# Best Practice Matrix for ERP System Implementation

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***Abstract*—This paper aims at approaching a matrix for the best practice of ERP system implementation. The conceptual model in this research paper model comprises several significant dimensions for instance, management level, type of industry, region, in-house vs. outsource, size, phase of implementation, and ERP persuasive derivation, and etc., which are crossed with several CSFs (Critical Success Factors) models. Additionally, this paper includes a case study of realistic ERP system implementation from Thai logistic business as a single case analysis research model, in order to focus on the study of how and why the ERP system has been implemented from contemporary event.**

***Keywords— ERP; Best Practice; Matrix; CSFs***

## I. INTRODUCTION

There have been massive research studies on successful ERP (Enterprise Resource Planning) system implementation. Many researchers try to develop the successful ERP implementation models. Some of them are seeking for success factors for ERP system implementation. Since, ERP has played a significant role on being a tool for the organization's competitive advantage, not only in the large-scale enterprise, but also the small and medium enterprises. So that any organization that decides to implement ERP system to support organizational functions' automatic system for handling the planning and processing of transaction and resources accurately and efficiently, could have a roadmap and some alternatives to ensure the successful ERP system implementation. ERP system has been defined typically as a software package for business system that is used to facilitate and manage a corporation efficiently and effectively on the use of resources by providing a total integrated solution for handling any request on the organization's information processing through a consistence processed-oriented view across the company [20]. To successfully implement the ERP system from the beginning till the end, it requires both technical and operational skills and practices that are appropriate to each of the organizational structure and scenario. Moreover, the management of ERP implementation phases is important, as it requires technical and managerial ability of the team made up of people from the system integrator and the key-users of the company [7]. There are also many factors influencing ERP outcomes such as type of ERP producer, number of updated processes, and extent organizational change [11]. Nevertheless, some research papers had been studied about failure factors of ERP implementation. There are around 75 percent of ERP projects have been classified by Standish Group's report as failure. Poonam and Atul Garg, [26] studied on the critical failure factors of ERP implementation in Indian retail sector and suggested 9 critical failure items, such as inadequate resources, poor user involvement and etc. Furthermore, many researchers studied and analyzed several CSFs models for IS (Information System) implementation. For instance, Alberto Felice De Toni et al. [7], analyzed the main features of TTF (Task-Technology Fit) and TAM (Technology Acceptance Model). However, only two items out of all in those models had been used as the measurement of system's acceptance. Those are reliability and utility perceived by users.

With regards to various significant facets about ERP implementation, introducing above, this research paper was decided to develop a model entitled "Best Practice Matrix for ERP System Implementation" or BePMERSi, to be useful for any organization that decides to have an automated system or to have ERP system implementation. However, implementing ERP system is not an easy task to do. Since, the author had also experienced on the ERP system implementation in one logistic business. Therefore, this paper was decided to propose on the analysis of realistic case to focus more on the study of how and why the ERP system had been implemented from realistic situation.

Resulting this, to cope with the most possible dimensions related to ERP system implementation as introducing, the reviews of literature are as the followings; ERP implementation and strategy, CSFs models in ERP implementation, and background of a case study at KIAT (Kiattana Transport Public Co., Ltd.), which is a Thai logistics business.

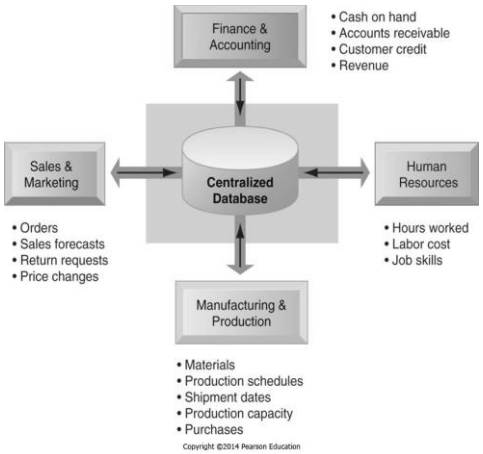
## II. LITERATURE REVIEW

### *A. ERP Implementation and Strategy*

During the past decades, several scholars argued and studied the concept of Enterprise Resource Planning (ERP) and the implementation of ERP system. Typically, ERP systems were potentially the mainstay of solutions integrating the various functional areas in an organization linking the whole supply chain [18], and ERP systems would be one of the most valuable investments in the business use of information, and improved process flow [8,13]. In addition, several firms believed that ERP systems were implemented in order to increase the operational excellences and efficiencies by collecting data from different key business processes and storing the data in the single data repository used by all functional areas of the businesses as shown in Figure 1 [14],

and such systems contained the capabilities to enable information to flow seamlessly throughout organizations, as well as providing management team with an enterprise-wide understanding of value creation and cost structure [2]. Furthermore, businesses expected the potential benefits from ERP implementation for an improvement in productivity, better warehouse management, and increases in efficiency, and so forth [7,17].

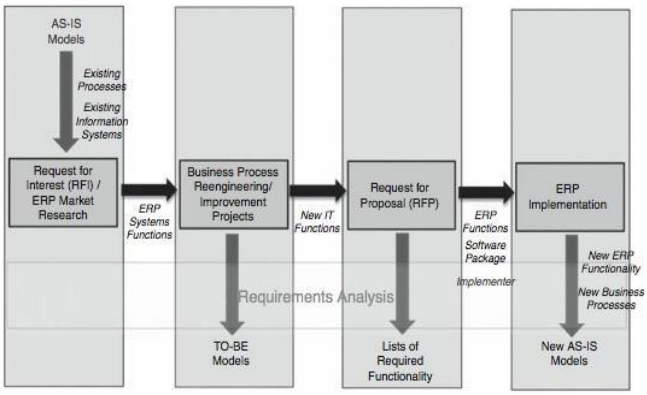
Fig. 1. Enterprise Resouce Planning (Laudon & Laudon, 2014)




Indeed, Momoh et al [18] argued that ERP implementations became the challenges for businesses in terms of cross-module integration, data tuning, the core business model adoption, well-managed implementation schedule, and the involvement of all stakeholders. Yu [31] also argued that less than 75 percent was effective in ERP implementation that implied 25 percent of the ERP investment would be wasted. Also, Krairojananan et al [13] proposed the evaluating factors of ERP system implementation (eFERSI) model that was derived from both front- and back-end systems of the organization. In sum, the front-end factors included the resistance to changes, timing for software usage allocation, user turnover, and user experiences. For the back-end factors, they comprised the intention to make gap for corruption, user background, as well as the user skills. Furthermore, Beheshti et al [3] conducted the case-based research, and revealed that firms deployed the ERP not only for improving operational excellences but being more responsive to the customer needs as well, and they suggested the identified and well-managed key elements at each phase of the implementation. For instance, the support of top management, which needed to be clearly communicated, played the vital role in the ERP implementation.

As one of the key elements in ERP implementation, change management became an important element to recognize the need to reduce the resistance to change from the user [18]. Thus, since the employees had the positive attitude toward change, each phase of the ERP implementation could be achieved from the engagement of the employees across the organization [3]. In addition, Panayiotou et al [23] argued that the requirements engineering framework consisted of four stages for effective requirements designed during the ERP development lifecycle (shown in Figure 2). During the first stage, the modeling of the existing procedures would be defined, including the enhancement of the "AS-IS process model" with desirable functions that served the business operations. For the second stage, the completion of the projects for the improvement in business processes would result in the generation of the future process model or "TO-BE models". In the third stage, the request for proposal (RFP) would be derived from the new business processes model from the second stage, including the activities that would be aligned with the required IT. Lastly, for the fourth stage, the system implementer followed the required functionality emerged from the requirements from the previous stages for the implementation of the selected ERP systems, and this became the "new AS-IS model". Moreover, they argued that it supported to stipulate the degree of adoption of ERP functionality, as well as ensuring that it would operate to be compatible with its unique business operations after the ERP implementation.

Fig. 2. The Applied Framework for Requirements Engineering in ERP Systems Development Life Cycle (Panayiotou et al, 2015)




Additionally, Nagpal et al [19] argued that ERP implementation strategies were categorized based on whether the requirement for ERP implementation of all organizational functions needed to be in one go or in groups as "Big Bang" or "Phased". For "Big Bang", all ERP modules were implemented in a single instant, maybe either at a pilot site or at all sites [22]. However, for "Phased", the implementation of ERP modules, as well as the site implementation, was in phased manner [15]. For instance, the core ERP modules would be implemented first, and then the implementation of peripheral modules would be followed. Nagpal et al [15] mentioned that Dante and Hussibuan (2011) compared two organizations using pilot implementation strategy; however, one organization decided to start implementing core ERP modules while it kept running the legacy system in parallel, and the other organization began implementing the ERP modules but stopped using the legacy system. They argued that former case required substantial customization whilst the latter case needed vital data analysis and migration. Accordingly, Nagpal et al [15] discussed that the analysis along-with the different alternatives that were available for selecting from different ERP implementation strategies and

their succeeding combinations had derived from a number of implementation plans for the ERP strategies. Nevertheless, a strategic management was needed to make decisions whether to develop and implement ERP from scratch using the typical organizational scenario or entail on consultants employing methodology by the ERP vendors. In sum, Nagpal et al [15] stated that ERP implementation strategy classification as "custom-made", "vendor-specific", and "consultant-specific", and mostly different strategies borrowed the Agile concept as best as they could. Broadly, the Agile development emphasized on brisk delivery of employed software by breaking large project into small sub-projects that would be accomplished in short period of time using iteration and persistent feedback [14]. Accordingly, the Agile method was consolidating into the ERP selection procedure, i.e. envision (creating an understanding of the objective as well as the breadth and depth of using such system), iterate (identifying the ERP solution that met user requirements), and decide (selecting any of the evaluated ERP solutions or not).

### *B. CSFs Model in ERP Implementation*

In the ERP system implementation, it is crucial to consider the critical point that influence the ERP success or failure. Momoh et al [18] suggested that 9 crucial factors in the ERP implementation failure included unnecessary customization, difficulties of in-house integration, poor understanding of business implications and requirements, absence of change management, poor data quality, misaligned information technology (IT) with business, hidden expenditures, inadequate training, and lack of support from senior management. Also, Dezdar and Sulaiman [8] categorized the critical success factors for ERP implementation into 3 categories related to ERP users, the organization, and ERP project since the ERP systems were different from other IT systems that the implementation of ERP involved the combination of technological, operational, managerial, strategic, and organizational related components. As a result, the success of ERP implementation in the "go-live" stage does not guarantee the success of the "ERP journey" of the organization such that the post-implementation or "post go-live" stage became the real challenge for managing the enterprise resources [13,24]. Besides that, lack of user involvement in the system development, as well as inadequate system training, were mentioned as the crucial factors for the failure in system implementation [3,8,14,17], including the way an ERP implementation took place; however, there were no standard instructions providing a comprehensive step-by-step ERP implementation strategy [19]. For that reason, the ERP implementation was normally depending on the plan developed by project manager in consultation with steering committee members; however, that might be able to lead to either the success in implementation or the ERP failure.

Nordin and Adegoke [22] discussed issues and challenges in ERP implementation confronted by SMEs that referred to six issues; i.e. business process re-engineering (BPR), senior management commitment and support, budgets, skilled manpower, data fill-in, and implementation-time. Also, they encapsulated the stages of successful ERP implementation into three stage strategies; pre-implementation or planning strategies, implementation strategies, and post-implementation strategies. In addition, post-implementation strategies were essential for the ERP systems acceptance, and the evaluation after the project had been implemented could be applied in order to measure the effectiveness of an ERP system. For that reason, the evaluation could offer the viable advancement to the system and procedures in staying away from failure in similar projects. De Toni et al [7] also mentioned that management team often had challenges on undesirable viewpoints from the users who resisted the implementation procedure, and they argued that the success in implementing ERP could be explained by Technology Acceptance Model (TAM) that aimed to examine how the acceptance of IT influenced the use of the technology itself, including its foundation on the notion that "perceived ease of use" and "perceived usefulness" determined the attitude towards the IT use. Hence, TAM showed relationships among IT experiences, attitudes, planned and actual behavior and aimed to measure computer anxiety. The failure in implementing ERP could be occurred since the end-users did not accept the system such that the user acceptance was compulsory in ERP implementation [27]. Consistently, Bento and Costa [4] suggested that the acceptance from the key users in the ERP implementation phase contributing to the ERP success. Besides, De Toni et al [7] also studied the Task-Technology Fit (TTF) model, as a practical measure of IT implementation success, examining the association between the effective use of IT and its performance via an analysis of the software functions and the user's perceived needs. In addition, TTF was the basis to study factors explaining the use of ERP and the relations with users' performance, as well as the relationship between the users' needs and the system functions. They also proposed that the implementation quality influenced the reliability and utility of the ERP perceived by the users more than the software quality. Nevertheless, DeLone and McLean [1, 6] suggested the D&M IS success model initialized in 1992 and the updated D&M IS success model in 2003 for conceptualizing and operationalizing IS success as system quality, information quality, and service quality shaping the system use and user's satisfaction, which in turn having the influence on the net benefits, which were the most important success measures for the user acceptance of the technology in the EPR implementation [5,7].

### *C. Background of a Case Study: KIAT (Kiattana Transport Public Co., Ltd.)*

This company was established in 1994 as a private company (Kiattana Transport Co., Ltd.) [32] to serve transportation needs for their clients. In addition, KIAT aimed to provide high quality logistics services for hazardous goods, and comply to be accredited from the international standards (e.g. International Standardization for Organization or ISO). Since then, KIAT also expanded their services, such as warehousing. At present, KIAT has central office in Nonthaburi Province, and 6 branch sites in various regions such as the northern, northeastern, central, and the eastern of

Thailand. To support the business expansion, KIAT management decided to adopt the ERP system, as well as the purpose of being listed in Stock Exchange of Thailand (SET). Hence, KIAT needed to study heavily in the ERP implementation.

## III. Research Methodology

### *A. Research Model Design*

Eisenhardt [9] studied the roadmap for building theories from case study researches involving single and multiple units analysis that could be used as the valuable guides for a case study approach. Eisenhardt's [9] roadmap comprised either single or multiple levels of analysis within a case study using for analyzing both qualitative and quantitative data. Table I showed the precise version of building theory [25, 29].

TABLE I. Precise Version of Eisenhardt's (1989) Roadmap of Building Theory

| Step | Activity |
|---|---|
| Getting Started | Definition of research question |
| Selecting Cases | No theory/hypothesis<br>Selective population, not random sampling |
| Crafting Instruments and Protocols | Multiple data collection methods<br>Qualitative and/or quantitative data<br>Multiple investigators |
| Entering the Field | Overlap data collection and analysis<br>Flexible and opportunistic data collection methods |
| Analyzing Data | Within-case or cross-case analysis |
| Shaping Hypotheses | Iterative tabulation of evidence<br>Replication logic across cases<br>Search evidence for "why" behind relationships |
| Enfolding Literature | Comparison with conflicting and similar literature |
| Reaching Closure | Theoretical saturation when possible |

Yin [30] argued that a case study research was suitable for answering the "how" and "why" research questions, and a case study was an empirical inquiry for exploring a fashionable occurrence in depth and within its real practices, particularly then the borderlines between phenomenon and context were not clear. In sum, the case study method would be used to study and understand a real-life situation but such understanding encompassed vital contextual settings since they were thoroughly relevant to the situation of study [21, 30]. Ellram [10] mentioned that the case study analysis was an "iterative process", resulting in either the depth or strong point of explanation growing, and case studies were outstanding for theory building, and providing comprehensive clarification of "best practices", and understanding of data collected since case study was already the examination of an instance in action [12,16].

Regarding to the intensive studies of numerous theories in the literature review to collect the data about dimensions and success factors model of the ERP implementation and the above theory of research model design's justification, the author had tried to build a model for the best practice matrix of ERP system implementation by applying and adapting from Table I. Additionally, this paper has been decided to include a case study of realistic ERP system implementation from KIAT which is Thai logistic business as a single case analysis research model, in order to focus on the study of how and why the ERP system has been implemented in the real case situation.

### *B. Proposed Model*

Encapsulating various facets, derived from the literature review performed on the CSFs assessment models of ERP system implementation, data from the studies have been compiled as a matrix to be considered as best practice illustrating in Table IV; Typical BePMERSi, including its taxonomy in Table V; BePMERSi Taxonomy.

In order to identify and focus on the particular and correct critical point in measuring the success of ERP implementation, BePMERSi proposes the assessment model to measure different aspects of the dimensions. They are generic CSFs, TAM, TTF, D&M and UAM [4,5,6,7,13,18,19,22,27]. Firstly, CSFs model shows the generic determinants for all dimensions to be measured. This could be a model for assessing or using in an exploratory study or research in which no scenario shows any significant or critical point. Secondly, TAM is an assessment model that focuses on the critical point related to the technological aspects, which have been approached in the system employment and accepted by the users using the acquired technology. Thirdly, TTF is the model required for measuring the model fit between tasks and technology employment regarding ERP modules function so that all tasks could be performed and handled by acquired technology appropriately [7]. Fourthly, D&M is considered as a generic assessment model that is focused on the input, processing, and output of IS [6]. Thus, measuring this model focuses on the accuracy of data entering into the ERP systems, the processing steps, and information generated from ERP modules functions. Lastly, UAM is a model required for assessing users' perception on the ERP system implementation for any organization that considers the critical point of system has been on the user acceptance [7].

Regarding to each particular assessment model, BePMERSi provides fifteen dimensions for cross analysis with the model depending on each of the model's characteristics and significance of the critical points on the ERP system implementation dimensions from D1 to D15. They are as follows; Management Level (Top , Middle, and Operational Management), Industry Type (Manufacturing and Non-manufacturing), Organization Size ( SMEs and Large Corporation), In-house/Outsource (SW (Software), HW (Hardware), and People-ware (Consultant), Phase of Implementation (Pre, During and Post Implementation), Persuasive Derivation (Top Management objective, Work problems, and Regulation Compliance), Time, Region, Legacy System, Implementation Strategy (Big Bang, Parallel, and Pilot Project), Number of ERP Modules to be Implemented, Culture (Country and Organization), Type of Source Code (Closed Source and Open Source), ERP Project Team, and BPR. In this regard, Table V; BePMERSi Taxonomy is provided to illustrate the dimensions abbreviation and their corresponding categories in Table IV; Typical BePMERSi.

In contrary to the above explanation on the employment of the model, BePMERSi could be used to measure with the focus

on the ERP system implementation (D5) by considering any model required in each phase of implementation, for example. So that the ERP project team could have some plans to cover all scenarios happened through all three phases of the implementation. That is the pre-implementation (D5-1) requires all except TTF model in order to consider users and technology acceptance determinant including data and system requirement from TAM, UAM, and D&M respectively, have been significant to be considered during this phase of implementation since the acquisition of technology (ERP software, hardware, and infrastructure) required to be considered carefully. Next, during implementation (D5-2) requires only TTF model. Since, this phase deals with the technology employment. Determining the tasks performed by the users is required by measuring their performance working in the system. Lastly, post-implementation (D5-3) requires all except UAM. This phase needs to determine the results of the prior phases, which are the output accuracy, the acceptance of technology, and performance of users in the new system.

However, the deployment of BePMERSi model needs to be determined by the project team on the consideration whether the best practice in each implementation should be drawn up by any scenario.

TABLE II. MASTER PLAN FOR THE IMPLEMENTATION OF KIAT ERP

| Master Plan for the Implementation of KIAT ERP | | | |
|---|---|---|---|
| *Implementation Phase*\Time | Start | Finish | Time consumed(month) |
| *Phase I : Pre*<br>-Recruitment : consult team, ERP and network admin, and IT support<br>-Vendor selection; SW, HW, and network infrastructure | <br>Mar 2010,<br>Apr 2010<br><br>Aug 2010 | <br>April 2010,<br>July 2010<br><br>Dec 2010 | <br>2<br>4<br><br>4 |
| -Plan & scope | Feb 2011 | Mar 2011 | 2 |
| -Analysis and Design | Feb 2011 | Jun 2011 | 5 |
| -Development and Testing | Jun 2011 | Aug 2011 | 3 |
| | | | |
| *Phase II : During*<br>- Deployment/Go-Live | <br>Aug 2011 | <br>Mar 2012 | <br>8** |
| | | | |
| *Phase III: Post* | | | |
| -Assessment and maintenance/Go-Live support | Apr 2012 | Nov 2012 | 8 |
| ** There was flood crisis in the central region of Thailand and at the company's location during this period (Oct-Nov 2011). | | | |

TABLE III. ERP MODULES AND FUNCTIONS

| ERP Modules | Vertical Logistics System |
|---|---|
| In standard ERP package<br>▪ General Ledger<br>▪ Sales & Purchase<br>▪ Payable & Receivable<br>▪ Inventory Management<br>▪ Fixed Assets<br>▪ Cash Management | Transportation management<br>▪ PM (Preventive Maintenance);Tire & Vehicle System<br>▪ Jet Report |

### *C. Case Study on ERP Implementation at KIAT*

As mentioning in the company background, KIAT persuasive derivation on the ERP implementation was from the company objective on business expansion and compliance with SET. Therefore, the company was seeking for the provider or developer for ERP implementation. Firstly, KIAT began to have a system development by outsourcing one system development company to develop and implement ERP system by coding a program. There was no consultant in this first move on the ERP implementation. The time spending for this development (only three modules which included inventory, maintenance and fleet management) was not up to one year, as the ERP system developed by this software development company was failed to handle the tasks and functions.

Regarding to this bad experience, KIAT changed the strategy to have an ERP consulting service. So, the consulting team was formed at the beginning of Phase I in the new ERP system implementation. At the beginning, the consulting team had started to do an exploratory research to determine the real need of the company regarding tasks and legacy systems [25]. The findings had been used as the criteria for vendor selection of all software, hardware, and network infrastructure. All job functions at all sites including host office had been determined in order to be the information for the acquisition of the required software, hardware, and network infrastructure appropriately. Due to different branch sites have been located on different regions, the criteria in choosing and employing the ICT (Information Communication Technology) have been different. For instance, the acquisition of internet service from any ISP (Internet Service Provider), need to be considered carefully. Same ISP company might provide different quality of services at different regions. This had been found out at KIAT in some branch sites, due to the lacking of experience and capability of the ISP technicians. So the consulting team needed to seek for the most efficient ISP for serving in each site and region individually. Some branch sites had got an unstable and poor internet signal, as they were located on the location that were very far from the internet node location and some were located on the road that were under reconstructing such as Samut Prakarn site.

Since KIAT decided to have fully automated system and also needed to serve the significant customer such as PTT (Petroleum Authority of Thailand) at all requirements, especially the most up to date information. The internet service and some other infrastructure are considered the critical point to the success of such required automated system of the ERP implementation. The study on both sides; KIAT and the providers, at every branch site had been determined and decided at each individual location in order to get the most suitable one for supporting the ERP system network communication efficiently.

Additionally, planning and scope, including analysis and design had also used the research findings mentioning above, as the criteria to do crosscheck and compared with the vendor's design and development. All these activities had been under the consulting team monitoring and controlling. In

the last step of Phase I, they were development and testing. Since, KIAT users have been at different locations and regions, organizing the ERP project team needed to set up a team of key users from each branch sites for the development and implementation activities at the host office. Especially, last testing required all users at all sites, and host office to get into the system and work simultaneously in order to ensure the system capability on handling the system processing smoothly at the peak time.

In Phase II, the deployment or go-live, there was a flood crisis in the central region of Thailand. The company host office was flooded since it had been located on the bank of Chao Phraya River. The main servers of ERP system and database had been urgently moved to the standby location near Central Chidlom office building.

Moreover, some user resistance problem occurred. As in some steps of the system, it was necessary to have a BPR. Some users who were in these changes generated some resistance. Therefore, the consulting team had done an exploratory research to find out the obstacles and vulnerable points from the system.

In addition to the above issues regarding the flood disaster and user resistance, another issue happened during this phase was dealing with the increase on management requirement to have a bar coding system. Due to the scope and contract between KIAT and the software vendor company which had not included such system since the beginning. Also this system was not dealt with the functions supporting the core services of the company. Regarding this scenario, all of the tasks and functions had already been determined and prioritized with all ERP standard modules and functions including the vertical logistic system at the beginning. And it might cause some difficulties on the activities and specified time in the master plan. However, the consulting team needed to convince KIAT ERP project team that bar coding system could be added later after achieving all requirements of the implementation as mentioned in the contract earlier.

Lastly, in Phase III, the results or findings of the above exploratory research had been used to modify and provide maintenance of go-live support, and again, a research on the ERP post-implementation had been conducted for the assessment of the system in the operational management in order to find out the determinants of successful ERP implementation [13]. So that, success and failure could be determined and taken action for better system performance later. The time of all three phases of KIAT ERP implementation and ERP module functions, both standard modules and vertical built-in functions were shown on Table II; Master Plan for the Implementation at KIAT, and Table III; ERP Modules and Functions, respectively.

As shown on Table III, ERP modules from standard packages are accounting and financial management, sale and purchase, and inventory management. Since, the core services were dealing with high quality transportation of hazardous goods, there were some functions required as vertical logistic system containing PM (Preventive Maintenance; tire and vehicle system). Also, to support the top and middle level of management for the decision making, Jet report generating had been required to generate and serve both periodical and ad hoc report to both levels. These are very significant for the company tactic and strategic planning decided in the meeting of the management team.

Finally, KIAT achieved all requirements decided to get from the ERP implementation under the specified time in the master plan. The three phases of ERP system had been implemented successfully within two years and nine months.

### *D. Analysis of Case Study on ERP Implementation: Relevance of the Proposed Model to the Case Study (KIAT BePMERSi)*

From the above case study, KIAT's first ERP implementation was failed, due to lacking of IT specialist, and ERP consulting team. The author had been invited to be a steering committee and formed a consulting team to run this ERP system implementation at KIAT (Nainapalert, Confirmation on the request for research information, August 24, 2015).

There were two published researches in the pre-implementation and post implementation, and one unpublished exploratory research had been conducted during the implementation to serve iterative processes on system assessment and implementation.

The first published research was an action research conducted to determine the real need of the company regarding tasks and legacy systems. The consulting team traveled to each branch site in order to study the different environment and situation including culture in each region. Moreover, it was to ensure the data collection to be accurate as required for each question in the questionnaire. Some users provided the information different from what really happened to the tasks and system operations. The key users had been interviewed by using the questionnaire. Only the site manager of each branch, the personal interview had been used to collect the data.

The second research was an unpublished one. Since, it was decided to find out the obstacle and vulnerability of the system which were dealing with the confidential information of the company. But these findings were very useful for the system, both during implementation and post implementation.

The last published research was also conducted as an action research to determine the work performance in the operational level of the system, and to make sure that all ERP modules and functions including network infrastructure had worked in the ERP system post implementation properly and efficiently. Since, the number of license for using the ERP software was less than the actual number of all users, due to the different time the users were working and accessing into the ERP system. This was one of the BPR that had been decided to manage the waste time in accessing into the system. Each user could have some certain time specified in using the ERP system. Any authorized user had left the system idled, the system will generate the authorization to the others who have made a request for sharing or using the system automatically. The time for checking the idle system had been announced to

all users at all branch sites. So that, users resistant about this scenario could be reduced.

Regarding to all researches mentioning above, findings from each research was helpful for being information support to generate best practices in the implementation. The time consumed in each phase of implementation could be controlled in accordance with the master plan set up. One of the determinant factors requested by top management to be complied with SET regulations for measuring the success of KIAT ERP implementation is to have an accurate financial reports generated in a timely manner.

Derived from KIAT BePMERSi, KIAT at that time also had some legacy systems (D9). However, new ICT acquisition was also required. Moreover, the outsourcing (D4-2) was also required to have not only SW, HW but also a consulting team, as shown on Table VI; KIAT BePMERSi. The critical points to be measured on technology and user acceptance are necessary to prevent different and inappropriate platform of SW, HW, and infrastructure are significant for the ERP system acquisition.

Referred to D8, D10-1, and D10-2, since KIAT has several branch sites in various regions of Thailand, the implementation strategy decided to use a hybrid strategy; big bang and parallel. The Big bang strategy had been employed by implementing all modules in the ERP systems at all sites simultaneously, including the host office. In parallel, KIAT also kept running the system manually so that result from the traditional system could be used for checking with the new system implementation. Also, to serve some significant customers such as PTT to cover all requirements, some business processes were needed to be redesigned (D15).

In sum, all of these significant dimensions (D4-2, D8, D9, D10-1, D10-2 and D15) , according to KIAT BePMERSi, were considered to be the critical points in all assessment models to be determined for ensuring the successful implementation of the system.

Moreover, to keep up with more assessing on the next lower level of significant dimensions, D1-1, D5-1, D5-3, and D11 are the dimensions to be considered. The other models are required except TTF model in the two dimensions which are top level of management (D1-1) and ERP pre-implementation (D5-1). Since, measuring how technology fit the tasks in the firm was not related to this level of management. It was also not applicable to the pre-implementation, since there was no employment of technology occurred during this phase.

Next in the post-implementation (D5-3), all assessment model were required except UAM. Since, determining user acceptance had been done in the pre-implementation phase of the system in order to prevent user resistance from the beginning.

Lastly, about the number of ERP modules dimension (D11), all assessment models were required for determining this, except D&M model. Since, any number of ERP modules implemented, by having well development and implementation, the system would generate the input and output including processing step accurately.

## IV. Conclusion and Reccomendation

Since, ERP system had not been widely implemented in Thailand [13], especially, for the SMEs. Due to the early ERP software that had been developed specifically for the large-scale enterprises [28], in this scenario, research based case study is significant and required to draw up the practices that leads to the successful implementation of ERP system. From KIAT BePMERSi as shown on Table VI, it illustrates why and how the practices have been drawn up from the analysis of critical point related to each of the dimension from the typical BePMERSi and KIAT ERP implementation.

It is important to each of the ERP system to have some best practices to be a guideline to ensure the success of implementation. So that, the project team in any organization could avoid trial and error to decrease the chance of failure on the implementation. BePMERSi has been drawn up as the matrix illustrating several dimensions of ERP implementation to be considered together with the critical points of each assessment model crosschecking with the dimensions as specified. Regarding the deployment of BePMERSi, any concern to the success of the implementation on any critical points will be chosen to be reviewed and contributed enough efforts for driving the system to be implemented successfully. For any company who may have any critical points that might not be clear, BePMERSi could be one of the best practice to serve ERP project team to design the step or process covering all critical success points whilst excluded vulnerabilities in the system implementation, and in order to make a plan and activity to prevent from the failure implementation.

However, for those who require a quick tool for doing an ERP system assessment and want to get into the specific critical points of each assessment model of the implementation, BePMERSi could help leading to certain practices for ensuring the successful implementation of ERP system in each of the iterative process.

Lastly, further research study should include details on assessment model regarding the determinant factors in order to clearly illustrate on each particular dimensions and sub-dimensions to get into deeper analysis. Additionally, multiple cases analysis would be required to generate the comparison among those cases when applying BePMERSi for identifying critical aspects and generate best practices to prevent any bias from the research analysis.

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TABLE IV. TYPICAL BEPMERSI

| Assess Mod | D1 | | | D2 | | D3 | | D4 | | D5 | | | D6 | | | D7 | D8 | D9 | D10 | | | D11 | D12 | | D13 | | D14 | D15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | D1-1 | D1-2 | D1-3 | D2-1 | D2-2 | D3-1 | D3-2 | D4-1 | D4-2 | D5-1 | D5-2 | D5-3 | D6-1 | D6-2 | D6-3 | | | | D10-1 | D10-2 | D10-3 | | D12-1 | D12-2 | D13-1 | D13-2 | | |
| CSF | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| TAM | √ | √ | √ | | | | | √ | √ | √ | | √ | | | | | | √ | √ | √ | √ | √ | √ | √ | √ | √ | | √ |
| TTF | | | | √ | √ | √ | | | √ | | √ | √ | | | | √ | √ | √ | √ | √ | √ | √ | | | | | | √ |
| D&M | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | | √ | | | | √ | √ | √ | √ | √ | √ | | | | | | | |
| UAM | √ | √ | √ | | | | | | √ | √ | | | | | | | √ | √ | √ | √ | √ | √ | √ | √ | | | √ | √ |

TABLE V. BEPMERSI TAXONOMY

| Dimension | Meaning |
|---|---|
| D1 | Management Level |
| D1-1 | Top Management |
| D1-2 | Middle Management |
| D1-3 | Operational Management |
| D2 | Industry Type |
| D2-1 | Manufacturing |
| D2-2 | Non-manufacturing |
| D3 | Organization Size |
| D3-1 | SMEs |
| D3-2 | Large Corporation |
| D4 | In-house/Outsource(SW,HW,Peopleware) |
| D4-1 | In-house |
| D4-2 | Outsource |
| D5 | Phase of Implementation |
| D5-1 | Pre-Implementation |
| D5-2 | Implementation |
| D5-3 | Post-Implementation |
| D6 | Persuasive Derivation |
| D6-1 | Top Management Objectives |
| D6-2 | Work Problems |
| D6-3 | Regulation Compliance |
| D7 | Time |
| D8 | Region |
| D9 | Legacy System |
| D10 | Implementation Strategy |
| D10-1 | Big Bang |
| D10-2 | Parallel |
| D10-3 | Pilot Project |
| D11 | No. of ERP module to be Implemented |
| D12 | Culture |
| D12-1 | Country |
| D12-2 | Organizational Culture |
| D13 | Types of Source Code |
| D13-1 | Closed Source |
| D13-2 | Open Source |
| D14 | ERP Project Team |
| D15 | Business Process Reengineering |

TABLE VI. KIAT BEPMERSI (CASE STUDY OF KIAT ON BEPMERSI MODEL )

| Assess Model | D1 | | | D2 | | D3 | | D4 | | D5 | | | D6 | | | D7 | D8 | D9 | D10 | | | D11 | D12 | | D13 | | D14 | D15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | D1-1 | D1-2 | D1-3 | D2-1 | D2-2 | D3-1 | D3-2 | D4-1 | D4-2 | D5-1 | D5-2 | D5-3 | D6-1 | D6-2 | D6-3 | | | | D10-1 | D10-2 | D10-3 | | D12-1 | D12-2 | D13-1 | D13-2 | | |
| TAM | √ | | | | | | | √ | √ | √ | | √ | | | | | √ | √ | √ | √ | | √ | √* | √ | √ | √ | | √ |
| TTF | | | | √ | √ | √ | | | √ | | √ | √ | | | | √ | √ | √ | √ | √ | | √ | | | | | | √ |
| D&M | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | | √ | | | | √ | √ | √ | √ | √ | | | | | | | | √ |
| UAM | √ | √ | √ | | | | | | √ | √ | | | | | | | √ | √ | √ | √ | | √ | √ | √ | | | √ | √ |