



**Faculty of Information and Communication Technology**

**GENERIC SOFTWARE DEVELOPMENT FRAMEWORK FOR  
ENTERPRISE RESOURCE PLANNING SYSTEM DEVELOPMENT**

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**GENERIC SOFTWARE DEVELOPMENT FRAMEWORK FOR ENTERPRISE  
RESOURCE PLANNING SYSTEM DEVELOPMENT**

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**A thesis submitted  
in fulfillment of the requirement for the degree of Doctor of Philosophy**

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**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**2014**

## **DECLARATION**

I declare that this thesis entitled “Generic Software Development Framework for Enterprise Resource Planning System Development” is the result of my research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : .....

Name : Basem Yousef Mofadi Zughoul

Date : .....

## **APPROVAL**

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Doctor of Philosophy.

Signature :.....

Supervisor Name : Associate Professor Dr. Burairah Hussin

Date : .....

## **DEDICATION**

I would like to dedicate my work to those who did not stop their daily support me during my study stay abroad; namely my mother, my wife and my family's members. They never hesitated to provide me with all the facilities to push me forward as much as they could. This work is a simple and humble reply to their much goodness I have taken over during that time. I do not forget my many friends who have helped and supported me throughout the process.

## **ABSTRACT**

Traditional software systems are developed in house to fit with a specific set of functions, but it does not comply with various business needs, like expanding markets, increasing competition and technology developments. Many organizations rely on Enterprise Resource Planning (ERP) systems to manage and process their entire business requirements, including a large size of applications. However, many ERP system implementations failed or were terminated abruptly, because of budget overrun, high business risks under extend scope of work, and takes a long time to implement. Most of the works include dealing with customization off-the-shelf ERP package, or changing organization business process to suite with the package. This thesis proposed a software development framework to develop traditional systems to ERP systems. The aim of this framework is to provide a solution for software companies to develop ERP systems from their own perspectives, and according to specific ERP characteristics to fulfill their business needs. The framework utilizes the software development life cycle focusing on functionality, procedures and business needs in organizations, based on the specific ERP characteristics. The proposed framework is verified by two case studies and survey questionnaires to get feedback from software companies experts on the suitability of the framework implementation in the organizations. The results indicated that around 81.86% found the framework is suitable for their needs. This thesis contributes to the body of knowledge on in-house development of ERP systems based on organizational perspective, business functionality, and best practices.

## **ABSTRAK**

*Sistem perisian tradisional yang dibangunkan oleh sesuatu organisasi atau syarikat, bertujuan untuk memenuhi fungsi tertentu syarikat tersebut didapati tidak mampu memenuhi pelbagai fungsi perniagaan seperti peningkatan pasaran dan persaingan serta perkembangan teknologi. Banyak organisasi bergantung kepada aplikasi sistem “Enterprise Resource Planning” (ERP) untuk mengurus dan memproses keperluan perniagaan keseluruhan mereka, tanpa mengira saiz aplikasi tersebut. Walau bagaimanapun, kebanyakan pelaksanaan sistem ERP ini, seringkali mengalami kegagalan atau ditamatkan penggunaannya, kerana sistem ini memerlukan kos pengoperasian yang besar dan berisiko tinggi untuk tidak memenuhi fungsi tugas yang diperlukan serta mengambil masa yang lama untuk dilaksanakan. Kebanyakan proses kerja di dalam system ERP semasa termasuk berurusan dengan penyesuaian pakej “off-the-shelf” ERP atau menukar proses perniagaan organisasi/syarikat mengikut kesesuaian pakej tersebut. Tesis ini mencadangkan agar pembangunan sebuah rangka kerja pembangunan perisian tradisional kepada sistem ERP yang memenuhi keperluan organisasi/syarikat dilaksanakan. Tujuan rangka kerja ini adalah untuk mendapatkan penyelesaian bagi syarikat-syarikat perisian untuk membangunkan sistem ERP dari perspektif organisasi/syarikat sendiri, mengikut ciri-ciri ERP yang dikenalpasti sesuai dengan keperluan perniagaan mereka. Kajian ini mencadangkan satu rangka kerja untuk membangunkan sistem ERP dengan menggunakan kitar hayat pembangunan perisian, dengan memberi tumpuan kepada fungsi, prosedur, dan keperluan perniagaan dalam organisasi untuk mencapai dan menyesuaikan dengan ciri-ciri ERP terbaik. Rangka kerja yang dicadangkan telah disahkan oleh dua kaedah kajian melalui temubual bersama pakar dan kajian soal selidik untuk mendapatkan maklum balas daripada pakar-pakar syarikat perisian mengenai kesesuaian menggunakan rangka kerja tersebut di dalam organisasi mereka. Keputusan menunjukkan bahawa kira-kira 81,86% mendapati rangka kerja tersebut adalah sesuai dengan keperluan organisasi. Oleh itu, tesis ini menyumbang kepada pembangunan sistem ERP secara “in-house” berdasarkan kepada keperluan organisasi dan fungsi perniagaan serta amalan terbaik dari perspektif organisasi/syarikat tersebut.*

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## **LIST OF ABBREVIATIONS**

BOM	-	Bill of Material
BPR	-	Business Process Reengineering
CBS	-	Computer Based System
COTS	-	Commercial Off-The-Shelf
CRM	-	Customer Relationship Management
CSFs	-	Critical Success Factors
DSLDC	-	Divided Software Life Cycle
ES	-	Enterprise Systems
ERP	-	Enterprise Resource Planning
EWS	-	Enterprise Wide Systems
ICT	-	Information and Communication Technology
IT	-	Information Technology
MRP	-	Material Requirement Planning
RAD	-	Raped Application Development
RFP	-	Request for proposal
SCM	-	Supply Chain Management
SDLC	-	System Development Life Cycle
SMEs	-	Small to Medium Enterprises
XP	-	eXtreme Programming

## LIST OF PUBLICATIONS

Some of research results contained in this thesis have been published as follows:

- Zughouli, Basem and Hussin, Burairah 'Migration Traditional Projects Framework to Enterprise Resource Planning System: An Empirical Study', *e-Proceeding of Software Engineering Postgraduates Workshop (SEPoW2013)*, pp. 98-102, 19 November 2013 City Campus Universiti Teknikal Malaysia Melaka, Malaysia.
- Zughouli, Basem and Hussin, Burairah 'Factors Effecting Migration Traditional Projects to Enterprise Resource Planning System (ERP)', *International Review on Computers & Software*, Vol. 8, Issue 8, pp. 2005-2012, Aug 2013. (IF 0.218 Scopus)
- Zughouli, Basem and Hussin, Burairah 'Migration Traditional Projects to Enterprise Resource Planning System', *International Review on Computers & Software*, Vol. 7, Issue 6, pp. 3162-3169, Nov 2012. (IF 0.218 Scopus)

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Research Background**

Today, public and private organizations are facing different challenges while running their business. These challenges include expanding markets, increasing competition, rising customer expectations, increasing needs for technology; and many others. On the other hand, the shortages in budgets, radical change in the business environment, demands in the development and integration of business processes, and the fast growth of technology development are the new factors need to be considered. Therefore, all these factors increased the pressure on organizations to reduce total costs in the business supply chain in a shorter time. This could result to reducing inventories, extending production choice, providing more reliable and better customer services, improving quality and coordinating efficiently demand, supply and production. Thus, there is a need for information system to manage all these aspects (Strong & Volkoff, 2004; Iskanius, 2009).

Information Systems (IS) are an arrangement of several components such as hardware, software, communications systems, people, process, and data. Therefore, most organizations use information systems to interact and improve their day-to-day business activities and operations, to support the problem solving and help decision making. Hence, they become critical components for any successful organizations. Information systems provide a high level of computers automation to carry out different business functions like finance, accounting, marketing, human resources management, customer services and operations (Jigeesh, 2011).

To develop such systems, the organizations need to have an approach either to develop or buy from vendors. Traditional information systems are known as custom built software, in house developed software, or mainframe system based on organizational requirements. Generally with this setting, the company retains full ownership rights of the source code and security of information. Organizations develop the software according to their requirements and needs. The traditional information systems emphasized on the specifications of requirement analysis and everything that revolves around it, until delivery of the business functions (Strong & Volkoff, 2004). The execution of this type of systems according to business requirements needs a high cost, time and efforts for the organization to achieve the competitive goals (Rizvi & Ahmad, 2008).

Furthermore, these systems are also suffering from important problems such as the compatibility in developments of software and hardware, integration, redundancy of data between modules making them difficult to maintain, and therefore can no longer meet the organization's business needs (Bradley, 2008; Tariqi et al., 2010). To support the entire business needs, there is a significant development in IS known as Enterprise Resource Planning (ERP) systems or Enterprise Systems (ES), which are used to plan their resources more effectively and manage traditional systems.

ERP system is defined as a software package, which attempts to integrate company's departments and functions into a central database in order to serve the different departments' needs, where these software packages can be customized according to the organization needs (Esteves & Pastor, 1999; Ahituv et al., 2002; Botta-genoulaz & Millet, 2005; Kerimoglu & Bauoglu, 2006).

In addition, the ERP system is a commercial software package that brings many benefits to an organization and supports most of the operations, through the integration of

data that is coming from transactions-oriented and various business processes throughout the organization (Markus & Tanis, 2000; Souza & Zwicker, 2009).

ERP systems are also known as multiple application modules, which integrate the activities across functional departments and support the work processes and resources management in organizations, such as human resources, sales, finance and production, while providing cross-organization integration of data through embedded business processes.

Rashid and Hossain (2002) and Supramaniam and Kuppusamy (2011) have both shown that ERP systems or enterprise systems are software systems used for business management and encompass modules which support functional areas such as planning, manufacturing, sales, marketing, distribution, accounting, financial, human resource management, project and inventory management, service and maintenance, transportation, and e-business. The core of an enterprise system is a single comprehensive database or central database, where the database collects and sends data into modular applications to support all company's business activities. Consequently, when any new information is entered in one module, the related information is automatically updated.

As a result, many companies change their IT strategies to maintain their competitive advantages, with a belief that it responses for changing markets and delivering better service at lower cost. One of the options is purchasing "off-the-shelf" integrated ERP software packages instead of developing systems in-house (Ahituv et al., 2002). Software packages must be configured to fit organizational structures and processes, by setting the parameters within the boundaries of the provided functionality to match the functions and processes with the organization's cases (Brehm & Markus, 2000). Moreover, these packages can bring significant benefits such as managing and integrating business

processes across various functions, minimizing time sharing for the information, streamline the business processes, and enhancing the competitive advantage (Choi et al., 2012).

The concept of the process is illustrated in the following diagram Davenport (1998) as in Figure 1.1.

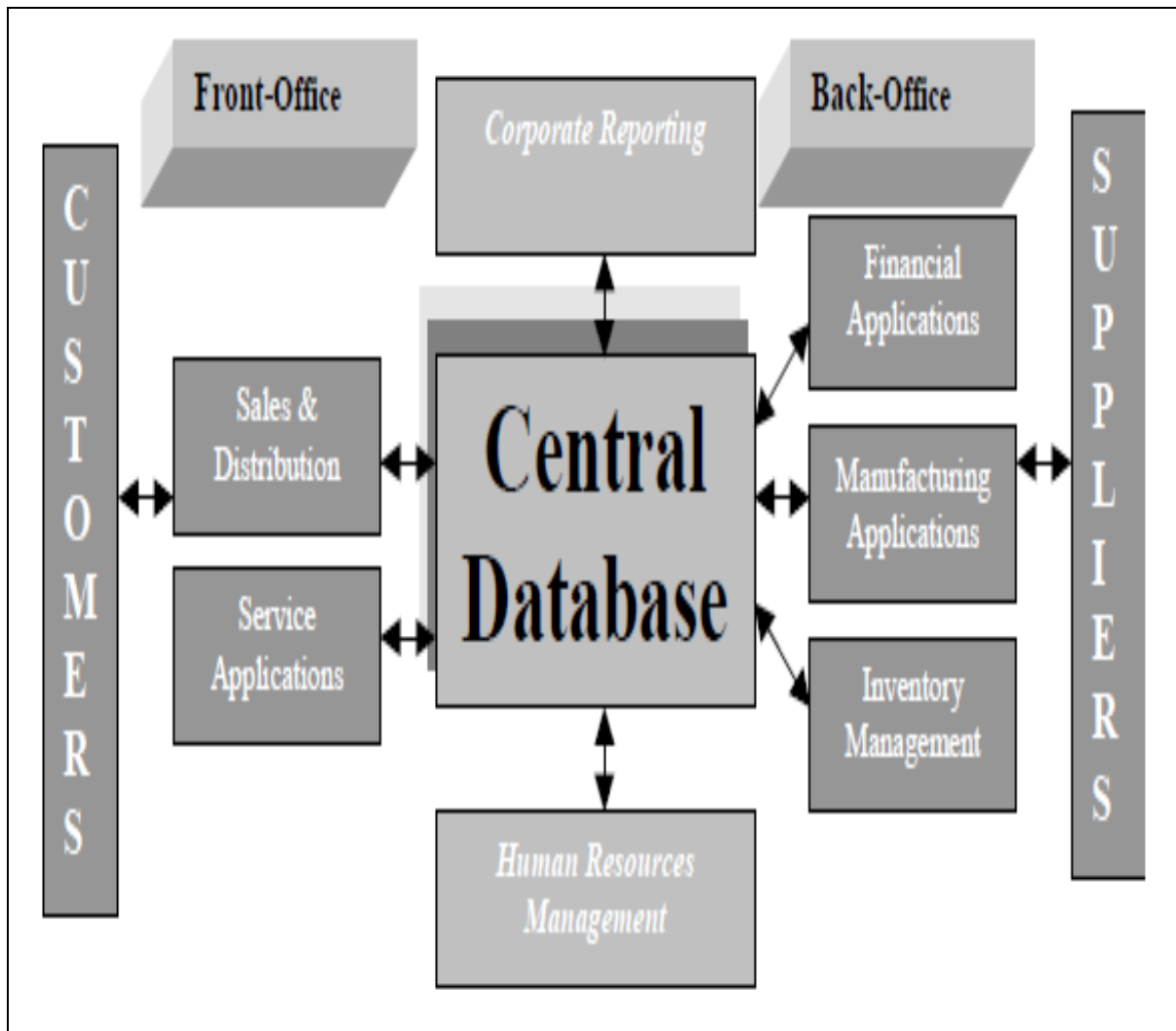


Figure 1.1 : ERP systems concept (Rashid & Hossain, 2002)

ERP systems are currently in high demand by both manufacturing and service organizations, as they provide a tightly integrated solution to the needs of organization from information systems (Shehab et al., 2004). Hence, ERP systems are becoming a standard information system, irrespective of the size and nature of the organization.

Different studies pointed out those ERP systems have become one of the largest IT investments in the late 1990s (Al-Mashari et al., 2003). It is not an easy task to understand an ERP system in business activities within complex organization. Thus, some authors have classified ERP system into technological and operational factors as shown below (Al-Mashari et al., 2003):

- Technological factor: different systems (hardware/software) should be replaced because of the maintenance and integration difficulty, and as the consequences of the systems do not meet business needs.
- Operational factors: customer satisfaction, improvement of process, simplification of complex process and standardization of process.

ERP systems support most industries including airlines, banking, hospitality, insurance, manufacturing, telecommunications, utilities, services and education. Besides its success and usefulness, ERP implementation needs to be managed and planned properly because it may affect every aspect of organizational performance and functioning (Tariqi et al., 2010).

Generally, ERP systems are software packages developed by independent vendors and implemented by the same vendors or third party consultant to meet the organization's business needs, which carries changes in organization structure, business process and how people work. In addition, some of the ERP implementations require all efforts together to redesign work process (O'Leary, 2002; Barki et al., 2005). The ERP systems have the ability to automate and integrate the business processes of an organization, to share common data and practices across the organization, and to produce and access information in real time (Nah et al., 2001).

Many companies consider and rely on ERP systems to manage and process their business data despite the high cost associated with the enterprise software (Borovski

&Zeier, 2009). Also (Sumner, 2005) presented four reasons that urge organizations to implement ERP system, namely (1) simplifying and standardizing systems, (2) replacing legacy systems, (3) gaining strategic advantage, and (4) improving interaction between suppliers and customers. It is reported that ERP system market was \$16.67 billion in 2005 and forecasted to be over \$21 billion in 2010 (Leon, 2008). Over 35 hundred million U.S. dollar has been invested in the deployment of ERP, and over 60,000 companies have already implemented ERP system in the whole world (Chen et al., 2011).

The implementation of information systems like ERP system is a complex, difficult, of high risk and expensive. Thus, it places tremendous demands on corporate time and resources, including associated massive changes in organizational structure, business process and people work. Such constraints occur because ERP contains multiple applications, needs large development teams, and usually requires a long time for its implementation. Moreover, it is possible to combine the implementation of new information system with redesigning work processes.

However, it also reported that ERP systems suffer from some major defects in its implementation because of the complexity of the system or the cost involved during installation (Bansal & Negi, 2008). Therefore, many ERP implementations have been classified as a failure because they did not achieve the organization's goals (Appuswamy, 2000; Umble & Haft, 2003; Cordeiro & Mar, 2008).

ERP systems development is difficult since it usually requires huge investments of time, costs and efforts (O'Leary, 2002; Barki et al., 2005). In addition, ERP system implementation has extremely high costs and time-consuming, therefore, companies look for consultants to implement their ERP system in hope for reducing costs and saving time. Hence, the selection of ERP consultant turns out to be a key-success factor to attain the goal; otherwise it will lead to a fail in ERP system (Tsai et al., 2009a).