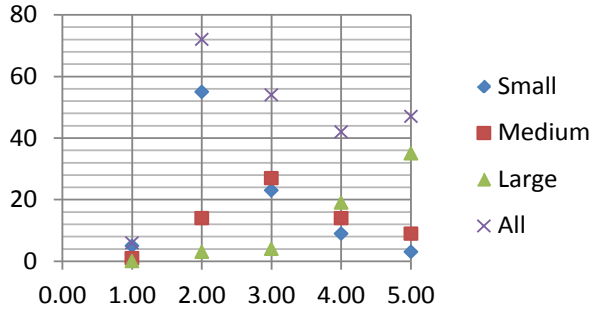

Fig. 2 Frequency of IT maturity rating at each level

The average IT rating score for SMEs together has been 2.79 out of maximum rating of 5, whereas large firms have shown much higher maturity with a rating of 4.41 out of 5. The average IT maturity score relative to size of the organization is depicted in Fig. 3.

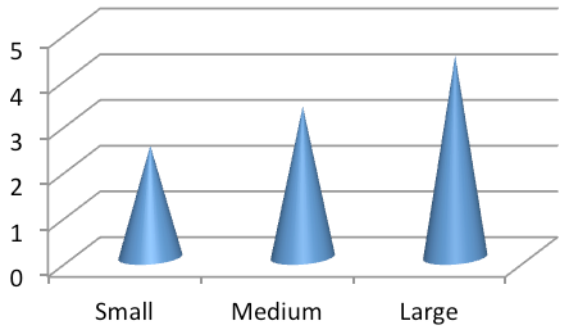

Fig. 3 Average IT maturity at each organizational size category

The variation in slope in Fig. 4 clearly shows that the maturity gap between SMEs and large corporations in Thailand is much higher than the maturity gap between SMEs and large corporations in North America, explaining the low likelihood of ERP implementation in Thailand.

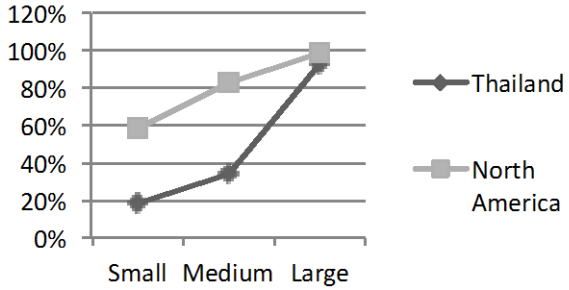

Fig. 4 Percentage of companies at each organizational size category to have ERP implemented; Comparison between North America and Thailand

Table II defines the analysis of the problems facing the majority of the firms in Thailand. It helps us see beyond the numbers into the actual problems that causes those disparities in the numbers (Fig. 2-4), thereby, confirming the hypotheses.

TABLE II
CSF'S IN ERP IMPLEMENTATION; HYPOTHESES SUPPORT.

CRITICAL SUCCESS FACTORS	ORGANIZATION SIZE (S, M, L)	AS % OF TOTAL FIRMS WITHIN THAT SIZE RANGE	STANDARD DEVIATION	HYPOTHESIS
DOCUMENTED BUSINESS PROCESSES	S M L	62 75 83	1.06 0.95 0.89	N/A
USER TRAINING AND EDUCATION	S M L	58 61 78	1.25 1.21 0.96	N/A
USER INVOLVEMENT AT EARLY STAGE OF IMPLEMENTATION	S M L	70 66 48	1.25 0.91 1.23	N/A
LEVEL OF IT MATURITY	S M L	49 66 88	0.87 0.97 0.81	SUPPORTED (H2)
TOP MANAGEMENT SUPPORT	S M L	57.38 76.47 92.81	N/A	N/A
FIRMS WITH ERP SYSTEMS	S M L	18.00 34.00 93.00	N/A	SUPPORTED (H1)
CULTURAL ISSUES RESULTING IN PROJECT DELAYS*	S M L	71.43 40.00 33.33	N/A	SUPPORTED (H3)
INTERNAL RESISTANCE TO CHANGES*	S M L	68.40 61.54 43.47	N/A	SUPPORTED (H3)

*The link between cultural issues resulting in project delays and internal resistance to changes within individual organization size is evidence-supporting H3 combined. The higher the likelihood of cultural issues, the higher the internal resistance to changes within the firms in that organization size category.

The empirical results suggest that small and medium companies have 'documented business processes' ranging from 60% to 75%. However, large companies have 83% processes and procedures well formed. In the questionnaire, response variables concerning business processes are considered standardized on the basis of several factors including process documentation, consistence IT support, skills defined, process involvement, and value chain modeling. The importance of user trainings and education (also relevance towards meetings, trainings, and workshops) in small and medium companies is as low as 58% and 61%. Large companies however have a considerable 78% of user training importance. Even though large companies postulate positive impact on business improvement, user involvement at early stage of implementation is not considered as an important factor for mostly all the companies in Thailand. The proposed research further suggests that 57% of small companies and 76% of medium companies have top management support in comparison with 93% of large companies.

The critical success factors were clearly identified in this study. The study elicited a broad spectrum of factors ranging from large organizations and SME's. The following factors that prominently influence for large companies and SMEs are as follows:

i. Business vision and strategy: ERP implementation requires clear definition of vision, goal, and business plan in line with company's strategic business goal, stipulating the benefits, resources, costs, risks as well as project timeline.

ii. Top management support: Top Management support plays the most important role in the successful implementation of ERP system, wherein it has to realize the effect of ERP implementation and empower the project team.

iii. User training and education: extensive user training and education are one of the most critical factors for ERP implementation. Proper trainings, manuals, and educations should be performed as a pre-implementation activity for successful implementation.

iv. IT Maturity: Increase level of IT maturity such as innovative approach, IT processes, and work flow are important components for business growth and strategy. In ERP implementation, the computer technology is necessary and business operation processes must be understood.

v. Change Management: ERP implementation inevitably leads to change management program. Change Management involves balancing of forces to support of change over forces against change.

vi. User involvement at an early stage: active user involvement in the design and implementation often leads to user acceptance and facilitate the desired transformation and adoption for the new system.

V. Conclusion and Future Work

This research focuses on three dimensions, namely, organizational aspect, technological aspect and cultural aspect. Organizational size has a significant impact on ERP adoption, which may differ in cultural, economic, and regulatory context. We have found that Thai companies need pay more attention on business process reengineering and change management programs than their Western competitors.

In the SME's of Thailand, the low management base, limit investment on information systems, and absence of information technology engineers counterwork the application of large and high-end ERP systems in large corporations. Adoption of middle or low ERP systems in SME's is the right choice. From the finding results, the comparison shows the difference between the ERP adoption in North America and Thailand and explains that higher cultural issues result in higher resistance and therefore resonates with the low ERP adoption. This study lists top management support, IT maturity, business vision and strategy, user training and education, change management, and user involvement at an early stage as important prerequisites for improved implementation strategies of ERP systems. Finally, standardization in processes, increasing productivity, improvement in communication and information flow should be included in expectations from ERP systems. The obtained results can be used as facts and rules to build knowledge-based systems for ERP selection and implementation.

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