CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

This chapter begins with a review of the literature on the intermediate benefits of ERP at the post implementations point of view. First, the chapter reviews ERP post Implementation benefits by discussing the model of ERP Post Implementation benefits and its related issues. There are three important intermediate benefits through which ERP could deliver overall plant level benefits to firms: more efficient internal business processes (task efficiency), and better coordination between different units of the firm (coordination improvements). Second, the chapter addresses the conceptualization of each dimension of the post implementation issues. The definition and explanation of each dimension is discussed together with the empirical findings. The two important elements of this context are interdependence and differentiation among subunits of the organization. Another important element that is included in this study is the IT Sophistication of the organization.

Finally, a research model is developed that specifies the determinants that activate and stimulate the ERP intermediate at subunit level and overall benefits at the company level. This research model is used as the basis for several testable hypotheses.

2.1 ERP Implementation Studies

Enterprise Resource Planning (ERP) is a term usually used in conjunction with ERP software or an ERP system which is intended to manage all the information and functions of a business or company from shared data stores (Esteves and Pastor, 2001). An ERP system is defined as a packaged business management software system that comprises integrated sets of comprehensive software, which enables a company to manage the efficient and effective use of resources. The total integrated solution facilitates the information-processing needs, through a process-oriented view standardized across the enterprise (Nah et al., 2001; Boykin, 2001; Chen, 2001and Yen et al., 2002). These sets usually include a set of mature business applications and tools for financial and cost accounting, sales and distribution, materials management, human resource, production planning and computer integrated manufacturing, supply chain, and customer information.
Many researchers and practitioners have arguably marked Enterprise Resource Planning (ERP) systems as the most popular business software of the last fifteen years (Wagner et al., 2006; Ehie and Madsen, 2005; Beheshti, 2006). These systems got very familiar partially because of their promises to transferring best practices embedded with the technology's design, integrating organizational business processes, and sharing information across functional areas through a common database. Many studies have been carried out to scrutinize the benefits of ERP in the two major categories – Tangible and Intangible benefits (Daniel E., 2004; Siriginidi, 2000; Deloitte Consulting's, 1998). The tangible benefits due to

ERP adoption includes: inventory reduction, personnel reduction, productivity improvement, operational cost reduction, revenue/profit increment, on-time delivery and etc. The intangible benefits include: better customer satisfaction, improved vendor performance, increased flexibility, reduced quality costs, improved resource utility, improved information accuracy and improved decision-making capability. All these promises have prompted commentators to declare that they are a prerequisite for success in the 21st century (Davenport, 2000). Today, there are more than 100 ERP systems vendors in the market and the five key players are: SAP, Oracle, JD Edwards, People Soft, and BAAN. Each of these main players has its own salient feature (Botta-Genoulaz and Millet, 2006). ERP is becoming the state of the art in the corporate information technology and as part of the price of entry in running successful businesses. Virtually almost every major business has implemented one or more ERP systems. Recent studies revealed that ERP adoption is approximately 75 percent for manufacturing and 60 percent in services among medium and large company (Scott and Shepherd 2002) and it is reaching 80 percent among Fortune 500 firms (META Group 2004). It is estimated that organizations worldwide spend approximately US$18.3 billion every year on ERP (Charles Møller et al., 2004).

While some firms have achieved impressive benefits from their ERP systems, others have experienced difficulty in gaining the benefits they expected. Many studies were conducted in order to identify factors relating to the success or failure of ERP systems at the various stages of ERP implementation life cycles. For instance, Hong and Kim (2002) study the critical success factors of ERP

implementation on the organizational fit perspective. They define the concept of organizational fit of ERP and examine its impact on ERP implementation. They suggested that ERP implementation success significantly depends on the organizational fit of ERP and certain implementation contingencies. In addition, Sarker and Lee (2003) conduct a longitudinal case study to test the three key social enablers in ERP implementation which includes strong and committed leadership, open and honest communication, and a balanced and empowered implementation team as necessary conditions for a successful ERP implementation. Their study indicates that while all three enablers may contribute to ERP implementation success, only strong and committed leadership are considered a salient condition. Further, Wu and Wang (2005) studied the critical success factors of ERP on the level of user satisfaction. They found that there is a relationship between key-user satisfaction and perceived system success. In the recent study by Chuck and Eric (2007) that examined the relationships between the success of ERP system adoption, extent of business process improvement (BPI), and organizational performance, they found that the organizational variables have significant influences on the organization-level benefits, BPI, and ERP success. Research on IT management sophistication and the technology-assimilation model suggests using managerial practices concerning IT planning, control, organization, and integration as benchmark variables for measuring the progression of firms toward IT management sophistication (Gupta at el., 1997). Ward at el. (1990) suggested that higher levels of IT management sophistication or IT maturity represent the evolution of a

firm's IS function from the data-processing orientation into the strategic IS orientation.

While there is a rich body of literature on ERP adoption and implementation (Holland and Light 1999; Markus and Tanis 2000), the research on ERP assimilation is limited (Gattiker and Goodhue, 2005). Existing post-implementation studies mainly focus on ascertaining their organizational impact of ERP systems and consequently their business value (e.g., Gattiker and Goodhue, 2005; Hitt et al., 2002). Gattiker and Goodhue (2004; 2005) study the interdependence and differences between divisions of the same organizations in ERP implementation. In brief, their supposition is that the Interdependence and differentiation are the two major characteristics that might influence the level of fit of the ERP system. High interdependence among organizational sub-units contributes to the positive ERP-related effects because of ERPs' ability to coordinate activities and facilitate information flows. However, when differentiation among sub-units is high, organizations may incur ERP-related compromise or design costs. As an attempt to study on issues related to benefits realized, barriers faced by businesses and to provide better understanding for ERP systems adoption, this current study adopted the Gattiker (2005) Research Model on the "ERP Impact at the Local Level". As suggested by Gattiker (2005), it is worth to address in details on these few questions: How can I maximize the positive impact? How do I avoid the problems? Is there some way to predict what the ultimate impact will be for my firm?

In accordance to Gattiker (2005) research model, one of the key characteristics of ERP systems is the extensive integration and standardization it provides among the subunits of a business. Their impact will be influenced by the interdependence and differentiation between subunits of the organization. OIPT suggests highly integrated systems will fit some organizational subunits better than others. Specifically, when ERP is implemented, subunits those are highly interdependent or in the other words very dependent on other subunits, may benefit substantially. However, subunits that are very different from the other subunits in the ERP implementation may incur costs (such as suboptimal business processes or dependence on employee work-around).

2.2 ERP Post-implementation Focus

Jacobs and Bendoly (2003) stated that despite the importance of performance analysis for the ERP post implementation state, relatively the majority of the existing research focuses on the ERP selection and implementation. ERP selection and implementation are the critical areas and these processes are often expensive and time-consuming. The ERP selection and implementation criteria and factors include the importance of relationships with consultants, core team characteristics, business process reengineering approach, change management approach, user training approach, top management support, project champion, user involvement, package choice, module choice, package customization, project management, implementation approach, and a clearly stated business case (Olson and Zhao, 2007; Akkermans and Van Helden 2002; Hong and Kim

2002). Despite the improvement on the implementation success itself, these factors will influence post implementation results as well. Therefore, it is one of the key concerns and issues for management to monitor and control the performance of the vast investment on ERP.

Recent literature reviews (Cosgrove Aware 2003; Markus and Tanis 1999; Ross and Vitale 2000), suggest ERP systems go through a post-implementation break-in phase, in which performance may not be typical of the longer-term effects that the organization might experience. According to Staehr et al. (2002), once the ERP system has been implemented, there is no thorough research on the ultimate impacts of ERP on the organization. Therefore, in this current study, the focus is on explaining differences in impacts among plants after it is implemented successfully and is running for certain period of time.

2.3 Theoretical Foundation

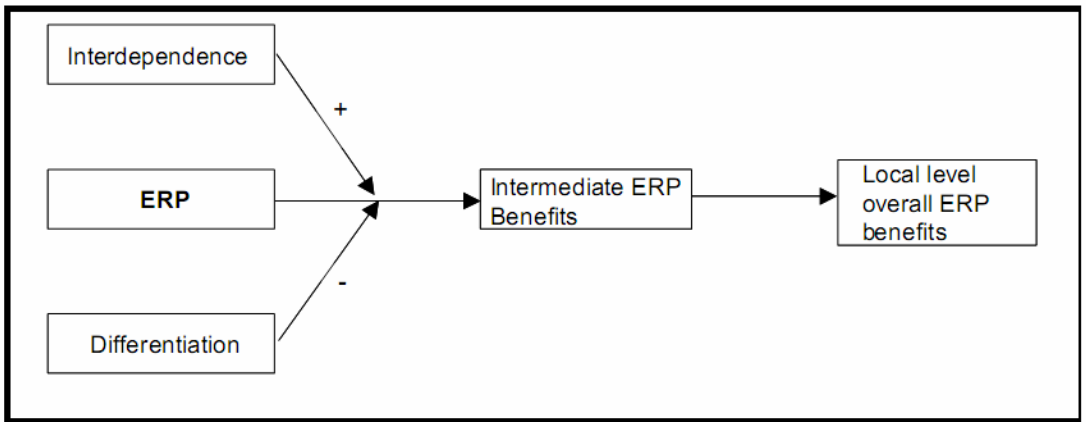

Figure 2.1. Conceptual Model of ERP Impact at the Local Level

Figure 2.1 shows a conceptual model of the local impact of interdependence and differentiation developed by Gattiker & Goodhue (2005). In brief, Gattiker and Goodhue (2005) supposition is that since ERP systems provide integration and standardization, their impact will be influenced by the interdependence and differentiation between subunits of the organization.

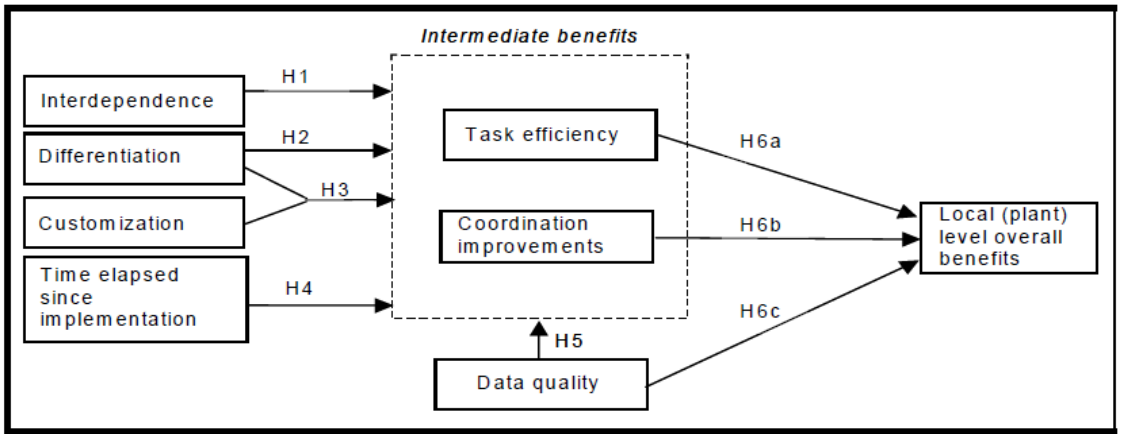

Figure 2.2. Detailed Conceptual Model of ERP Impact at the Local Level

Figure 2.2 shows the rationale and key links in the model developed by Gattiker and Goodhue (2005). In addition, it shows several other control variables, which are suggested by the existing ERP literature. As suggested in the introduction to this study, Gattiker and Goodhue (2005) believe there are three important intermediate benefits through which ERP could deliver overall plant level benefits to firms: better information (data quality), more efficient internal business processes (task efficiency), and better coordination between different units of the firm (Coordination Improvements). Thus an arrow is shown from each of them to local level overall benefits.

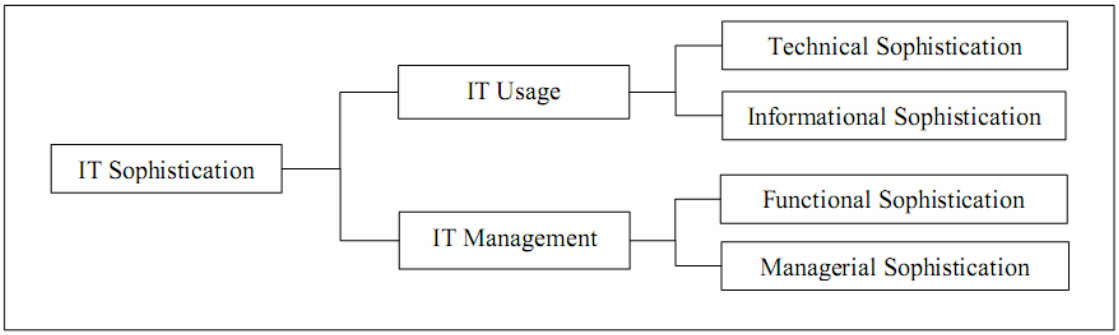

Figure 2.3. Dimensions of IT Sophistication (Raymond and Pare, 1992)

Figure 2.3 shows an IT Sophistication Dimension developed by Raymond and Pare (1992). They characterize overall IT sophistication under two major dimensions, IT usage and IT management. According to this model, IT usage consists of two dimensions, Technical and Informational Sophistication while IT management also comprise of two dimensions, functional sophistication and managerial sophistication.

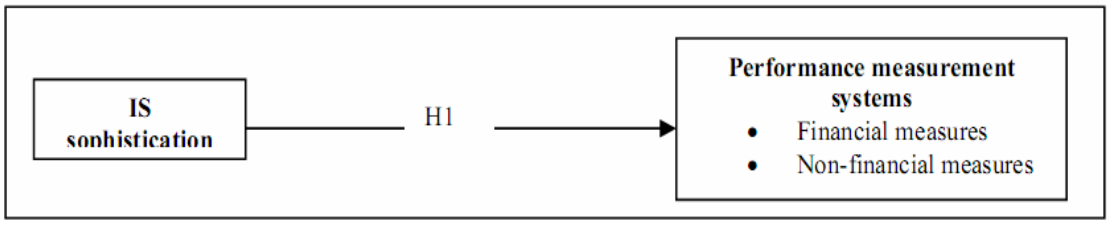

Figure 2.4. Conceptual Model of IS Sophistication and Performance Measurement System.

Figure 2.4 shows a conceptual model of IS Sophistication and Performance Measurement system. Several empirical studies have shown that the use of IS Sophistication have positive impact on organizational performance. (De Burca et al., 2006; Heine et al., 2003; Raymund and Pare, 1992). In relating performance measurement system to IS Sophistication of the firm, many researchers have

investigated the success of IS in many ways. The two major categories are measured by financial indicator and non-financial indicator. The primary objective of this research project is to focus on the very specific non-financial measurements. The IS Sophistication elements will be included as part of the independence variables while the intermediate ERP benefits will be used as the non-financial measurements in this study.

2.4 Research Framework

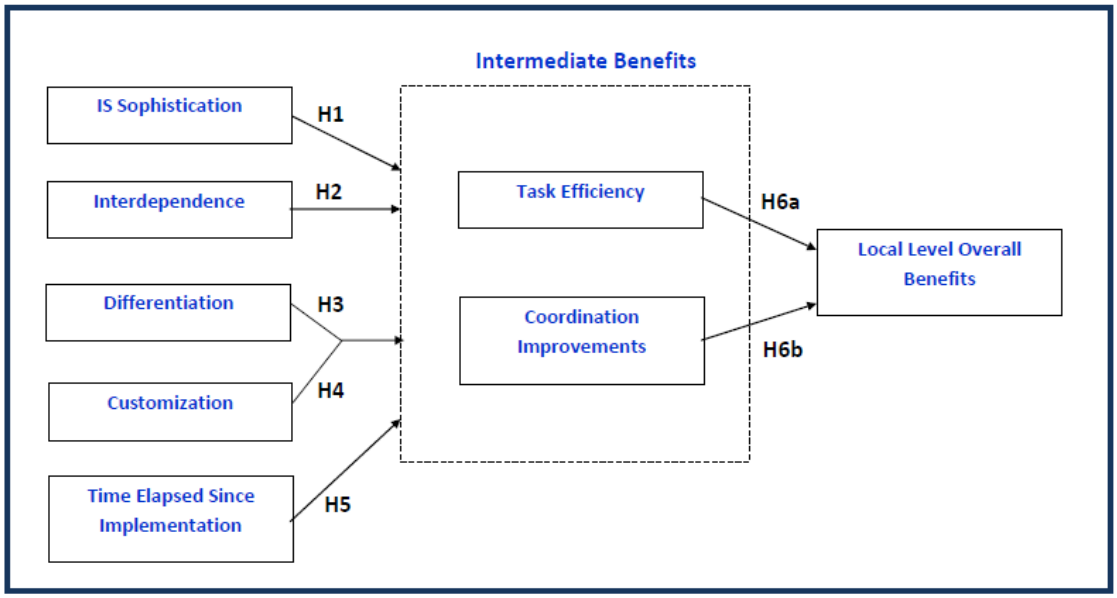

Figure2. 5 : Research Framework

This study examines the effect of various factors on the post implementation of ERP. As the research framework in Figure 2.5 shows, this study identified the following seven factors which are considered to have association with the overall ERP benefits of the post implementation of ERP in the organizations. These factors includes: IS Sophistication, Interdependence, Differentiations,

Customizations, Time Elapsed after ERP Implementation, Task Efficiency and Coordination Improvements.

Table 2.1. Definitions and Constructs in the Model

Construct	Definitions
IS Sophistication	The effectiveness of the firm in using Information Technology (IT) to support and enhance its core competencies.
Interdependence	The degree to which plant/sub-units must exchange information or material in order to complete their task. It also implies the extent of the integrative coordination mechanism on a subunit.
Differentiation	The level of difference between that plant and the organizational norm on a number of key characteristics, such as the volume and variety of products produced.
Customization	The changes to the ERP system to meet the needs of an individual plant/subunit.
ERP Time Elapsed	The number of years after ERP system has been successfully implemented on a plant/subunit.
Task Efficiency	The level of efficiency between the internal business processes.
Coordination Improvements	The improvement in the coordination between different plants/subunits.
Overall ERP Benefits	The overall business impact of ERP on that plant/subunit.

This study includes the various aspects of ERP Post Implementation Benefits and bridge theory and practice, with particular attention to its four core dimensions as below:

i. **IS Sophistication** – Imply the effectiveness of the firm in using Information Technology (IT) to support and enhance its core competencies. IS sophistication include platform technologies (hardware and operating systems), network and telecommunications technologies, databases and a variety of shared services, such as electronic data interchange (EDI), e-mail, universal file access, videoconferencing and teleconferencing services. The conceptualization of the IS sophistication in this study includes three dimensions:

(1) **Extent of use of IS** - It reflects the diversity of the software application use by the organization.
(2) **Intensity of use of IS** – It reflects the diversity of process or activities by the organization.
(3) **IS integration** - It reflects the integration of computer-based applications both internally via common database and externally via electronic communication links.

ii. **Interdependence** – Study the impact of an integrative coordination mechanism on a subunit, such as a plant, may depend on the level of interdependence between that plant and other plants in the organization.

iii. **Differentiation** – Study on the level of "misfit" of the ERP. ERP defines standard processes and data definitions to meet the needs of the overall company and its plants. However, when an individual subunit's local task characteristics or its local external environment differ from other organizational subunits, then that subunit may well require a unique and nonstandard system in order to cope with its particular circumstances.

iv. **Customization** – It is conceptualize customization as changes to the ERP system to meet the needs of an individual plant. Customization could potentially also be used to bring the ERP into line with the requirements of a nonstandard plant. Customization may, therefore, be an effective strategy for dealing with the unique needs of the extremely different plants discussed in the previous section. Since we have a theoretical interest in differentiation, our model needs to include customization as well.