# PERCEIVED BENEFITS OF ERP SYSTEM ON PERCEIVED COMPANY PERFORMANCE AMONG MANAGERS IN MALAYSIAN MANUFACTURING COMPANIES

ASNIATI



SCHOOL OF BUSINESS AND ECONOMICS

UNIVERSITI MALAYSIA SABAH

2011

# PERCEIVED BENEFITS OF ERP SYSTEM ON PERCEIVED COMPANY PERFORMANCE AMONG MANAGERS IN MALAYSIAN MANUFACTURING COMPANIES

ASNIATI



THESIS SUBMITTED IN FULFILLMENT

FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

SCHOOL OF BUSINESS AND ECONOMICS

UNIVERSITI MALAYSIA SABAH

2011

**UNIVERSITI MALAYSIA SABAH**

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## DECLARATION

I hereby declare that the material in this thesis is my own except for quotations, excerpts, equations, summaries and references, which have been duly acknowledged.

17 August 2011

_____

Asniati
PS05-002-066(A)

# CERTIFICATION

NAME : **ASNIATI**

MATRIC NO. : **PS05-002-066(A)**

TITTLE : **PERCEIVED BENEFITS OF ERP SYSTEM ON PERCEIVED COMPANY PERFORMANCE AMONG MANAGERS IN MALAYSIAN MANUFACTURING COMPANIES**

DEGREE : **DOCTOR OF PHILOSOPHY**

**(ACCOUNTING INFORMATION SYSTEMS)**

VIVA DATE : **28 September 2010**



**DECLARED BY**

**1. SUPERVISOR**

Assoc. Prof. Dr. Noorhayati Mansor, CMA Signature

_____

## ACKNOWLEDGEMENTS

Praise and thanks to the Almighty Allah for giving me the strength and patience to cope with the problems and difficulties that I faced in completing this thesis.

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ASNIATI
17 August 2011

## ABSTRACT

## PERCEIVED BENEFITS OF ERP SYSTEM ON PERCEIVED COMPANY PERFORMANCE AMONG MANAGERS IN MALAYSIAN MANUFACTURING COMPANIES

Enterprise Resource Planning (ERP) system is a business management system that comprises integrated sets of comprehensive software that integrates all the business functions within an organization. The benefits of enterprise resource planning (ERP) include increased efficiency and productivity as well as cost reduction (Kakouris & Polychronopolous (2005). Similar to ERP, a Balanced Scorecard (BSC) has been globally adopted since introduced by Kaplan & Norton in 1992. Using benefits identified by previous researchers and combination of framework introduced by Shang & Seddon (2002) and Chand et al. (2005), an empirical study was conducted to examine the benefits at the three different managerial levels (operational, tactical and strategic decision levels) and the effect of ERP system adoption on business performance. A mixed methodology was adopted. The first stage involves semi-structured personal interviews of CEOs to develop a set of questionnaire. In the second stage, managers of Malaysian manufacturing companies are randomly selected to respond to the questionnaire to ask their perception about ERP system adoption benefits and company's business performance. Data were analysed using descriptive and inferential statistics. Finally, interview was conducted to reconfirm the survey results with Malaysian manufacturing CEOs and managing director of ERP vendors. Overall, the findings suggest that ERP systems adoption has positive and significant effect on business performance. However, when the performance is divided according to the four perspectives of the balanced scorecard, the results show differences in the benefits. For the operational managers, the highest benefits are derived from improvements related to internal processes only. At tactical level, ERP adoption improves customer service, financial and innovation and growth performance. ERP adoption at strategic level improves customer service and financial performance. The finding provides evidence that today's companies are serious about satisfying customers' needs and the responsibility rests with the higher level managers. The output of this research can serve as a guideline for managers to improve or reassess their performance management system in line with ERP-scorecard frameworks. The findings also contribute to the knowledge and application of Management Accounting Systems and Management Information Systems.

# *ABSTRAK*

*Sistem perancangan sumber perusahaan (ERP) adalah sistem pengurusan perniagaan yang terdiri daripada set dalam perisian komprehensif berintegrasi yang boleh mengurus dan mengintegrasi kesemua fungsi perniagaan dalam sesuatu organisasi. Manfaat perancangan sumber perusahaan (ERP) termasuk peningkatan kecekapan dan produktiviti pengurangan kos (Kakouris and Polychronopolous (2005). Seperti ERP, Balanced Scorecard (BSC) telah diterima secara global sejak ia diperkenalkan oleh Kaplan & Norton dalam tahun 1992. Dengan menggunakan manfaat yang telah dikenalpasti oleh para penyelidik terdahulu dan penggabungan kerangka kerja yang telah diperkenalkan oleh Shang and Seddom (2002) dan Chand et al. (2005), satu kajian empirikal telah dilaksanakan untuk menguji manfaat pada tiga tingkat pengurusan yang berbeza (tingkat keputusan operasi, taktikal dan strategik) dan kesan pelaksanaan sistem ERP ke atas prestasi perniagaan. Metodologi campuran telah digunakan. Tahap pertama melibatkan temuduga peribadi separa struktur dengan Ketua Pegawai Eksekutif (CEOs) untuk membangunkan soal selidik. Pada tahap kedua, syarikat pembuatan Malaysia dipilih secara rawak untuk memberi maklumbalas kepada soal selidik untuk menanyakan persepsi mereka terhadap manfaat pelaksanaan sistem ERP dan prestasi perniagaan. Data dianalisis menggunakan statistik deskriptif dan inferential. Akhirnya, temuduga dilaksanakan dengan Ketua Pegawai Eksekutif (CEOs) Malaysia dalam bidang pengilangan dan pengarah urusan pembekal ERP untuk memastikan semula hasil penyelidikan yang diperolehi. Secara keseluruhannya, penemuan mencadangkan bahawa pelaksanaan sistem ERP mempunyai kesan positif dan signifikan ke atas prestasi perniagaan. Akan tetapi, apabila prestasi dibahagi kepada empat perspektif dalam BSC, keputusan menunjukkan perbezaan dalam manfaat. Bagi pengurus operasi, manfaat yang paling besar adalah berkaitan dengan proses dalaman sahaja. Pada tahap taktikal pula, perolehan ERP boleh meningkatkan prestasi perkhidmatan pelanggan, kewangan dan inovasi serta pembangunan. Pelaksanaan ERP pada tahap strategik boleh memperbaiki prestasi perkhidmatan pelanggan dan kewangan. Penemuan ini menyediakan bukti bahawa syarikat masa kini adalah serius dalam memenuhi keperluan pelanggan dan tanggungjawab ini ditumpukan pada tahap pengurus yang lebih tinggi. Hasil kajian ini boleh memberi garis panduan kepada pengurus dalam meningkat atau menilai semula sistem pengurusan prestasi selari dengan kerangka "ERP-Scorecard". Penemuan ini juga menyumbang kepada ilmu pengetahuan dan pelaksanaan Sistem Pengurusan Perakaunan dan Sistem Pengurusan Maklumat.*

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## LIST OF ABREVIATIONS

ATO : Asset Turnover
BP : Business Planning
BPR : Business Process Reengineering
BSC : Balanced Scorecards
CRM : Customer Relationship Management
DBMS : Database Management System
EDI : Electronic Data Interchange
ERP : Enterprise Resource Planning
EVA : Economic Value Added
ES : Enterprise System
GLCs : Government-Linked Companies
IS : Information System
ISP : Information Systems Planning
IT : Information Technology
KPIs : Key Performance Indicators
MIS : Management Information System
MRP : Material Requirement Planning
MRP II : Manufacturing Resource Planning
OLAP : On-Line Analytical Processing
OLTP : On-Line Transaction Processing
RBV : Resource-Based View
ROA : Return On Assets
ROCE : Return On Capital Employed
ROI : Return On Investment
SCM : Supply Chain Management
SME : Small and Medium Enterprise
TQM : Total Quality Management
VIF : Variance Inflation Factor

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## DECLARATION

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Asniati
PS05-002-066(A)

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**DECLARED BY**

**1. SUPERVISOR**

Assoc. Prof. Dr. Noorhayati Mansor, CMA Signature

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ASNIATI
17 August 2011

# ABSTRACT

## PERCEIVED BENEFITS OF ERP SYSTEM ON PERCEIVED COMPANY PERFORMANCE AMONG MANAGERS IN MALAYSIAN MANUFACTURING COMPANIES

Enterprise Resource Planning (ERP) system is a business management system that comprises integrated sets of comprehensive software that integrates all the business functions within an organization. The benefits of enterprise resource planning (ERP) include increased efficiency and productivity as well as cost reduction (Kakouris & Polychronopolous (2005). Similar to ERP, a Balanced Scorecard (BSC) has been globally adopted since introduced by Kaplan & Norton in 1992. Using benefits identified by previous researchers and combination of framework introduced by Shang & Seddon (2002) and Chand et al. (2005), an empirical study was conducted to examine the benefits at the three different managerial levels (operational, tactical and strategic decision levels) and the effect of ERP system adoption on business performance. A mixed methodology was adopted. The first stage involves semi-structured personal interviews of CEOs to develop a set of questionnaire. In the second stage, managers of Malaysian manufacturing companies are randomly selected to respond to the questionnaire to ask their perception about ERP system adoption benefits and company's business performance. Data were analysed using descriptive and inferential statistics. Finally, interview was conducted to reconfirm the survey results with Malaysian manufacturing CEOs and managing director of ERP vendors. Overall, the findings suggest that ERP systems adoption has positive and significant effect on business performance. However, when the performance is divided according to the four perspectives of the balanced scorecard, the results show differences in the benefits. For the operational managers, the highest benefits are derived from improvements related to internal processes only. At tactical level, ERP adoption improves customer service, financial and innovation and growth performance. ERP adoption at strategic level improves customer service and financial performance. The finding provides evidence that today's companies are serious about satisfying customers' needs and the responsibility rests with the higher level managers. The output of this research can serve as a guideline for managers to improve or reassess their performance management system in line with ERP-scorecard frameworks. The findings also contribute to the knowledge and application of Management Accounting Systems and Management Information Systems.

# *ABSTRAK*

*Sistem perancangan sumber perusahaan (ERP) adalah sistem pengurusan perniagaan yang terdiri daripada set dalam perisian komprehensif berintegrasi yang boleh mengurus dan mengintegrasi kesemua fungsi perniagaan dalam sesuatu organisasi. Manfaat perancangan sumber perusahaan (ERP) termasuk peningkatan kecekapan dan produktiviti pengurangan kos (Kakouris and Polychronopolous (2005). Seperti ERP, Balanced Scorecard (BSC) telah diterima secara global sejak ia diperkenalkan oleh Kaplan & Norton dalam tahun 1992. Dengan menggunakan manfaat yang telah dikenalpasti oleh para penyelidik terdahulu dan penggabungan kerangka kerja yang telah diperkenalkan oleh Shang and Seddom (2002) dan Chand et al. (2005), satu kajian empirikal telah dilaksanakan untuk menguji manfaat pada tiga tingkat pengurusan yang berbeza (tingkat keputusan operasi, taktikal dan strategik) dan kesan pelaksanaan sistem ERP ke atas prestasi perniagaan. Metodologi campuran telah digunakan. Tahap pertama melibatkan temuduga peribadi separa struktur dengan Ketua Pegawai Eksekutif (CEOs) untuk membangunkan soal selidik. Pada tahap kedua, syarikat pembuatan Malaysia dipilih secara rawak untuk memberi maklumbalas kepada soal selidik untuk menanyakan persepsi mereka terhadap manfaat pelaksanaan sistem ERP dan prestasi perniagaan. Data dianalisis menggunakan statistik deskriptif dan inferential. Akhirnya, temuduga dilaksanakan dengan Ketua Pegawai Eksekutif (CEOs) Malaysia dalam bidang pengilangan dan pengarah urusan pembekal ERP untuk memastikan semula hasil penyelidikan yang diperolehi. Secara keseluruhannya, penemuan mencadangkan bahawa pelaksanaan sistem ERP mempunyai kesan positif dan signifikan ke atas prestasi perniagaan. Akan tetapi, apabila prestasi dibahagi kepada empat perspektif dalam BSC, keputusan menunjukkan perbezaan dalam manfaat. Bagi pengurus operasi, manfaat yang paling besar adalah berkaitan dengan proses dalaman sahaja. Pada tahap taktikal pula, perolehan ERP boleh meningkatkan prestasi perkhidmatan pelanggan, kewangan dan inovasi serta pembangunan. Pelaksanaan ERP pada tahap strategik boleh memperbaiki prestasi perkhidmatan pelanggan dan kewangan. Penemuan ini menyediakan bukti bahawa syarikat masa kini adalah serius dalam memenuhi keperluan pelanggan dan tanggungjawab ini ditumpukan pada tahap pengurus yang lebih tinggi. Hasil kajian ini boleh memberi garis panduan kepada pengurus dalam meningkat atau menilai semula sistem pengurusan prestasi selari dengan kerangka "ERP-Scorecard". Penemuan ini juga menyumbang kepada ilmu pengetahuan dan pelaksanaan Sistem Pengurusan Perakaunan dan Sistem Pengurusan Maklumat.*

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## LIST OF ABREVIATIONS

| | |
|---|---|
| ATO | : Asset Turnover |
| BP | : Business Planning |
| BPR | : Business Process Reengineering |
| BSC | : Balanced Scorecards |
| CRM | : Customer Relationship Management |
| DBMS | : Database Management System |
| EDI | : Electronic Data Interchange |
| ERP | : Enterprise Resource Planning |
| EVA | : Economic Value Added |
| ES | : Enterprise System |
| GLCs | : Government-Linked Companies |
| IS | : Information System |
| ISP | : Information Systems Planning |
| IT | : Information Technology |
| KPIs | : Key Performance Indicators |
| MIS | : Management Information System |
| MRP | : Material Requirement Planning |
| MRP II | : Manufacturing Resource Planning |
| OLAP | : On-Line Analytical Processing |
| OLTP | : On-Line Transaction Processing |
| RBV | : Resource-Based View |
| ROA | : Return On Assets |
| ROCE | : Return On Capital Employed |
| ROI | : Return On Investment |
| SCM | : Supply Chain Management |
| SME | : Small and Medium Enterprise |
| TQM | : Total Quality Management |
| VIF | : Variance Inflation Factor |

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# CHAPTER 1

# INTRODUCTION

## 1.1 Introduction

This chapter briefly presents the general essence of the research endeavor conducted. It highlights the underlying problem and main thesis of the research. The chapter is started with background of the study, followed by problem statement, research questions and research objectives. The expected contribution for both of the theory and practice are explained in significant of the study. Finally, the scope of the study, the operational definition of key terms and variable used and organization of the thesis are provided at the end of this chapter. The chapter will be ended with chapter summary.

## 1.2 Background of the Study

Manufacturers are in a period of dynamic transformation. Rapid swings in consumer demands, shorter product life cycle, and foreign competition have radically changed the rules of the market place. In attempting to cope with these challenges, manufacturers are beginning to conduct business in a dramatically new way. The term "world-class" defines this new era of business (Hall, 2007). According to the author, the world-class companies are companies that have achieved high standards and have undergone fundamental changes from the traditional forms of organization and management. This type of company continuously pursues improvement in all aspects of its operations, including its manufacturing procedures.

The world-class firm needs new accounting methods and new information systems that: (i) show what matters to its customers; (ii) identify profitable products; (iii) identify profitable customers; (iv) identify opportunities for improvement in operations and products; (v) encourage the adoption of value-added activities and processes within the organization and identify those that do not add value; and (vi) efficiently support multiple users with both financial and

non-financial information (Hall, 2007). Achieving world-class status carries significant implications for accounting and accounting information systems. Traditional information produced under conventional accounting techniques does not adequately support the needs of the world-class firm. The traditional model of manufacturing firm such as Manufacturing Resource Planning (hereafter called MRP II), employs a closed database architecture, which is similar in concept to the basic flat file model. These systems dealt with their designated tasks efficiently but did not provide strategic decision support at the enterprise level due to lack of integration needed for information transfer across organization boundaries.

Today, the trend in information systems (IS) is toward implementing highly integrated enterprise-oriented systems. In addition, new information technology can create sustainable competitive advantage (Porter & Millar, 1985). The global competition, along with shorter product life cycles, ever-increasing market niches and the pressure to react quickly to the changing external business environment have forced companies to make decisions in an integrated manner (Gupta & Kohli, 2006). Organizations mix and match prefabricated software components to assemble an Enterprise Resource Planning (hereafter called ERP) system that best meet their business requirements. ERP systems are multiple module software packages that evolved primarily from traditional MRP II systems. Compared to MRP II, ERP system can better manage company's information system (Hall, 2007).

ERP system is a business management system that comprises integrated sets of comprehensive software and when successfully implemented, it can manage and integrate all the business functions within an organization (Shehab et al., 2004). This integration is accomplished through a database shared by all the application programs. Unlike MRP II system, ERP systems work in real-time, meaning that the exact status of everything is always available. Further, many of these systems are global. Since they can be deployed at sites around the world, they can work in multiple languages and currencies.

The term ERP was coined by the Gartner Group and has become widely used in recent years (Hall, 2007). The system has played significant roles in

Information Technology (IT) for several decades. While there is wide acceptance of ERP in developed countries such as USA, Canada, UK and Australia, developing countries lag far behind. At present, North America occupies 66 percent of the ERP market, Europe takes 22 percent, while the whole of Asia represents only 9 percent. However, due to economic growth, developing countries in Asia and Latin America are becoming major targets of large ERP vendors (Huang & Palvia, 2001).

ERP systems include a set of modules for 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 (Shehab et al., 2004). All functional departments that are involved in operations or production are integrated into one system. Furthermore, an ERP system can be used as a tool to help improve the performance level of a supply chain network by helping to reduce cycle times (Adam & Sammon, 2004; Rashid, Hossain & Patrick, 2002; Hsu & Chen, 2004). Hence, ERP system can aid in the control of many business activities like sales, delivery, billing, production, inventory management and human resource management systems.



The benefits of ERP are claimed to include: significant improvements in quality and efficiency of customer service, production and distribution; costs reductions; improved decision-making; and enterprise agility (Kakouris & Polychronopoulos, 2005). ERP is an industry term for the broad set of activities supported by multi-module application software that helps a manufacturer or a service provider manages the important parts of its business. In addition, research findings shed new light on the productivity paradox associated with ERP systems and suggest that ERP adoption helps firms gain a competitive advantage over non-adopters (Hunton et al., 2003). ERP system is an important factor which enables a company to compete effectively in the global market (Rikhardson & Kraemmergaard, 2006).

Even though the ERP system has been implemented in many companies during the last decade, the benefits of ERP system implementation still need to be

improved. Recent studies on ERP system no longer focus on how to implement the ERP system, but rather on how to maintain and improve the ERP system as a strategic tool to increase business performance. However, literature on how to sustain and improve business performance by implementing ERP systems is still limited (Chand et al., 2005).

Management is the attainment of organizational goals in an effective and efficient manner through planning, organizing, leading and controlling organizational resources (Samson & Daft, 2009). To achieve the goals, managers need to have job description through developing organizational structure. Managers at all organizational level have critical strategies roles to fulfill for the organization to be successful (Floyd & Lane, 2000). According to the author, senior (strategic), middle (tactical) and first (operational) level have distinct responsibilities with respect to each sub-processes. Compared to lower level, president of the company and the vice presidents, have a higher degree of decision authority, more impact on corporate goals, and more unique problems to solve. So, basically, the top managers are responsible for creating context for change, developing attitudes of commitment and ownership, creating appositive organizational culture through words and actions, and monitoring their company's business environment. Middle level managers are responsible for planning and allocating resources, coordinating and linking groups and departments, monitoring and managing the performance of subunits and managers and implementing the changes or strategies generated by top managers. The lower level managers are responsible for managing the performance of non managerial employees and teaching direct reports. To conduct their daily activities, different managerial level needs different information whis is produce by different information system.

Based on 233 ERP-vendor success stories and interviews with 34 ERP cases, Shang and Seddon (2002) divided the ERP system benefits into operational, managerial, strategic, IT infrastructure and organizational aspects. They found that ERP system implementation can give benefits to the operational, tactical and strategic level of managers as well as to the organization. Unfortunately, they did not test the effect of the ERP system adoption benefits at the three managerial

levels on company business performance. The purpose of this research is to examine the relationship of ERP system adoption benefits at the three managerial levels on a company's business performance.

In order to be able to measure business performance, a company can use financial or/and non-financial measurements. Many alternatives have been suggested by experts, but choosing a right performance measurement for ERP adoption is a strategic issue (Kaplan & Norton, 2001; Valiris, Chytas & Glykas, 2005; Chenhall, 2005). Managers place importance on multiple measures to find the association between the importance of strategic resources and performance (Widener, 2005). There are established multiple measures such as the balanced scorecard (thereafter called BSC) system; Business Process Reengineering (BPR) system; and Medori and Steeple's system (Folan & Browne, 2005). The most famous among them is the BSC, and it can assist in better quality decision-making (Valiris, Chytas & Glykas, 2005; Bremser & Chung, 2005). The scorecard enables managers to see the breadth and totality of company operations (Kaplan & Norton, 1993).



The BSC concept has been widely adopted by manufacturing and service companies, nonprofit organizations and government entities around the world since its introduction by Kaplan and Norton in 1992. The BSC, a model for strategy implementation and control, is the most visible performance measurement model (Bremser & Chung, 2005). In addition, the BSC is formulated at the top of the organization, and it is cascaded downward so that measurements are used throughout the organization to implement strategy. When integrated carefully and in a balanced manner, BSC provides a timely and summarized report-card of performance (Braam & Nijsen, 2004).

Kaplan and Norton (1993) clarified that financial measures alone are inadequate and ineffective to capture the other important dimensions of performance which are qualitative in nature. In addition to the financial group of indicators, the other key performance factors are clustered into 3 areas or perspectives. They are (i) customers, (ii) internal business process, and (iii)

learning (innovation) and growth (infrastructure). The financial perspective summarizes the economic consequences of actions implemented under the other three perspectives. The customer perspective describes the market in which the organization is competing and its target customers. The internal business process perspective defines the major internal processes required to create value for owners and customers. The final perspective, innovation and growth, describes the capabilities needed for the organization to establish long-term growth and improvement.

A number of researches have been conducted to determine companies' success in adopting the BSC. For example, a survey of 66 Australian manufacturing companies suggests that the BSC usage is associated with improved performance (Hoque dan James, 2000). Another survey conducted using a sample of 140 United States financial services firms document that the use of BSC is associated with a higher measurement system satisfaction (Ittner, Larcker & Randall, 2003). A study in the United States within the banking industry indicates that bank branches implementing the BSC outperformed non-BSC-implementing branches on key financial measures (Davis & Albright, 2004). A research conducted in Finland (Malmi, 2001), and another in Poland (Michalaska, 2005) also supported the success of BSC as a strategy-focus performance tool. BSC is a management tool that makes organizational performance transparent to the whole organization (Papalexandris, Ioannou, Prastacos & Soderquist, 2005). In addition, multi-layer evaluation process, or evaluation process derived from the balanced scorecard is recommended for the appraisal of major Information and Communication Technology investment (Milis & Mercken, 2004).

Previous researches provide evidence on the relationship between ERP implementation and BSC as performance measurement (Rosemann & Wiese, 1999; Chand, et al., 2005). Rosemann & Wiese (1999) use a modified balanced scorecard approach to evaluate the implementation of ERP software and to evaluate the continuous operation of the ERP installation. Unfortunately, the Rosemann and Wiese study focused on evaluating the information technology (IT) department only. In addition to that, using a successful ERP implementation by a major

international aircraft engine manufacturing and service organization as a case study, Chand et al. (2005) integrated the four BSC dimensions to study the contributions and effects of ERP systems on the strategic goals of the company. Both of the researches did not test the benefit of combining ERP system and BSC usage and its effect to company's business performance.

Complementarities theory argues that while some business benefits accrue from information system innovation and some benefits accrue from management system innovation, benefits are maximized when information system innovation occurs in parallel with management system innovation (Neely, 2009). The combined development of organizational and technological infrastructures leads to a 34% performance improvement, compared with an 8% improvement when only the management or the information system is improved (Bloom et al., 2007). In addition, integrating information system development and performance measurement further improves the company's business performance. Based on these findings, this research was conducted to empirically test the relationship between ERP system adoption benefits at the three managerial levels and company's performance within the BSC framework. The study also tried to find out whether integrating ERP as an information system and BSC as a performance measurement system can be a good combination to improve the company's performance.

In Malaysia, manufacturing sector has been recognized as a main sector that supports Malaysian economy. In the last three years, manufacturing sector has contributed to Gross Domestic Product (GDP). Based on FMM report, the manufacturing sector is the second largest sector that contributed to the GDP. In 2007, it contributed about 29.1 percent to the GDP. In 2008, 26.4 percent of the GDP was contributed by manufacturing sector. However, the contribution reduced to 26.2 percent of the GDP was contributed by manufacturing sector in 2009 (FMM, 2010). In line with the sharp decline in global FDI inflows in 2009, the total investments in approved manufacturing projects in Malaysia amounted to RM32.6 billion in 2009 compared with RM62.8 billion in 2008. A total of 766 manufacturing projects were approved in 2009 compared to 919 in 2008 (FMM, 2010). The fact

shows that there is a decline in manufacturing companies' performance in Malaysia nowadays. Based on that condition, a strategic way should be found to increase the companies' performance. In attempting to cope with these challenges, the companies should undergo fundamental changes from the traditional forms of organization and management. The change is toward implementing highly integrated enterprise-oriented systems (hall, 2007). A new information technology can create sustainable competitive advantage (Porter & Millar, 1985).

The implementation of Enterprise Resource Planning (ERP) system has grown rapidly world-wide in recent years. According to AMR Research, the globalization and centralization, and the performance management as the key drivers for continue ERP investment among the large corporations and small companies. Research on ERP in Malaysia is still inadequate as compared to those carried out in developed countries (Zainol, 2007). When compared to many developed nations, the implementation level of information and communications technology (ICT) among Malaysian companies remain low and the IT implementation among Malaysian companies is consider to be at a very basic level although over the past few years, there has been some improvement (Manecksha, 2003). Given the current competitive business environment, many companies have started to invest in ERP to improve their business processes. In 2002, to encourage Malaysian companies to implement ERP, SMIDEC started giving out loans to SMEs for adoption of ERP under the E- manufacturing Grant scheme. The aim of providing such loans to Malaysian SMEs is to improve productivity, competitiveness and efficiency of the SMEs. Given that SMEs forms a vital part of the Malaysian economy sector, the Malaysian government knows that ERP is a critical business-enabling tool for SMEs, especially those serving multinational corporations. Therefore the Malaysian government, through MIDEC, gave out RM150,000 of matching grants to SMEs that wanted to adopt ERP (Manecksha, 2003).

As a consequence, this research was conducted to explore the relationship between benefits of ERP system adoption and company's performance. The study fills the gap that was not found in the previous research where no research conducted to find the relationship between ERP system benefits at the three

managerial levels namely operational, tactical and strategic levels and company's business performance. The business performance was based on balanced scorecard perspectives namely internal processes, customer service, financial and innovation and growth performance. This study attempts to contribute to the management accounting system and accounting information system literature related to enterprise resource planning system from developing country's perspective in general and Malaysia in particular. Specifically, this study focuses on benefits of enterprise resource planning system among large manufacturing companies in Malaysia.

## 1.3 Problem Statement

Since installing and maintaining an ERP system requires large capital, the technical and managerial challenges of its implementation are widely researched and analyzed (Markus, 2000). However, assessing the benefits of ERP systems is less well studied and understood despite the observation that the difficulties experienced in measuring the business value of ERP systems are not typical of most IT projects (Chand, et al., 2005). Most researchers focused on factors influencing ERP implementation success or on the critical success factors. Examples include Mandal and Gunasekaran (2003); Sun, Yazdani and Overend (2005); King and Burges (2006); Yusuf et al. (2006); Vlachos (2006); and Hendricks et al. (2007).

Some researchers attempt to determine the effects of ERP implementation on financial performance. They include Poston and Grabski (2001); Hunton et al. (2003); and Hendricks, Singhal and Stratman (2007). The relationship of ERP system implementation on customer satisfaction was documented by Davenport (1998); Mabert et al. (2003); and Gupta and Kohli (2006). ERP implementation also affects internal processes of a company (Mabert et al. (2003); Hsu and Chen (2004); and Rikhardsson and Kraemmergaard ( 2006). In addition, ERP system implementation also affects ability to grow in a company (Quatrone & Hopper (2005); Kakouris and Polychronopoulos (2005); and Gupta and Kohli (2006). On the other hand, the question on how to measure the benefits of ERP system

implementation on company's performance has been raised but not fully analyzed (Chand et al., 2005).

Choosing the right performance measurement system is a strategic issue for a company. More and more companies in Malaysia started to use BSC as a tool for their responsibility accounting systems. However, one of the factors to be associated with the failure of BSC effort among Malaysian organizations is the information system that is not sufficiently developed to meet the information requirements of performance management systems (Othman, 2007). In addition, difficulties with data access and the information technology systems are faced when designing and implementing the performance measurement systems (Bourne et al., 2002).

The ERP systems journey has taken us beyond implementation into the second wave of ERP. One interesting question at this stage is how the ERP system contributes to firm success and survival after years of implementation. This research focuses on linking the ERP systems adoption benefits to performance measurement based on the BSC framework at the three different managerial levels (operational, tactical and strategic level). The idea of developing an ERP balanced scorecard has been suggested by several authors but only Rosemann and Weise (1999) and Chand et al. (2005) have attempted to apply the balanced scorecard approach to the specific task of managing ERP systems. However, none of those studies investigated empirically the effect of ERP system adoption benefits at the three different managerial levels on company's performance.



## 1.4 Research Questions

Based on the objectives of this study, there are three research questions need to be answered. They are:

a. do the benefits of ERP system adoption differ according to the three managerial levels?
b. what is the relationship between ERP system adoption benefits and company's business performance?

c. what is the relationship between ERP system adoption benefits and internal processes performance?
d. what is the relationship between ERP system adoption benefits and customer service performance?
e. what is the relationship between ERP system adoption benefits and financial performance?
f. what is the relationship between ERP system adoption benefits and innovation and growth performance?
g. does organizational performance increase when the ERP system is integrated with the BSC?

## 1.5 Research Objectives

This research is designed to assess the effect of ERP system adoption benefits and integrating ERP system and BSC on the performance of Malaysian manufacturing companies. The findings of the research are expected to provide practical input to improve the existing benefit measurements of ERP system and help improve the competitive advantage of Malaysian Manufacturers. The main objectives of this study are to:

a. determine if the benefits of ERP system adoption differ according to the three managerial levels;
b. assess the relationship between ERP system adoption benefits and company's business performance;
c. assess the relationship between ERP system adoption benefits and internal processes performance;
d. assess the relationship between ERP system adoption benefits and customer service performance;
e. assess the relationship between ERP system adoption benefits and financial performance;
f. assess the relationship between ERP system adoption benefits and innovation and growth performance and;
g. find out whether the organizational performance increases when the ERP system is integrated with the BSC.

## 1.6 Significance of the Study

This study attempts to contribute to the current accounting knowledge. The findings will thus contribute to the knowledge and application of Management Accounting Systems as well as Accounting Information Systems. The following two subsections present some of the possible contribution expected out of this research endeavor.

### 1.6.1 Theoretical Contribution

It has been highlighted in the previous section that the main motivation of this study is to fill the apparent gap in management accounting system and accounting information system literature related to enterprise resource planning systems. ERP is an industry term for the broad set of activities supported by multi-module application software that helps a manufacturer or a service provider manages the important parts of its business. In addition, research findings shed new light on the productivity paradox associated with ERP systems and suggest that ERP adoption helps firms gain a competitive advantage over non-adopters (Hunton et al., 2003). ERP system is an important factor which enables a company to compete effectively in the global market (Rikhardson & Kraemmergaard, 2006). However, little attention has been devoted to make progress to the subject, especially in developing countries. This research attempts to investigate the extent of ERP system benefits at manufacturing companies in Malaysia. It can enrich ERP system research in developing countries.

In addition, using benefits identified by previous researchers and a combination of frameworks introduced by Shang and Seddon (2002) and Chand et al. (2005), an empirical study was conducted to examine the ERP system benefits at the three different managerial levels (operational, tactical and strategic decision levels) and the effect of the ERP system adoption benefits on business performance. The measurements of ERP system benefits used in this research are more comprehensive in comparison to existing ERP studies. It combines measurements developed by previous researchers and suggestions made by CEOs of Malaysian GLC's during a series of interviews. The measurements developed for this study are focused only on manufacturing companies. The research findings will

be useful by manufacturing companies' managers to measure their own ERP system benefits at their own levels.

The study looks at the significant effect of ERP system adoption benefits at the three different managerial levels on the companies' performance based on the four dimensions of BSC. The results of this study will be able to discover which level of manager that experience the most benefits from ERP system adoption and whether different levels of managers will have different contributions toward the companies' performance. This empirical research can contribute to the usefulness of the BSC as an additional tool for managers in performance monitoring and evaluation. The research result may help to discover the current practice of responsibility accounting system and its contribution to organizational performance. In addition, the research results are able to find out managers' perception on using BSC to gain value added for ERP adopters to achieve competitive advantage. The output of this research can serve as a guideline for managers at manufacturing companies to improve or reassess their performance measurement systems in line with the ERP-Scorecard framework. Thus, integrating the BSC with the ERP systems provide an additional competitive edge for those companies by increasing the effectiveness and efficiency of the information needs.



### 1.6.2 Practical Contribution

Several practical contributions are expected to emerge from the current study. As noted in the previous study, managers at the three managerial levels have experienced benefits from ERP system adoption and the adoption can improve the company's business performance. This implies that all managers contribute towards achieving a company's objectives, goals, missions and vision. Hence, all of them should be actively involved in developing the company information system that provides data and information suitable for their own needs. Successful information system development should not be the responsibility of Chief Information Officers only. All managers should work hand in hand to create an information system that produces high quality information that is accurate, free from error, relevant, complete and aggregated. In addition, an integrated ERP system and Balanced Scorecard maximises benefits; hence a company should simultaneously develop its

information system and performance measurement system. Integrating information system with multiple performance measurements or the BSC can assist sustaining the company's competitive advantage.

At the operational level, managers use the core application of ERP system in their work. Core applications that operationally support the day-to-day business activities enable the managers' jobs to be done more accurately and easily. Based on the research findings, ERP adoption at the operational level increases the company's business performance through internal processes performance. Hence, the managers should ensure that these applications work well without interruption to provide common data for all units and departments in a company. If these applications fail, so does the business. This research will find out the effect of ERP system adoption on business performance. By using benefits experienced by the managers at the operational level , the finding can be used by operational level managers at manufacturing companies in Malaysia to increase their performance using measurements provided in this study.

ERP adoption at the tactical level affects a company's business performance by increasing financial and innovation and growth performances. Real time information that is supplied by core applications at the operational level permits managers at the tactical level to make timely decisions to improve performance and achieve competitive advantage. The managers at this level should use decision support modules, modelling, ad hoc reporting and analysis and 'what if' analysis to set company's goals in the short term basis so as to increase short term financial and innovation performances. This research will find out the effect of ERP system adoption on business performance. By using benefits experienced by the managers at the tactical level, the finding can be used by tactical level managers at manufacturing companies in Malaysia to increase their performance using measurements provided in this study.

ERP adoption at the strategic level affects a company's business performance by improving customer service, financial and innovation and growth performance. Real time information that is supplied by core applications of the

operational and application modules at the tactical level permits managers at the strategic level to make timely decisions to improve business performance and achieve sustainable competitive advantage. This research will find out the effect of ERP system adoption on business performance. By using benefits experienced by the managers at the strategic level, the finding can be used by strategic level managers at manufacturing companies in Malaysia to increase their performance using measurements provided in this study. Finally, looking at the ERP system benefits experienced by the managers at manufacturing companies in Malaysia, suggestions could put forth to the organization to improve certain aspects of organizational performance, organization needs to emphasis on a particular ERP system adoption in Malaysian manufacturing companies.

## 1.7 Scope of the Study

Previous studies show that manufacturing companies implement more ERP modules than non-manufacturing companies, such as service and merchandising companies. For this study, the population represents manufacturing companies that have implemented the ERP system in Malaysia. A manufacturing company is defined as a firm that transforms raw materials into finished goods that are sold to customers (Reeve, Warren & Duchac, 2007). A list of manufacturing companies in Malaysia was obtained from the Federation of Malaysian Manufacturing (FMM) 2008. A mixed methodology was adopted. The first stage involves semi-structured personal interviews with CEOs to develop a questionnaire in addition to previous research results. In the second stage, managers of Malaysian manufacturing companies are randomly selected to respond to the questionnaire to ask about their perception on the ERP system benefits and business performance. Data was collected through self-administered questionnaires. Managers were chosen because managers at all levels have critical strategic roles to fulfill for the organization to be successful (Floyd & Lane, 2000). According to the authors, senior, middle and first level managers have distinct responsibilities with respect to each sub-process. Managers at operational, tactical and strategic levels were respondents for the study. Data were analysed using descriptive and inferential statistics. Finally, series of interviews with CEOs of Malaysian manufacturing companies and Managing

Directors of ERP system vendors were also conducted to reconfirm the survey results.

New information technology can create sustainable competitive advantage (Porter & Millar, 1985). Chand et.al. (2005) incorporates the balanced scorecard (BSC) framework to the ERP system. Existing work on the combined ERP and BSC includes Rosemann and Wiese (1999), Wier et. al (2007) and Mansor and Bahari (2008). This study focuses on the effects of ERP adoption benefits at three different managerial levels on companies' business performance. Using benefits identified by previous researchers and a combination of frameworks introduced by Shang and Seddon (2002) and Chand et al. (2005), an empirical study was conducted to examine the benefits at three different managerial decision levels (operational, tactical and strategic decision levels) and the effect of ERP system adoption on business performance. ERP system adoption was measured by asking managers about their perception about the benefits they experienced using the ERP system. Business performance were measured based on managers' perception about company's business performance based on balanced scorecard perspectives. They are: (i) customers; (ii) internal processes; (iii) ability to learn and grow; and (iv) financial perspectives.



## 1.8 Operational Definition of Key Terms and Variables

This section presents the definition of terms used in the study. The terms are presented for both independent and dependent variables.

### 1.8.1 Independent Variables

The Enterprise Resource Planning (ERP) system is a business management system that comprises of integrated sets of comprehensive software. When successfully implemented, the ERP can manage and integrate all the business functions within an organization (Shehab, et al. 2004). A company can be grouped as ERP system implementers if the information system adopted has the following characteristics: information is generated on real time basis; common data are shared throughout company; and IS software are integrated and automated (Rashid, 2002). Thus, in this study, respondents were asked to identify the characteristics of information

system adoption, by using similar characteristics, to be classified as an ERP adopter.

Management is the act of getting people together to accomplish desired goals and objectives (Gomez-Mejia et al., 2008). Three levels of management that are usually practiced in a company are top level, middle and operational. The top-level management (strategic level managers): requires an extensive knowledge of management roles and skills; has to be very aware of external factors such as markets; involves long-term decisions and require analytic, directive, conceptual and/or behavioral/participative processes; and is responsible for strategic decisions. Middle managers (tactical level of managers) have a specialized understanding of certain managerial tasks and are responsible for carrying out the decisions made by top-level management. Meanwhile, the lower management (operational level of managers) ensures that the decisions and plans taken by the other two levels are implemented; their decisions are generally short-term.

### a. Operational Level Benefits of ERP System Adoption

The definition of operational level benefits in this study is a combination of definitions by Shang and Seddon (2002) and Chand et al. (2005). According to Shang and Seddon, at the operational level, the ES adoption will cause cost reduction, cycle time reduction, productivity improvement, quality improvement and customer service improvement. According to Chand et al. (2005), the goals of ERP system at this level are to improve process efficiency, meet current needs of customers more efficiently, reduce cost and increase productivity. In this study, operational level benefits are measured and grouped as internal processes benefits, customer benefits, financial benefits and innovation and growth benefits.

### b. Tactical Level Benefits of ERP System Adoption

Based on the Shang and Seddon (2002) study, at the managerial (tactical) level, ERP adoption provides better resource management, improves decision making and planning, and performance improvement. According to Chand et al. (2005), the goals of ERP system at this level are to improve tactical decision making, identify and meet customer needs proactively, increase revenues and make workers more

effective decision makers. In this study, tactical level benefits are measured and grouped as internal processes benefits, customer benefits, financial benefits and innovation and growth benefits.

### c. Strategic Level Benefits of ERP System Adoption

Based on Shang and Seddon (2002), at the strategic level, the ERP adoption supports business growth, business alliance, build business innovations, cost leadership, generate product differentiation (including customization), and build external linkages (customers and suppliers). According to Chand et al. (2005), the goals of ERP system at this level are to adapt to radical environment changes routinely, meet new customer needs or new needs of customers, improve market value and absorb radical change routinely. In this study, strategic level benefits are measured and grouped as internal processes benefits, customer benefits, financial benefits and innovation and growth benefits.

## 1.8.2 Dependent Variables

### a. Business Performance

For the purpose of the present study, the definition of business performance as proposed by Kaplan and Norton (1996) was used. According to Kaplan and Norton (1996), a comprehensive set of performance measures defined from four different measurement perspectives (internal processes, customer, financial and innovation and growth). It provides a framework for translating the business strategy into operational terms. The four performance measurement perspectives are called Balanced Scorecard (BSC). Kaplan and Norton (1992, 1996, 2001) define the BSC as a framework to facilitate the translation of business strategy into controllable performance measures.

### b. Internal Processes Performance

In the internal-business-process perspective, executives identify the critical internal processes in which the organization must excel to achieve customer and shareholder objectives. Measurements for internal business processes performance

are efficiency ratio, complaints amount, production ratio, failure amount, reduced cycle time and reduced employee turnover.

**c. Financial Performance**

Financial performance measures indicate whether a company's strategy, implementation and execution are contributing to bottom-line improvement. Measurements for financial performance are return on investment, return on assets, operating profits, sales growth rate, cost reduction and Economic Value Added.

**d. Customer Service Performance**

In the customer perspective of the BSC, companies identify the customers and market segments in which they have chosen to compete. Since companies create value through customers, understanding how they view performance becomes a major aspect of performance measurement. Customer service performance is measured by quality of customer service, quality of products, competitive advantage gained, on-time delivery and increased customer partnership.



**e. Innovation and Growth Performance**

The innovation and growth perspective identifies the infrastructure that the organization must build to create long-term growth and improvement. Meanwhile, measurements for innovation and growths are training amount, empowerment, better employee morale and development of workers' qualifications.

### 1.8.9 Organization of the Thesis

This thesis is divided into seven chapters. Chapter one presents the overview of the study in the thesis. Briefly, it highlights the motivation that leads to the underlying thesis of the research. Enterprise resource planning at manufacturing companies in Malaysia is discussed in chapter two. Chapter three and four explain about literature review and hypothesis development and theoretical framework respectively. Research methodology is presented in chapter five and followed by

chapter six with result of the study. Finally, chapter seven discusses the research findings, implications and future research related to this study.

# CHAPTER 2

# ENTERPRISE RESOURCE PLANNING SYSTEMS AND MANUFACTURING COMPANIES IN MALAYSIA

## 2.1 Introduction

This chapter discusses issues that are related to enterprise resource planning and manufacturing companies in Malaysia. Definition of manufacturing companies is discussed first and followed by historical development of manufacturing companies in Malaysia. Next, issues about policy towards manufacturing companies in Malaysia are presented and followed by profile of manufacturing sector in Malaysia. Finally, this chapter discusses about the contribution of manufacturing companies to Malaysian economy, classification of manufacturing companies and enterprise resource planning system in Malaysia.

## 2.2 Definition of Manufacturing Companies

Manufacturing consists of activities and processes that convert raw materials into finished goods (Weygandt et.al, 2010). The manufacturing company uses machines, tools and labor to produce goods for use or sale. The term may refer to a range of human activity, from handicraft to high tech, but is most commonly applied to industrial production, in which raw materials are transformed into finished goods on a large scale. Such finished goods may be used for other manufacturing, more complex products, such as aircraft, household appliances or automobiles. It may be sold to wholesales, who in turn sell them to retailers who then sell them to end users or customers. A manufacturing company is defined as a firm that transforms raw materials into finished goods that are sold to customers (Reeve, Warren and Duchac, 2007). There are some categories of manufacturing activities exists. They are chemical industry, construction, electronics, engineering, energy industry, food and beverages, industrial design and metalworking.

Manufacturing process includes all steps necessary to convert raw materials, components, or parts into finished goods that meet a customer's expectations or specifications. The industrial Co-ordination Act 1975 (ICA) defines manufacturing activities as the making, altering, blending, ornamenting, finishing or otherwise treating or adapting any article or substance with a view to its use, sale, transport, delivery or disposal. It

includes the assembly of parts and ship repairing but shall not include any activity normally associated with retail or wholesale trade. Companies with manufacturing activities differ from both merchandising and service companies. The main difference between merchandising and manufacturing companies is that merchandisers buy goods ready for sale while manufacturers produce goods from materials and labour.

## 2.3 Historical Development of Manufacturing Companies in Malaysia

Prior to its independence, Malaysia relied heavily on agriculture as a means of income for the country. By the time the nation received independence from the British in 1957, its economic activities had varied to a certain extent and in that year itself, 40% of the Gross Domestic Product (GDP) was attributed to the fishery and forestry sector, apart from agriculture. Malaya had also made a mark for herself as the world's largest exporter of rubber and tin at the time and could boast one-third of the world's rubber output production and 33% of tin. At that era, Malaya was still very backward in the manufacturing industry and had to rely heavily on imports to fulfil the needs of the country. It was only after independence that changes began to take place in the economy.

Malaysia is generally regarded as one of the most successful non-western countries to have achieved a relatively smooth transition to modern economic growth over the last century or so. Since the late nineteenth century it has been a major supplier of primary products to the industrialized countries: tin rubber, palm oil, timber, oil and natural gas. However, since about 1970 the leading sector in development has been a range of export-oriented manufacturing industries such as textiles, electrical and electronic goods and rubber products. Government policy has generally accorded a central role to foreign capital, while at the same time working towards more substantial participation for domestic, especially *bumiputera,* capital and enterprise. By 1990 the country had largely met the criteria for a Newly-Industrialized Country (NIC) status (30 percent of exports to consist of manufactured goods). While the Asian economic crisis of 1997-98 slowed growth temporarily, the current plan, titled Vision 2020, aims to achieve "a fully developed industrialized economy by that date. This will require an annual growth rate in real GDP of 7 percent" (Far Eastern Economic Review, Nov. 6, 2003). Malaysia is perhaps the best example of a country in which the economic roles and interests of various racial groups have been pragmatically managed in the long-term without significant loss of growth

momentum, despite the ongoing presence of inter-ethnic tensions which have occasionally manifested in violence, notably in 1969.

The Malaysian Economy has made a gargantuan leap since 1957 (MIDA, 2010). The transformation of the country's economy from one based on primary commodities like tin, rubber and palm oil to a dynamic and vibrant industrialising nation is attributed to a variety of pull factors. Malaysia's political and economic stability, prudent and pragmatic investor friendly business policies, cost-productive workforce, a developed infrastructure comparable to that of any western country and a host of other amenities makes this country an enticing place for investor.

There are some reasons for investors to invest in Malaysian manufactures. Malaysia has economic strength with many natural resources such as oil, gas, tin, timber, palm oil, rubber. It also has high GDP growth (4.6%), gross national savings (37.9 of GNI), debt service ratio (2.7%), low unemployment rate (3.7%), inflation rate (5.4%) and 70% of exports are from manufacturing goods. It also has supportive government policies such as pro-business policies, responsive government, liberal investment policies, attractive tax and other incentive. Malaysia also has developed infrastructure such as network of well-maintained highways and railways, well-equipped seaports and airports, high quality telecommunications network and services and fully developed industrial parks. It is also supported by quality of life in Malaysia such as friendly and hospitality, safe and comfortable living environment, excellent housing and medical facilities, excellent educational institutions, world class recreational and sports facilities and excellent shopping malls.

In 2008, the Malaysian economy remained resilient with a growth in Groups Domestic Product (GDP) of 4.6 per cent. In tandem with the GDP growth, productivity grew by 2.9 percent to a level of RM49,526 (Productivity Report, MIDA, 2008). This achievement was commendable in the context of the global economic slowdown. The productivity growth attained was attributed to the strong domestic consumption which was facilitated by the government's proactive approaches to stimulate economic growth. The productivity and cost rationalisation measures adopted by private sector further contributed to the

higher productivity registered. Productivity growth was broad-based, with all economic sectors registering growth.

## 2.4 Policy towards Manufacturing Companies in Malaysia

The industrial Co-ordination Act 1975 (ICA) was introduced with the aim to maintain an orderly development and growth in the country's manufacturing sector. The ICA requires manufacturing companies with shareholders' fund of RM2,5 million and above or engaging 75 or more full time employees to apply for a manufacturing licence for approval by the Ministry of International Trade and Industry (MITI). Applications for manufacturing licences are to be submitted to the Malaysian Industrial Development Authority (MIDA), an agency under MITI in charge of the promotion and coordination of industrial development in Malaysia.

In Malaysia, a business may be conducted by an individual operating as a sole proprietor, partnership or a locally incorporated company or by a foreign company registered under the provisions of the Companies Act 1965. All sole proprietorships in Malaysia must be registered with the Companies Commission of Malaysia (SSM) under the Registration of Businesses Act 1965. In the case of partnerships, partners are both jointly and severally liable for the debts and obligations of the partnership should have sufficient assets. Formal partnership deeds may be drawn up governing the rights and obligations of each partner but this is not obligatory. It provides three types of companies: (1) a company limited by shares where the personal liability of its members is limited to the par value of their shares and the number of shares taken or agreed to be taken by them; (2) a company limited by guarantee where members guarantee to meet liability up to an amount nominated in the Memorandum and Articles of Association in the event of the company being wound up; (3) an unlimited company, where there is no limit to the members' liability.

A company must maintain a registered office in Malaysia where all books and documents required under the provision of the Act are kept. The name of the company shall appear in legible Romanised letters, together with the company number, on its seal and documents. The company cannot deal with its own share or hold shares in its holding company. Each equity share of a public company carries only one vote at a poll any general

meeting of the company. A private company may, however, provide for varying voting rights for its shareholders.

A foreign company desiring to conduct business or establish a place for one in Malaysia must register with SSM. The same registration procedure applies whereby an application must be submitted on Form 13A to the SSM in Kuala Lumpur or any of its branch offices in Malaysia, with payment of RM30. If the intended name of the foreign company is available, the application will be approved and the name reserved for three months. The foreign incorporated company must file a copy of the annual return each year within one month of its annual general meeting. Within two months of its annual general meeting, the company must file a copy of the balance sheet of the head office, a duly audited statement of assets used and liabilities arising out of its operations in Malaysia, and a duly audited profit and loss account.

## 2.5 Profile of Manufacturing Sector in Malaysia

Efforts to develop the nation and to provide prosperity to the people is a continuous process made possible by a government. After Outline Perspective Plan (OPP2) ended in 2000, the government presented another long term plan known as Third Outline Perspective Plan (OPP3). This long-term plan for another 10 years starting 2001 to 2010 covers the Eight and Ninth Malaysia Plan. OPP3 as a continuation of OPP2 is also the second phase in the nation's framework to achieve Vision 2020 which began in 1991. If OPP2 was known as the National Development Policy, the new long-term plan is known as National Vision Policy (NVP). The essence of these two long term plans is still to bring about a balance development. A balance in development put forward this time, touches specifically on industries based on high technology and information technology. The use of information technology can generate economic growth based on knowledge or what is currently more popularly known as 'k-economy'. The focus is development on various levels and sectors, means at the same time that the government is continuing its endeavour to bring prosperity to all strata of society or entrepreneurs involved directly or indirectly in these sectors. It is in this context that the government is emphasizing the need for balanced development between sectors and groups that are involved. Indeed, the thrust of OPP3 and NVP is the creation of an enduring and competitive Malaysian society.

Among the major economic sector, the manufacturing sector registered a productivity growth of 2.0 per cent amidst unfavourable export market conditions especially during the fourth quarter of 2008 (MIDA, 2008). The manufacturing performance was supported by strong growth among domestic oriented-industries such as chemicals and chemical products, food and beverages, non-metallic mineral products, transport equipment and machinery. The export-oriented industries, especially electronics and equipment products, rubber products, iron and steel products as well as appliances and parts, were however, affected by the slower export demand.

The Malaysian Economy registered a growth of 6.3 per cent for the first nine months of 2008 despite the challenging global economic environment. The growth was supported by domestic demand, following continued expansion in private and public consumption (MIDA, 2008). During that term, the manufacturing sector registered a growth in value added of 4.8 per cent despite the impact of the global economic slowdown particularly in export- oriented industries.

During the first 11 months of 2008, the sales value of the manufacturing sector recorded growth of 12 per cent to RM533.4 billion compared with RM476.2 billion for the corresponding period in 2007 (MIDA, 2008). Productivity in the sector, as measured by sales value per employee, recorded a growth of 15.2 per cent in 2008. Employment in the manufacturing sector was estimated at 3.4 million persons or 29 per cent of total employment in 2008. Table 2.1 shows approved manufacturing projects by industry in 2009, 2008 and 2007. Based on the table,

**Table 2.1: Approved Manufacturing Projects by Industry**

| Industry | 2009 | | 2008 | | 2007 | |
|---|---|---|---|---|---|---|
| | Number | Total Capital Investment | Number | Total Capital Investment | Number | Total Capital Investment |
| Chemicals & Chemical Products | 77 | 8,379.6 | 70 | 2656.5 | 52 | 12,173.4 |
| Non-Metallic Mineral Products | 27 | 6,415.0 | 28 | 1268.5 | 144 | 15,1116 |
| Electronics &Electrical Products | 115 | 4,745.9 | 132 | 17773.0 | 53 | 1,195.9 |
| Basic Metal Products | 30 | 2,587.2 | 53 | 25768.2 | 75 | 2,383.3 |
| Food Manufacturing | 69 | 1,971.8 | 87 | 2781.5 | 17 | 13,832.4 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Transport Equipment | 54 | 1,405.9 | 73 | 2890.0 | 71 | 3,800.8 |
| Fabricated Metal Products | 99 | 1,370.0 | 105 | 1073.4 | 16 | 1,301.0 |
| Machinery & Equipment | 95 | 1,239.9 | 93 | 1257.6 | 98 | 1,765.3 |
| Petroleum Products | 8 | 1,179.3 | 16 | 2749.6 | 101 | 657.5 |
| Plastic Products | 42 | 770.8 | 60 | 635.8 | 33 | 571.8 |
| Scientific & measuring Equipment | 19 | 515.0 | 18 | 520.1 | 36 | 2,898.0 |
| Paper, Printing &Publishing | 20 | 502.3 | 26 | 910.5 | 33 | 510.2 |
| Beverages & Tobacco | 3 | 393.2 | 3 | 87.8 | 92 | 1,076.6 |
| Textiles & Textile Products | 9 | 333.6 | 18 | 408.4 | 19 | 372.2 |
| Woods & Wood Products | 31 | 318.7 | 37 | 930.2 | 22 | 1,400.9 |
| Rubber Products | 22 | 220.4 | 37 | 721.9 | 51 | 309.1 |
| Furniture & Fixtures | 31 | 174.6 | 45 | 215.6 | 10 | 100.2 |
| Leather & Leather Products | 2 | 13.3 | - | - | 1 | 4.6 |
| Miscellaneous | 13 | 100.6 | 18 | 136.6 | 25 | 467.5 |
| Total | 766 | 32,636.8 | 919 | 62.785.0 | 949 | 59,932.2 |

Source: MIDA, 2009

total number of project approved in 2009, 2008 and 2007 were 766, 919 and 949 respectively. Total employment in 2009, 2008 and 2007 were 64,330, 101,173 and 97,673 respectively. Total capital investment in 2009, 2008 and 2007 were RM32,636,800, RM62.785,000 and RM59,932,200 respectively. Table 2.2 shows new manufacturing projects approved by size of capital investment. It shows that most of project approved in year 2009, 2008 and 2007 were projects in between RM 10.0 million - < RM50.0 million. Table 2.3 shows approved manufacturing projects by State. It seems that out of 766 projects in 2009, 919 projects in 2008 and 324 projects in 2007, most of them were in Selangor.

**Table 2.2: New Manufacturing Projects Approved by Size of Capital Investment**

| Size of Capital Investment | 2009 | | 2008 | | 2007 | |
|---|---|---|---|---|---|---|
| | Number | Total Capital Investment | Number | Total Capital Investment | Number | Total Capital Investment |
| Less than RM 2.5 million | 103 | 132.6 | 119 | 168.2 | 160 | 204.6 |
| RM 2.5 million - < RM5.0 million | 66 | 232.1 | 82 | 286.4 | 97 | 350.7 |

| | | | | | | |
|---|---|---|---|---|---|---|
| RM 5.0 million - < RM10.0 million | 113 | 794.5 | 104 | 729.1 | 111 | 781.5 |
| RM 10.0 million - < RM50.0 million | 143 | 2,926.2 | 187 | 3,723.4 | 167 | 3,648.4 |
| RM 50.0 million - < RM 100.0 million | 15 | 1,015.5 | 21 | 1,424.1 | 45 | 2,934.2 |
| RM 100.0 million - < RM500.0 million | 28 | 5,138.2 | 24 | 4,992.2 | 29 | 5,096.1 |
| RM 500.0 million - < RM1.0 billion | - | - | 5 | 2,919.8 | 11 | 7,128.6 |
| RM 1.0 billion & Above | 3 | 11,132.5 | 6 | 27,748.8 | 5 | 11,006.0 |
| TOTAL | 471 | 22,051.4 | 548 | 41,992.0 | 625 | 31,150.0 |

Source: MIDA, 2009

## 2.6 The Contribution of Manufacturing Companies to Malaysian Economy

Manufacturing sector has been recognized as a main sector that supports Malaysian economy. In the last three years, manufacturing sector has contributed to Gross Domestic Product (GDP). Based on FMM report, the manufacturing sector is the second largest sector that contributed to the GDP. In 2007, it contributed about 29.1 percent to the GDP. In 2008, 26.4 percent of the GDP was contributed by manufacturing sector. Meanwhile, 26.2 percent of the GDP was contributed by manufacturing sector in 2009 (FMM, 2010). In addition, the manufacturing sector increases the total employment in Malaysia. The sector has contributed to reduce unemployment in Malaysia. In 2007, total employment from manufacturing sector

**Table 2.3: Approved Manufacturing Projects by State**

| State | 2009 | | 2008 | | 2007 | |
|---|---|---|---|---|---|---|
| | Number | Total Capital Investment | Number | Total Capital Investment | Number | Total Capital Investment |
| Sarawak | 25 | 8,450.8 | 39 | 15,168.9 | 10 | 1,034.5 |
| Selangor D.E | 278 | 6,759.6 | 301 | 11,840.9 | 87 | 11,181.5 |
| Sabah | 25 | 5,664.3 | 40 | 9,64.4 | 86 | 9,242.8 |
| Johor D.T | 150 | 4,063.4 | 173 | 11,711.7 | 50 | 4,768.7 |
| Penang | 104 | 2,165.2 | 151 | 10,156.3 | 19 | 3,837.7 |
| Kedah D.A | 40 | 1,496.1 | 46 | 2,567.3 | 13 | 2,034.6 |
| Perak D.R | 47 | 893.9 | 50 | 3,130.0 | 19 | 13,990.2 |
| Melaka | 23 | 892.7 | 41 | 3,634.5 | 16 | 2,675.6 |
| Negeri Sembilan D.K | 30 | 857.6 | 27 | 1,145.8 | 10 | 1,563.8 |
| Pahang D.M | 17 | 604.8 | 23 | 1,080.7 | 2 | 6,163.2 |
| Terengganu D.I | 9 | 505.8 | 9 | 992.3 | 8 | 3,257.5 |
| Kuala Lumpur | 14 | 155.7 | 12 | 117.8 | 1 | 7.1 |
| Kelantan D.N | 4 | 126.9 | 3 | 83.6 | 1 | 92.4 |
| Perlis I.K | - | - | 2 | 170.3 | 2 | 82.7 |
| Labuan | - | - | 2 | 20.5 | - | - |
| TOTAL | 766 | 32,636.8 | 919 | 62,785.0 | 324 | 59,932.2 |

Source: MIDA, 2009

was 28.9 percent of total Malaysian employment. In 2008, it was about 28.8 percent and in 2009 was 28.4 percent. The manufacturing sector was always the highest sector that absorb employee in Malaysia.

The investment trend in Malaysia is strongly influenced by global economic developments which turned negative towards the end of 2008 and 2009. In line with the sharp decline in global FDI inflows in 2009, the total investments in approved manufacturing projects in Malaysia amounted to RM32.6 billion in 2009 compared with RM62.8 billion in 2008. A total of 766 manufacturing projects were approved in 2009 (FMM, 2010). The total investments approved in 2009 exceeded the average annual investment target of RM27.5 billion set under the third Industrial Master Plan (IMP3). This indicates that Malaysia remains an attractive investment destination. Foreign investments in 2009 amounted to RM22.1 billion and accounted for 67.8 per cent of the total investments approved for the year. The balanced of RM10.5 billion or 32.2 per cent were investments from domestic sources. Despite the global slowdown, Malaysia continued to receive a significant amount of new projects amounted to RM22.1 billion (471projects), constituting 67.8 per cent of the total investments approved. Of this, RM5.7 billion or 25.8 per cent was domestic investments while RM16.4 billion or 74.2 per cent was from foreign sources.

Existing companies continue to expand and diversify their operations in the country. A total of 295 projects with investments amounting to RM10.5 billion were approved in 2009, accounting for 32.2 per cent of the total investments approved. It is significant to note that the investments approved in 2009 helped to develop and strengthen specific industry clusters in the country. Malaysia's strength in the electrical and electronics (E&E) industry continued to provide the platform for developing other clusters especially clusters in the solar, medical devices and machinery & equipment (M&E) industries.

In 2009, there were 50 projects approved which recorded investments of at least RM100 million each. Total investments in these projects amounted to RM23.8 billion or 73.0 per cent of total investments approved in 2009. These 50 projects were mainly in the chemicals and chemical products (RM7.3 billion), non-metallic mineral products (RM6.1 billion), electrical and electronic projects (RM3.3 billion), basic metal products (RM2.1 billion), petroleum products (RM1.1 billion) and transport equipment (RM923.4 .million) industries. The projects approved with investments of at least RM1 billion each were;

- A new foreign-owned project with investments of RM5.2 billion for the production of polycrystalline silicon, fumed silica and trichlorosilane;
- A new wholly foreign-owned project with investments of RM5.2 billion to manufacture solar glass (coated, tempered, etc) and solar mirror;

- A majority Malaysian-owned expansion project with investments of RM1.6 billion to manufacture aluminium ingots , aluminium alloy ingots and aluminium billets;
- A new joint-venture project with investments of RM1.1 billion to produce petrochemical feedstock and fuels;
- An expansion project by a wholly foreign owned company with investments of RM1.0 billion to produce advanced integrated circuits.

## 2.7 Classification of Manufacturing Companies in Malaysia

As discussed earlier, manufacturing companies are companies that process raw material becomes finished goods. In Malaysia, manufacturing companies are classified into electronics, electrical machinery and appliances; textiles, apparel and footwear; wood products; rubber products; food, beverages and tobacco; petroleum products; chemicals and plastic products; non-metallic mineral products; iron, steel and metal products; transport equipments and other manufactured products (FMM, 2010).

Besides classifying the manufacturing companies into several type of product produced, the manufacturing companies can be classified based on the company size. There are three categories of manufacturing companies. They are small, medium and large companies. This means that the small-sized, medium-sized or large-sized of companies can be found in an industry. There are numerous definitions of small and medium-sized (SME) and large-sized companies in many countries and agencies, however, there is still no consensus among them about definition. Most of the definitions are different because of the difference in the phase of economic development, the prevailing social conditions as well as the nature and importance of the industries and the countries. Although the definitions and descriptions of the size vary, in practice, quantitative and qualitative criteria are usually used to define it. For quantitative criteria, various indexes are used such as number of employees, invested capital, total amount of assets, sales volume and production capability and the most commonly used index is the number of employees.

According to World Bank Group, SME department is currently working with the following definitions: micro enterprise is an enterprise with up to 10 employees, total assets of up to US$100,000 and total annual sales of up to US$100,000; small enterprise is an enterprise with up to 50 employees, total assets of up to US$3 million and total sales of up

to US$3 million; medium enterprise is an enterprise with up to 300 employees, total assets of up to US$15 million, and total annual sales of up to US$15 million. Large enterprise is an enterprise with more than 300 employees, total assets that is more than US$15 million and total annual sales more than US$15 million. However, these definitions are admittedly subjective and still under review.

In most European countries, there is a distinction between the legal definition and the statistical definition. The legal definition, based on EU recommendation number 2003/361/E and which took effect on January, 2005 takes account of the number of employees, annual turnover, annual balance sheet and independence. However, the main criterion of SME statistics for statistical purposes is the number of persons employed. The details of the EU legal definition are shown in Table 2.4.

In Russia, as defined in the Federal Law on State Support of Small Entrepreneurship of June 14, 1995, small and medium enterprises are self-employed individuals, or commerce in which the authorized capital of public sector bodies, charities, or businesses have no more than a 25% share and where the



**Table 2.4: European Legal Definition of Manufacturing Companies**

| Enterprises | Employees | Annual Turnover | Annual Balance Sheet |
|---|---|---|---|
| Micro | 1 – 9 | <2 million Euro | <2 million Euro |
| Small | 10 – 19 | 2 - <10 million Euro | 2 - <10 million Euro |
| Medium | 50 - 249 | 10 - <50 million Euro | 10 - <50 million Euro |
| Large | >249 | >50 million Euro | >50 million Euro |

average number of employees does not exceed the limits according to main sector of activity. The limit for every sector of activity is:

- 110 employees for the sector of industrial production & construction
- 80 employees for the sector of agriculture
- 60 employees for the sector of scientific & technical
- 50 employees for the sector of wholesale trading
- 30 employees for the sector of retail trade and domestic service
- 50 employees for the other sectors

- It means that criteria for large manufacturing companies in Russia are manufacturing companies that have more than 110 employees.

In the United States of America, SME is defined variously for different sectors of industries by using some quantitative and qualitative criteria. However, the most common definition is that proposed by the Small Business Administration (SBA). According to the SBA, SME has established a size standard for most industries in the economy and the most common size standards are:

- 500 employees for most manufacturing and mining industries
- 100 employees for all wholesale trade industries
- $6 million average annual revenues for most retail and service industries
- $28.5 million average annual revenues for most general & heavy construction industries
- $12 million average annual revenues for all special trade contractors
- $0.75 million average annual revenues for most agricultural industries.
- It means that criteria for large manufacturing companies in the United States of America are manufacturing companies that have more than 500 employees.

About one fourth of industries have a size standard that is different from these levels. They vary from $0.75 million to $28.5 million for size standards based on average annual revenues and from 100 to 1500 employees for size standards based on number of employees. There are nearly 1100 sub groups of business in major groups of agriculture, forestry, fishing, hunting, mining, construction, manufacturing, wholesale trade, retail trade, transportation, information, finance and insurance, real estate, rental, leasing, professional, scientific and technical services, management of companies and enterprises, administrative support, waste management and remediation services, educational services, health care and social services, arts, entertainment and recreation, accommodation, food services and other services.

In Canada, there are no standards definitions. However, according to the one used by Statistical Office of Canada, SME includes all incorporated and non-incorporated, employer and non-employer business with less than 500 employees and 50 millions Canadian Dollars in revenue. It means that criteria for large manufacturing companies in the Canada are manufacturing companies that have more than 500 employees.

In Australia, The Australia Bureau of Statistics (ABS) in 1999 conducted a review of the SME definition. The review has recommended that for statistical purposes, firm-size classifications must be based on full-time equivalent (FTE) employment. In addition, public companies and business in parent or subsidiary relationships, cooperatives and associations should be excluded from the "small enterprise" category. The boundaries for enterprise classification, in accordance with the review by the ABS are defined as follows: large businesses are company with 200 and more employees; medium businesses they can employ 20 - 199 people; and small businesses are businesses employing 5 people but fewer than 20 people.

In New Zealand, there is no formal definition of SMEs (OECD, 2004). However, in the 2001 survey of business practices and performance conducted by the Statistics New Zealand (jointly sponsored by the Ministry of Economic Development, Ministry of Research, Science and Technology (MORST) and Statistics New Zealand) the following categories were used: small firms are defined as those employing 6 to 19 full time equivalent employees (FTEs) and medium firms are those employing 20 to 49 FTEs. Meanwhile the New Zealand Centre for SME Research, which is part of the College of Business at Massey University, in one of its publications uses the following employment size classes: micro business are firms with 0 – 5 employees, small business are firms with 6 to 49 employees, medium sized businesses are firms with 50 to 99 employees and large sized businesses are firms with 100 and more employees (OECD, 2004).

In Asia, the definitions of SMEs are also quite different. In China, as stated in the State Economic and Trade commission news on Mac 7, 2003, the Tentative Classification Standards on the Small and Medium-sized Enterprises (SMEs) applies to the government statistics work. The standards were jointly written by the State Economic and Trade Commission, the State Development Planning Commission, the Ministry of Finance and National Statistics Bureau. The standards were designed in accordance with the SMEs Promotion Law. Major elements of consideration cover the payrolls, revenue and total assets of enterprises. The standards apply to industrial sectors, construction, transportation and posts, wholesale and retail, and hotels and restaurants.

Industry-specific standard for SMEs in China mentioned that industrial SMEs should employ less than 2,000 people or with annual revenue less than RMB 300 million or with total assets less than RMB 400 million. Medium-sized enterprises in this category should employ 300 or more people with annual and total assets exceeding RMB 30 million and 40 million respectively. The rest are classified as small enterprises. It means that criteria for large manufacturing companies in China are manufacturing companies that have more than 2000 employees.

In Japan, the Ministry of Economy, Trade and Industry defines SMEs as any entity which is a company whose capital or total amount of investment does not exceed ¥300,000,000 or a company whose regular workforce does not exceed 300 persons and which is principally engaged in manufacturing, construction, transportation or any other category of business.

In Indonesia, the Ministry of Industry and Statistics Bureau has defined small enterprises as those with assets less than or equal to Rp200 million, annual sales less than or equal to Rp 1 billion and employing less than 20 employees. While the medium enterprises are defined as those whose annual sales more than Rp 1 billion but less than Rp 50 billion and employing less than 100 employees. It means that criteria for large manufacturing companies in Indonesia are those whose annual sales more than Rp 50 billion and employing more than 100 employees. Meanwhile, the Ministry of Industry and Natural Resources of Brunei Darussalam defines SMEs in all sector of industries as those employing less than 100 employees. So, it means that criteria for large manufacturing companies in Brunei Darussalam are those which employ more than 100 employees.

The Ministry of Industry of Thailand issues the definition of SMEs as a manufacturing business that employs a maximum of 50 employees or owning maximum in fixed assets of 50 million baht. Medium enterprises are characterized by a manufacturing business that employs more than 50 employees and not exceeding 200 or owning fixed assets of more than 50 million baht and not exceeding 200 million. It means that criteria for large manufacturing companies in Thailand are those whose annual sales more than 200 million baht and employing more than 200 employees. In Singapore, SMEs are defined according to industrial sectors whose fixed assets do not exceed $15 million and

employment size does not exceed 200 employees. It means that criteria for large manufacturing companies in Singapore are those whose annual sales more than $15 million and employing more than 200 employees. Meanwhile, in the Philippines, the SMEs are defined as enterprises whose assets size do not exceed P100,000,000 and employment size does not exceed 200 employees. It means that criteria for large manufacturing companies in Indonesia are those whose annual sales more than P100 million and employing more than 200 employees.

Finally, in Malaysia, under the Industrial Coordination Act 1975 (Amendment 1986), the Promotion of Investment Act 1986, and as noted in the Bank Negara's lending guidelines, SMEs are defined as enterprises with net assets or shareholders' funds of not more than RM2.5 million. Under this definition, a firm with shareholders' fund of less than RM500,000 is considered as small, whereas a firm with shareholders' fund of between RM500,000 to RM2.5 million is labelled as medium-sized. However, on June 2005, National SME Development Council (NSDC) has approved the use of common definitions for SMEs in the manufacturing, manufacturing-related services, primary agriculture and service sectors. These definitions are applied by all Government Ministries and Agencies involved in SME development, as well as by the financial institutions. The use of the common definition for SMEs will: strengthen government efforts to create effective policies and support programmes for specific target; make it easier to provide technical and financial assistance to SMEs; and allow for the identification of SMEs in the various categories and levels.

According to the definition, Malaysian SMEs can be grouped into three categories: Micro, Small, Medium or Large. These groupings are decided based on EITHER the number of people a business employs OR on the total sales or revenue generated by a business in a year. The details of the common definition of Malaysian SMEs are reported in Table 2.5.

This research chooses large manufacturing companies as a population for the study. The large manufacturing companies are suitable for the ERP system research population due to big number of employees and big amount of sales turnover. ERP system is suitable for big number of employees because ERP system can simplify the companies' business processes and it can be afforded only by companies that have high annual sales turnover.

**Table 2.5: Common Definition of Malaysian Manufacturing Companies**

| | Primary Agriculture | Manufacturing | Service Sector |
|---|---|---|---|
| Based on the number of full-time employee | | | |
| Micro | Less than 5 employees | Less than 5 employees | Less than 5 employees |
| Small | Between 5 – 19 employees | Between 5 – 50 employees | Between 5 – 19 employees |
| Medium | Between 20 – 50 employees | Between 51 – 150 employees | Between 20 – 50 employees |
| Large | More than 50 employees | More than 150 employees | More than 50 employees |
| Based on annual sales turnover | | | |
| Micro | Less than RM200,000 | Less than RM250,000 | Less than RM200,000 |
| Small | Between RM200,000 – RM1 million | Between RM250,000-RM10million | Between RM200,000 – RM1 million |
| Medium | Between RM1 million-RM5 million | Between RM1 million – RM25 million | Between RM1 million-5 million |
| Large | More than RM5 million | More than RM25 million | More than RM5 million |

## 2.8 Enterprise Resource Planning System in Malaysia

The implementation of Enterprise Resource Planning (ERP) system has grown rapidly world-wide in recent years. According to AMR Research, the globalization and centralization, and the performance management as the key drivers for continue ERP investment among the large corporations and small companies. Research on ERP in Malaysia is still inadequate as compared to those carried out in developed countries (Zainol, 2007). When compared to many developed nations, the implementation level of information and communications technology (ICT) among Malaysian companies remain low and the IT implementation among Malaysian companies is consider to be at a very basic level although over the past few years, there has been some improvement (Manecksha, 2003). Given the current competitive business environment, many companies have started to invest in ERP to improve their business processes. In 2002, to encourage Malaysian companies to implement ERP, SMIDEC started giving out loans to SMEs for adoption of ERP under the E- manufacturing Grant scheme. The aim of providing such loans to Malaysian SMEs is to improve productivity, competitiveness and efficiency of the SMEs. Given that SMEs forms a vital part of the Malaysian economy sector, the Malaysian government knows

that ERP is a critical business-enabling tool for SMEs, especially those serving multinational corporations. Therefore the Malaysian government, through MIDEC, gave out RM150,000 of matching grants to SMEs that wanted to adopt ERP.

Based on case studies done about ERP system in five listed companies in Malaysia, Thambyrajah (1999) found out that the level of fit of the application to the business needs was the biggest consideration when it came to making a selection on ERP system. He also found that the relationship between consultants and the users are significant. In fact many IS managers that were interviewed readily attributed much of the implementation success to the consultants' expertise. In term of reasons why they adopted their ERP systems, among reasons given were the current software were not able to handle the processes of the reorganized company (Thambyrajah, 1999).

A study was conducted in 2004 by NPC on selected manufacturing companies that had implemented ERP. The study sought to assess the impact ERP implementation by these companies (Productivity Report 2004). Respondents in general agreed that ERP's benefits include providing a better management tools which enhance their competitiveness and increase customer satisfaction. The results from the study support the importance of ERP systems for Malaysian SMEs to retain competitiveness. One challenge however, is that the cost of ERPs is still extremely high for many Malaysian SMEs. However, for the Malaysian SMEs, such initial high cost will be offset in the long run as they will be able to save cost and have a more efficient and effective business processes. For Malaysian SMEs, issues and delays in ERP implementations will be a major problem hindering the long term success of ERP adoption. Therefore, ensuring a quality ERP system after it was implemented is important to SMEs.

Kwang et al. (2009) conducted research to re-specification to DeLone and McLean's IS success Model and empirically examines it in ERP context. A conceptual model was proposed by the comprehensive review of IS success literature that attempted to evaluate the ERP system success. Four dependent variables (system quality, information quality, vendor/consultant's quality, and perceived ERP benefits) were used in evaluating ERP system success. They found out that although ERP is no longer consider a new IT tools, many companies in Malaysia are still unaware of ERP or are not willing to invest money to

implement ERP. The perceived benefits of ERP will also have a positive influence on the ERP system success of Malaysian companies.

According to Goni et al. (2010) ERP system adoption in Malaysian SMEs is still low, even that they have implemented ICT in their plants. Most Malaysian SMEs do not have awareness to implement high level information system to streamline their business processes due to its complexity and high cost of implementation. Generally SMEs which has large business level have willingness to implement ERP system. Conversely, SMEs with the lower business level do not attempt to implement ERP system because of avoiding from the risks. International ERP vendors may have difficulty in entering most SMEs market in Malaysia, because their software packages are still not compatible to the needs of some SMEs in Malaysia. Most existing ERP software packages are only suitable for large companies. Besides the budget and market issues, SMEs also have problem with the complexity in implementing ERP system in their business operation, lack of strategic decision making, and acceptance of a new work culture.

The Information Technology market in Malaysia is expected to increase from US $1.2 billion in 2007 to US $2 billion in 2012 with a compound annual growth rate of 11.1 percent (IDC in Torefder et al., 2010). According to them, IDC also forecasts that spending for business service will grow between 17 percent to 18 percent in 2009. In addition, Malaysia IT spending is expected to grow between 4% to 5% in 2009, surpassing the US$6 billion mark. This probable scenario is based on the current GDP growth forecast of 3.5% for 2009 by the Malaysia Institute of Economic Research, which led IDC to adjust the 2009 IT spending downwards from its previous 7.6%. In spite of increasing Malaysian IT investment, Malaysian businesses have been relatively slow in web adoption (Alam et al., 2007). According to Lee (2005) here are about 30 percent of Malaysian enterprises have web presence and use information technology in their daily operations. This reflects a poor rate of information technology among the estimated 600,000 local enterprises.

Similarly, Tan (2006) argues that Information and Communication Technology (ICT) in Malaysia is facing big challenges due to the slow adoption of technology by Malaysian enterprise. He also mentioned that enterprise must learn to adopt technology to increase their global competitiveness. Yeung et.al.(2003) mentioned that most Malaysian enterprises

perceived the barriers of implementing Information Technology into their business operation as expensive initiatives, risk, complex, technical expatriate. Moreover, Mohamed et.al. (2008) mentioned that e-commerce in Malaysia still at infancy stage although country has sufficient infrastructure and technological facilities. However, despite various IT and E-commerce initiatives by Malaysian government, e-commerce penetration among Malaysian firm still very low (Hussin and Noor 2005).

Ramayah (2007) conducted research to examine the impact of shared beliefs concerning the benefits of enterprise resource planning (ERP) among executives and engineers in the northern region of Malaysia. Respondents comprise managers in the departments of production control, production, materials, engineering and information technology, and executives within the organization, who are cognizant of the ERP implementation. A questionnaire was sent to managers in 113 manufacturing organizations. A total of 69 responses was received, all of which were used in the analysis. The findings support the notion that systems or technologies, which are perceived to be easy to use and understand, will be viewed as more useful from the end-user's perspective. In addition, perceived ease of use (PEU) was found to mediate partially the effects of shared beliefs concerning the usefulness of the ERP system. The study provides evidence that the level of managerial support, in terms of shared beliefs about the benefits of ERP, is critical in increasing the level of PEU and perceived usefulness.



Kamaruddin et al. (2009) conducted research to identify the relevance of technology adoption factors and to explore how it can influence suppliers of automotive manufacturers to adopt the supply chain technology (SCT) within their organizations. An empirical survey of Malaysian's automotive supplier was conducted to study those factors and also their relationship to the types of technologies being adopted. Data were collected using mail questionnaires which were sent to suppliers of two leading national automotive manufacturers. Out of 122, a total of 73 respondents were used for the purpose of the study. The results of the analysis confirm that three identified factors namely; organizational structure, organisational size and supply chain member pressure have a positive relationship with the SCT adoption. The analysis shows these three hypotheses have been supported and satisfied the identified gaps. The proposed framework provides important insights into the key factors, which enable managers or supply chain practitioners to gain better understanding of these factors impacting SCT adoptions.

## 2.9 Summary

Based on discussion above, it is clear that Malaysia is generally regarded as one of the most successful non-western countries to have achieved a relatively smooth transition to modern economic growth over the last century or so. However, the contribution reduced to 26.2 percent of the GDP was contributed by manufacturing sector in 2009 compared to 29.1 percent in 2007 (FMM, 2010). Under the Industrial Coordination Act 1975 (Amendment 1986), the Promotion of Investment Act 1986, and as noted in the Bank Negara's lending guidelines, a firm with shareholders' fund of more than RM2.5 million is considered as large manufacturing companies. Hence, this research was conducted for large manufacturing companies in Malaysia. Research on ERP in Malaysia is still inadequate as compared to those carried out in developed countries (Zainol, 2007). When compared to many developed nations, the implementation level of information and communications technology (ICT) among Malaysian companies remain low and the IT implementation among Malaysian companies is considered to be at a very basic level (Manecksha, 2003). This research will enrich research findings that related to ERP system study in Malaysian environment.

# CHAPTER 3

# LITERATURE REVIEW

## 3. 1 Introduction

This chapter discusses the literature review related to the proposed study. Issues on business performance were discussed first, followed by manager levels and information needs and information system and the competitive advantage. Next, issues related to information system and the basic theories were discussed. This chapter ends with evolution of manufacturing information systems and Enterprise Resource Planning (ERP) systems.

## 3. 2 Business Performance

Business performance is defined as degree to which strategic goals are achieved by a business organization (Houghton Mifflin Harcourt Publishing Company, 2010). Various methodologies are exist to be chosen by managers for a business performance management. A business performance measurement (BPM) system refers to the use of a multi-dimensional set of performance measures for the planning and management of a business (Bourne, Neely, Mills & Platts, 2003). Good business performance is always one of the main targets of every company either in service, merchandising or manufacturing sectors. In order to be able to see the level of business performance, companies should implement business performance measurement techniques. A performance measurement system enables informed decisions to be made and actions to be taken because it quantifies the efficiency and effectiveness of past actions through the acquisition, collation, sorting, analysis, interpretation and dissemination of appropriate data (Neely, 1998). According to Neely, organizations measure their performance in order to check their position (as a means to establish position, compare position or benchmarking and monitor progress), communicate their position (as a means to communicate performance internally and with the regulators), confirm priorities (as a means to manage performance, cost and control, focus investment and actions) and compel progress (to motivate and reward).

There are five different categories of BPM system roles (Monica et.al, 2007). They are: (1) measure performance: this category encompasses the role of monitor progress and measure performance/evaluate performance; (2) strategy management: this category comprises the roles of planning, strategy formulation, strategy implementation/execution, and focus attention/provide alignment; (3) communication: comprises the roles of internal and external communication, benchmarking and compliance with regulations; (4) influence behavior: this category encompasses the roles of rewarding or compensating behaviour, managing relationships and control; and (5) learning and improvement: that comprises the roles of feedback, double-loop learning and performance improvement.

Business performance measurement draws inferences about economic performance by looking forward to the present from the vantage of the past (Meyer, 2002). The purpose of performance measurement for a company is to look ahead, look back, compare, roll up, cascade down, motivate, and composite of functional units of the company. Performance measures are intended, among other things, to give us insight into the future, the long-term economic performance of the firm, which is beyond the reach of measurement. Based on a sample of 70 managers in Indonesian listed companies, Lau and Sholihin (2005) report that the use of performance measures for performance evaluation significantly affects managers' job satisfaction.



There are many measurements suggested by many different experts for measuring business performance. However, different perspectives on the concept were adopted, and no two definitions agree on the precise characteristics (Franco-Santos et al., 2007). Some experts use one dimension of performance measures, but many others use multiple performance measurements. Lebas (1995) mention that a performance measurement system includes performance measures that can be key success factors, measures for detection of deviations, measures to track past achievements, measures to describe the status potential, measures of output as well as measures of input. According to Kaplan and Norton (1996), a comprehensive set of performance measures defined from four different measurement perspectives (financial, customer, internal and learning and growth) provide a framework for

translating the business strategy into operational terms. The four performance measurement perspectives comprise the Balanced Scorecard (BSC).

The Balanced scorecard is performance measurement that has been used widely. BSC is a strategic management system that translates an organization's strategy into clear objectives, measures, targets and initiatives organized by four perspectives (Atkinson, Kaplan & Young, 2004). The BSC emphasizes that financial and nonfinancial measures must be a part of the information system for employees at all levels of organization. It translates a business unit's mission and strategy into tangible objectives and measures. The measures represent a balance between external measures for shareholders and customers, and internal measures of critical business processes, innovation, and learning and growth. The measures are balanced between the outcome measures (the results from past efforts) and the measures that drive future performance. The scorecard is also balanced between objective, easily quantified outcome measures and subjective, somewhat judgmental, performance drivers of the outcome measures. Innovative companies are using the scorecard as a strategic management system as well as tactical and operational measures (Kaplan & Norton).

Balance is a word that indicates the essence of a healthy organisation (Amaratunga et al., 2001). According to the authors, balance is necessary for efficient and effective movement and for assisting in maximising potential. In the same way, performance measurement systems must achieve a balance which supports progress against predetermined objectives, without suboptimisation. Over the recent past, organisations have tried various methods to create an organisation that is healthy and sound. By requiring strategic planning and a linking of program activities/performance goals to an organisation's budget, decision-making and confidence in the organisational performance is expected to improve.

### 3.2.1 Review of Empirical Research on Performance Effects of BSC

A number of researchers have conducted studies in assessing the performance effects of BSC. Braam and Nijsen (2004) conducted a research to explore performance effects of using the

BSC on Dutch companies. By using a survey of 100 companies in the Netherlands, they reported that BSC use does not automatically improve company performance, but that the manner of its use matters. Empirical evidence from the research suggests that BSC usage that complements corporate strategy influences company performance in a positive way. In addition, Davis and Albright (2004) conducted research to find out the relationship between BSC implementation and financial performance of bank branches. By conducting quasi-experimental studies in United State banking organizations, they conclude that bank branches implementing the BSC outperform non-BSC implementing branches.

A study by Sim and Koh (2001) demonstrate that BSC can be used as a tool for monitoring the long-term value creation process. Based on a survey of 83 electronics companies located within the USA, they found out that manufacturing plants that have strategically linked their corporate goals or objectives to their performance measurement systems, via the balanced scorecard, performed better than those that did not. The research results also showed a positive relationship between employee training and delivery and customer performance. It is also related to lower manufacturing costs, higher sales, greater market share and shorter product development.

The balanced scorecard helps managers understand the interrelationships and tradeoffs between alternative performance dimensions and leads to improved decision making and problem solving (Banker et al. 2004). This result supports the research findings by Hoque (2003) which attempts to establish a link between BSC and Total Quality Management (TQM). The results show that by adopting a BSC, a firm that has adopted TQM will increase employee satisfaction and subsequently firm performance.

According to Fernandes et al. (2006) the implementation of BSC will enhance SMEs' ability to respond rapidly to changing markets within which the companies operate. It also enhances the stability and operability of the company. By implementing BSC, the inventory could be kept at a very low level, and the average stock turnover of products in the warehouse was lowered. In addition, the information flow in the supply chain was significantly speeded. The framework and methodology developed by Papalexandris et al.

(2005) has been proven efficient in BSC implementation. More precisely, the organizations that implemented BSC and used the methodology had achieved: (i) better performance management; (ii) reduced resistance to change and enhanced team cooperation; (iii) respect of time and budget constraints; and (iv) employee buy-in and transfer of knowledge.

By conducting a survey of 66 Australian manufacturing companies, Hoque and James (2000) examine the relationship between BSC usage and company performance. They report that greater BSC usage is associated with improved performance. In addition, Ittner, Larcker and Randall (2003) also attempt to search the relationship between BSC use and measurement system satisfaction and financial performance by conducting a survey of 140 US financial services firms. They conclude that BSC use is associated with higher measurement system satisfaction.

In 2002, Lipe and Salterio conducted a research to discover the context effect of organizing performance measures into four BSC perspectives. Their study propose that BSC perspectives have meaning to the decision-maker as they prime him or her to recognize potential relations among the measures within one category and to react to any perceived correlation. Olson and Slater (2002) studied the relationship between tailoring the BSC to the firm's strategic orientation and company performance. They conducted a survey of 200 US services and manufacturing firms. The research results showed that the level of co-alignment of the BSC measures with strategy improves performance, suggesting that performance measurement should be tailored to strategic orientation.

Based on a case study in a large international manufacturing company, Malina and Selto (2001) found that BSC may intensify organizational focus to gain strategic objective. It helps to align actions to strategic objectives and to improve the quality of information for managerial decision making. In addition, Malmi (2001) performed a study on the use of BSC in Finnish companies. They conducted a series of semi-structured interviews in 17 organizations. All interviewed persons had a positive attitude towards BSCs, even though the idea of linking measures together based on assumed cause-and-effect relationships was not well understood by early adopters of BSCs.

### 3.2.2 Balanced Scorecard Perspectives

Kaplan and Norton (1992, 1996, 2001) define the BSC as a framework to facilitate the translation of business strategy into controllable performance measures. A BSC should be used to communicate the strategy of the business, and to help align individual, organizational and cross-departmental initiatives to achieve a common goal (Kaplan & Norton, 1996:25). Kaplan and Norton also stated that the BSC should be used as a communication, informing and learning system, not a controlling system. The BSC translates mission and strategy into objectives and measures, organized into four different perspectives: financial, customer, internal business process, and learning and growth. The four perspectives of the scorecard permit a balance between short and long-term objectives, between outcomes desired and the performance drivers of those outcomes, and between hard objectives measures and softer, more subjective measures. The following section will further explain the four BSC perspectives.

**a. Internal Business Processes Perspective**

In the internal-business-process perspective, executives identify the critical internal processes in which the organization must excel to achieve customer and shareholders objectives. Kaplan and Norton (1996) mentioned that these processes enable the business to: (1) deliver the value propositions that will attract and retain customers in targeted market segments; and (2) satisfy shareholder expectations of excellent financial returns.

The internal-business-process measures focuses on the internal processes that will have the greatest impact on customer satisfaction and achieving an organization's financial objectives. A company may realize that it must develop a process to anticipate customer needs and deliver new services that target customer value. The BSC internal-business-objectives highlight the processes, several of which may not be currently be performing at all, that are most critical for an organization's strategy to succeed. Generic measures for this perspective are operating processes, customer management processes, innovation processes and regulatory and social processes (Kaplan & Norton, 2004). Niven (2002) suggests some generic measures to be used in performance measurement from the internal process perspective in Table 3.1.

**b. Financial Perspective**

Financial performance measures indicate whether a company's strategy, implementation and execution contribute to bottom-line improvement (Kaplan & Norton, 1996:25). Financial objectives typically relate to profitability-measured, for example, by return on investment and return on asset. The company's financial performance can be improved through two basic approaches-revenue growth and productivity (Atkinson, Kaplan & Young, 2004). Profitable revenue growth can be achieved by deepening relationship with existing customers, such as selling the additional products and services beyond the first product or service purchased. Nicolaou (2004) used some measurements for measuring a company's financial performance: return on assets, return on investment, operating income over assets, return on sales, operating income over sales, cost of goods sold divided by sales, selling, general and administrative expenses over sales and number of employees divided by sales.

**Table 3.1: Generic Measures for the Internal Process Perspectives**

| | | |
|---|---|---|
| • Average cost per transaction<br>• On-time delivery<br>• Average lead time<br>• Inventory turn over<br>• Environmental emissions<br>• Research and development expense<br>• Community involvement<br>• Patents pending<br>• Average age of patents<br>• Ratio of new products to total offerings | • Stock out<br>• Labor utilization rates<br>• Response time to customer requests<br>• Defect percentage<br>• Rework<br>• Customer database availability<br>• Breakeven time<br>• Cycle time improvement<br>• Continuous improvement<br>• Warranty claims<br>• Number of positive media stories | • Lead user identification<br>• Product and services in the pipeline<br>• Internal rate of return on new projects<br>• Waste reduction<br>• Space utilization<br>• Frequency of returned purchases<br>• Downtime Planning accuracy<br>• Time to market of new products/ services<br>• New products introduced |

Source: Niven (2002)

Every company can choose its own financial performance measurement that fits the company. Gomes, Yasin and Lisboa (2006) suggest the following financial measurements: earnings per share, cash flow, return on assets, sales, Earning Before Interests and Taxes (EBIT), sales/total assets, equity/total assets and quality of accounting policies. Niven (2002) suggests some generic measures to be used in performance measurement from the financial perspectives in Table 3.2.

### c. Customer Perspective

In the customer perspective of the BSC, companies identify the customer and market segments in which they have chosen to compete. Since companies create value through customers, understanding how they view performance becomes a major aspect of performance measurement. This perspective typically includes several core or generic measures of the successful outcomes from a well-formulated and implemented strategy. The core outcome measures include customer satisfaction, customer retention, new customer acquisition, customer

**Table 3.2: Generic Measures for the Financial Perspectives**

| | | |
|---|---|---|
| • Total Assets<br>• Total Assets per employee<br>• Profit as a % of total assets<br>• Return on total assets<br>• Return on net assets<br>• Revenues/ total assets<br>• Gross margin<br>• Net income<br>• Profit as a % of sales<br>• Profit per employee<br>• Revenue<br>• Revenue from new products | • Revenue per employee<br>• Return on equity (ROE)<br>• Return on capital employed (ROCE)<br>• Return on investment (ROI)<br>• Economic value added<br>• Market value added<br>• Value added per employee<br>• Compound growth rate<br>• Dividends<br>• Market value<br>• Share price<br>• Shareholder mix | • Shareholder loyalty<br>• Cash flow<br>• Total costs<br>• Credit rating<br>• Debt<br>• Debt to equity<br>• Times interest earned<br>• Days sales in receivables<br>• Accounts receivable turnover<br>• Days in payables<br>• Days in inventory<br>• Inventory turnover ratio |

Source: Niven (2002)

profitability and market share (Kaplan & Norton, 1996). The customer perspective should also include specific measures of the value propositions that the company will deliver to customers in targeted market segments. The segment-specific drivers of core customer outcomes represent those factors that are critical for customers to switch to or remain loyal to their suppliers, such as short lead time, on-time deliveries and a constant stream of innovative products and services. It is also the ability to anticipate the customers' emerging needs and the capability of developing new products and approaches to satisfy those needs. Niven (2002) suggests some generic measures to be used in the performance measurement from the customer perspective in Table 3.3.

**Table 3.3: Generic Measures for the Customer Perspective**

| | | |
|---|---|---|
| • Customer satisfaction<br>• Customer loyalty<br>• Market share<br>• Customer complaints<br>• Complaints resolved on first contact<br>• Return rates<br>• Response time per customer request<br>• Direct price<br>• Price relative to competition<br>• Total cost to customers<br>• Average duration of customer relationship<br>• Frequency (number of sales transactions) | • Customers lost<br>• Customer retention<br>• Customer acquisition rates<br>• Percentage of revenue from new customers<br>• Number of customers<br>• Annual sales per customer<br>• Win rate (sales closed/ sales contracts)<br>• Customer visit to company<br>• Hours spent with customers<br>• Marketing cost as a percentage of sales<br>• Number of ads placed | • Number of proposals made<br>• Brand recognition<br>• Response rate<br>• Number of trade shows attended<br>• Sales volume<br>• Share of target customer spending<br>• Sales per channel per customer<br>• Average customer size<br>• Customers per employee<br>• Customer service expense per customer<br>• Customer profitability |

Source: Niven (2002)

**d. Innovation and Growth Perspective**

The innovation and growth perspective identifies the infrastructure that the organization must build to create long-term growth and improvement (Kaplan & Norton, 1996). According to Kaplan and Norton, this perspective comes from three principal sources, which are people (employee capabilities), information system capabilities and organizational procedures. The financial, customer and internal business process objectives on BSC typically will reveal large gaps between the existing capabilities of people, systems and procedures and what will be required to achieve breakthrough performance. To close this gap, business will have to invest in re-skilling employees, enhancing information technology and systems and aligning organizational procedures and routines. Generic measures for this perspective are competencies (skills, training and knowledge), technology (systems, databases and networks), and organization (culture and climate, alignment and knowledge sharing). Niven (2002) suggests some generic measures to be used in performance measurement of the learning and growth perspective in Table 3.4.

**Table 3.4: Generic Measures for the Learning and Growth Perspective**

| | | |
|---|---|---|
| • Employee participation in professional or trade association<br>• Training investment per customer<br>• Average years of service<br>• Percentage of employees with advanced degree<br>• Number of cross-trained employees<br>• Absenteeism<br>• Turn over rate<br>• Employee suggestions<br>• Employee satisfaction<br>• Participation in stock ownership plans<br>• Lost time accidents | • Value added per employee<br>• Motivation index<br>• Outstanding number of applicants for employment<br>• Diversity rates<br>• Empowerment index (number of managers)<br>• Quality of work environment<br>• Internal communicating rating<br>• Employee productivity<br>• Number of scorecards produced<br>• Health promotion<br>• Training hours<br>• Ethics violation | • Competency coverage ratio<br>• Personal goal achievement<br>• Timely completion of performance appraisals<br>• Leadership development<br>• Communication planning<br>• Reportable accidents<br>• Percentage of employee with computers<br>• Strategic information ratio<br>• Cross functional assignment<br>• Knowledge management |

Source: Niven (2002)

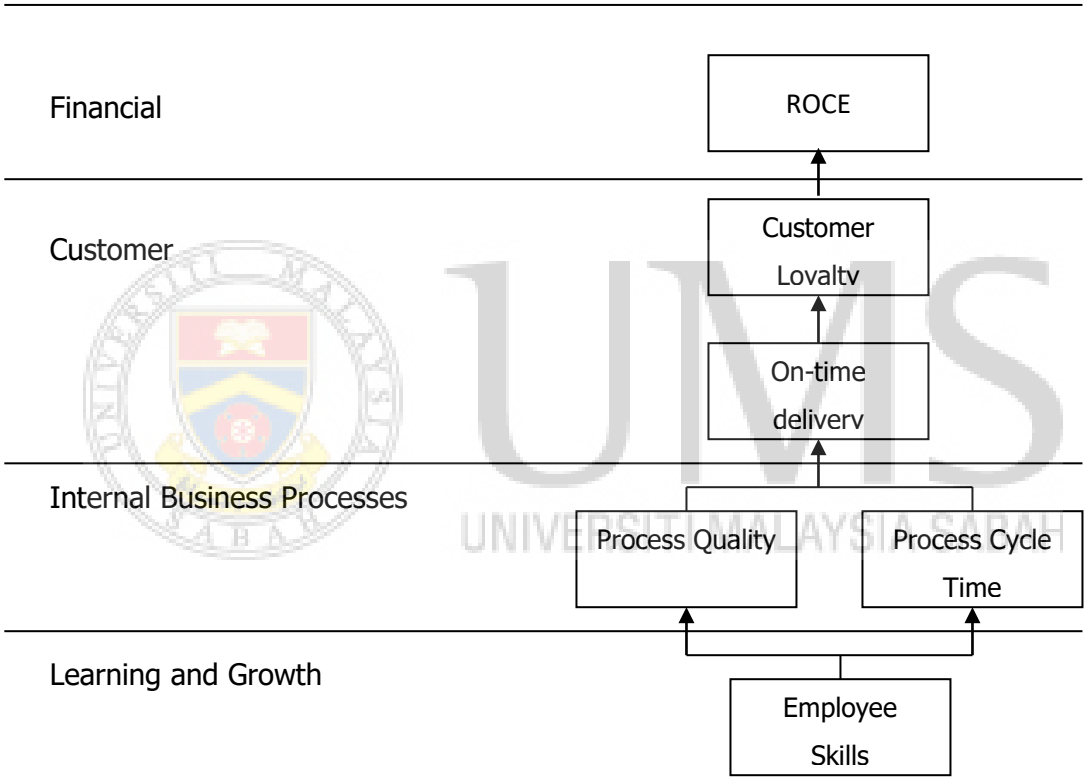
### 3.2.3 Linking Multiple Scorecard Measures to a Single Strategy

A properly constructed BSC should tell the story of the business unit's strategy (Kaplan & Norton, 1996). Kaplan and Norton suggest that it should identify and show explicitly the cause-and-effect relationships between outcome measures and the performance drivers of those outcomes. For example, return on capital employed (ROCE) will be generated because of a high degree of customer loyalty. Customer loyalty can be caused by on-time delivery of orders. To achieve improved on-time-delivery, the business may need short cycle times in operating process and high quality internal processes. The company can improve the quality and reduce the cycle times of the internal processes by training and improving the skills of the company's operating employees. Figure 3.1 shows a chain of cause-and-effect relationships through the four BSC perspectives.

The BSC concept has been so widely adopted by manufacturing and service companies, nonprofit organizations and government entities around the world since its introduction in 1992. There are two reasons for the adoption (Kaplan & Norton, 2001a). First, previous systems that incorporated non-financial measurements used ad-hoc collections of

such measures, more like checklists of measures for managers to keep track of and improve on rather than a comprehensive system of linked measurements. The BSC emphasizes the linkage of measurement to strategy and the cause-and-effect linkages that describe the hypothesis of the strategy. Second, the BSC reflects the changing nature of technology and competitive advantage in the later decades of the 20th century.

**Figure 3.1: A Chain of Cause-and-Effect Relationships through the Four BSC Perspectives**




Source: Kaplan and Norton (1996)

According to Kaplan and Norton (1996), a typical balanced scorecard may employ 20-25 measures. However, in almost all cases, when developing a balanced scorecard, the people involved in the process end up with a huge list of measures. Identifying which measures to be employed for the development of the balanced scorecard is a crucial step. The authors also extended their view, stressing the importance of aligning the scorecard information with business strategy. To translate the strategic goals efficiently into tangible

objectives and measures, they suggested four interrelated management processes: (i) clarifying and translating vision and strategy; (ii) communicating and linking strategic objectives and measures; (iii) business planning and target setting; and (iv) enhancing strategic feedback and learning.

Kaplan and Norton (2001b) introduced five principles to keep strategy the focus of organizational management processes. They are: (i) translate the strategy into operational terms; (ii) align the organizational vision into strategy; (iii) make strategy everyone's everyday job; (iv) make strategy a continual process; and (v) mobilize change through executive leadership. According to them, organizations translate their strategy into the logical architecture of a strategy map and BSC to specify in detail the critical elements for their growth strategies. For organizational performance to be more than the sum of its parts, individual strategies must be linked and integrated. The corporate role defines the linkages expected to create synergy and ensures that the linkages actually occur. In the third principle, a strategy-focused organization requires that all employees understand the strategy and conduct their day-to-day business in ways that contribute to the success of that strategy. In order to make a strategy becomes a continual process, the organization should link strategy to the budgeting process, introduce a simple management meeting to review strategy, and create a process for learning and adapting the strategy. Once the change process is launched, executives establish a governance process to guide the transition (Kaplan & Norton, 2001b).

Thus, in their work, Kaplan and Norton move gradually from (i) defining the BSC as a tool to facilitate and control performance measurement system to (ii) using the BSC as a strategy implementation tool to facilitate and control performance measurement and management. Data that is needed for constructing the BSC can be derived depending on the company needs. Table 3.5 shows how the BSC can be used to find background information (Niven, 2002).

**Table 3.5: Information Sources of BSC Perspective**

| Perspective | Information sources |
|---|---|
| Financial | • Annual report<br>• Performance report<br>• Analyst report<br>• Trade journal<br>• Benchmark reports |
| Customer | • Marketing department<br>• Trade journal<br>• Consulting studies<br>• Project plans<br>• Strategic plan<br>• Performance report<br>• Benchmark reports |
| Internal processes | • Operational reports<br>• Manufacturing reports<br>• Competitor data<br>• Benchmark reports<br>• Trade journals<br>• Consulting studies<br>• Project plans |
| Employee learning and growth | • Human resource data<br>• Trade journal<br>• Core values<br>• Benchmark reports<br>• Consulting studies |

Source: Niven (2002)



### 3.2.4 Performance Measurement Using the Balanced Scorecard

If a company wants to implement BSC for its performance measurement, there are some factors that need to be considered to make sure that the implementation is successful. Papalexandris et al. (2005) proposed a six phases approach to implement the BSC. The phases are: preparing for the project, understanding the vision and the strategy, identifying the strategic priorities and objectives, selecting performance measures, operationalizing the project and implementing and rolling out the system. Table 3.6 shows the phases and the relevant steps developed.

**Table 3.6: BSC Implementation Approach**

| Phase No. | Phase Title | Phase Step |
|---|---|---|

| | | |
|---|---|---|
| I | Prepare for the Project | • Plan and initiate the project |
| | | • Gain commitment |
| | | • Assess change readiness |
| | | • Establish Quality Assurance mechanisms |
| | | • Select the project team |
| | | • Establish communication plan |
| II | Understand the Vision and the Strategy | • Assess external and internal environment |
| | | • Develop a contingency plan |
| | | • Clarify the organization's vision and mission |
| | | • Identify the strategic directions |
| | | • Develop a change management plan |
| III | Identify the Strategic Priorities and Objectives | • Identify strategic objectives |
| | | • Design Strategy Map |
| | | • Present findings to stakeholders and gain approval |
| IV | Select Performance Measures | • Gather, rank and select performance measures |
| | | • Establish way of measurement |
| | | • Appoint a performance measurement owner |
| | | • Identify gaps between existing and desired business processes and IT infrastructure |
| V | Operationalize the Project | • Set stretch targets for the measures |
| | | • Determine measurement frequency |
| | | • Develop strategic initiatives |
| | | • Establish budget |
| | | • Redesign/fine-tune performance management process |
| VI | Implement and Rollout the System | • Select and customize the IT solution |
| | | • Roll-out the project |
| | | • Prepare periodic re-evaluation plan |
| | | • Plan other BSC related projects |
| | | • Transfer knowledge |

Source: Papalexandris et al. (2005)

Gomes, Yasin and Lisboa (2006) introduce eight perspectives in performance measurement for manufacturing companies. They are financial, product quality and customer satisfaction, process efficiency, product and process innovation, competitive environment, quality/independence of management, Human Resource Management and Social Responsibility. Meanwhile, Bose (2006) introduces enterprise performance management measures by using three perspectives such as cost leadership, product or service

differentiation and growth. In addition to that, Fernandes et al. (2006) suggest using some measurements based on BSC, as can be seen in Table 3.7.

As mentioned in phase IV, every company selects its own performance measure to gather, ranks and selects performance measures, establishes way of measurement, appoints a performance measurement owner and identifies gaps between existing and desired business processes and Information Technology (IT) infrastructure. Different experts suggested different measurements for every BSC perspective depending on the type of industry in which the company is involved.

Contrary to Kaplan and Norton's model, many researchers propose using additional or different perspectives which are thought to be more informative or representative in certain market segments. For example, Gomes, Yasin and Lisboa (2006) use 7 perspectives in measuring manufacturing performance. They are financial, product quality and customer satisfaction, process efficiency, product and process innovation, competitive environment, quality/independence of management and human resource management. Maisel (1992) used a human resource perspective instead of learning and growth. However, the four-perspective BSC model originally developed by Kaplan and Norton is better because of its simplicity and compactness, which accounts for its communication potential (Papalexandris et al., 2005).

## 3. 3 Managerial Levels and Information Needs

Management is the attainment of organizational goals in an effective and efficient manner through planning, organizing, leading and controlling organizational resources (Samson & Daft, 2009). To achieve the goals, managers need to have job description through developing organizational structure. A traditional organizational structure, also called *hierarchical structure*, is like a managerial pyramid where the hierarchy of decision making and authority flows from the strategic management at the top down to operational management and non management employees.

**Table 3.7: BSC Measurement According to Fernandes**

| Perspective | Strategy | KPI | Frequency |
|---|---|---|---|
| Finance | Growth | Revenue growth | Yearly |
| | Profitability | Return on Equity | |
| | Cost Leadership | Unit cost | |
| | Add value to company | Economic value added | |
| | Increased earnings | EBIT | |
| Customer | New products | % of sales from new product | Quarterly |
| | Responsible supply | On-time delivery | |
| | Preferred supplier | Share of key accounts | Half-yearly |
| | Customer partnership | No. of cooperative efforts | Quarterly |
| Internal processes | Product excellence | Cycle time | |
| | Increased design productivity | Efficiency | |
| | Product launch | Actual launch vs. delay | Half-yearly |
| | Employee turnover | Reduction in W/F | Yearly |
| Learning and growth | Product learning | Time to new process maturity | |
| | Product focus | % of product representing 80% sales | |

Source: Fernandes et al. (2006)



Compared to lower level, including the president of the company and vice presidents, has a higher degree of decision authority, more impact on corporate goals, and more unique problems to solve. In most cases, major department heads report to president or top level manager. The major departments are usually divided according to function and can include marketing, production, information system, finance and accounting, research and development, and so on. The positions or departments that are directly associated with making, packing, or shipping goods are called line positions. A production supervisor who reports to a vice president of production is an example of a line position. Other positions might not be directly involved with the formal chain of command but instead assist a department or area. These are staff position, such as legal counsel reporting to the president.

Today, the trend is to reduce the number of management levels, or layers, in the traditional organizational structure. This type of structure, often called a flat organizational structure, empowers employees at lower level to make decisions and solve problem without needing permission from midlevel managers. Empowerments give employees and their managers more responsibility and authority to make decision, take action, and have more control over their jobs. For example, an empowered sales clerk could respond to certain customer requests or problems without needing permission from supervisor. On a factory floor, empowerment might mean that an assembly-line worker can stop the production line to correct the problem or defect before the product is passed to the next station. Policies and programs that let employees share ownership in a company flatten the organizational structure. Information system can be a key element in empowering employees because they provide the information employees need to make decision. The employees might also be empowered to develop or use their own personal information system, such as a simple forecasting model or spreadsheet.

Management practices have actually been used from the earliest times of recorded history. Early on, the Greeks Fayol, who was a managing director (CEO) of a large steel company in the early 1900s, was one of the founders of the field of management. Based on 20 years experiences of experiences as a CEO, Fayol argued that the success of an enterprise generally depends much more on the administrative ability of its leaders than on their technical ability (Wren et.al, 2002). According to Fayol, to be successful, a manager needs to perform five managerial functions: planning, organizing, coordinating, commanding, and controlling. However, Henry Fayol's classic management functions are known today as planning, organizing, leading and controlling (Wiliams et.al, 2009). Planning is determining organizational goals and a means for achieving them. Organizing is deciding where decisions will be made, who will do what jobs and tasks, and who will work for whom. Leading is inspiring and motivating workers to work hard to achieve organization goals. Controlling is monitoring progress toward goal achievement and taking corrective action when needed.

Top managers hold positions like chief excecutive officer (CEO), chief operating officer (COO), chief financial officer (CFO), and chief information officer (CIO) and are responsible

for the oferall direction of the organization. Top managers have the following responsibilities (Wiliams et.al, 2009). First, they are responsible for creating a context for change. Creating a context for change includes forming a long range vision or mission for the company. Second, much more than used to be the case, top managers are responsible for developing employee's commitment to and ownership of the company's performance. Third, top managers are responsible for creating a positive organizational culture through language and action. Top managers impart company values, strategies, and lessons through what they do and say to others, both inside and outside the company. Finally, top managers are responsible for monitoring their business environment. This means that top managers must closely monitor customer needs, competitor moves, and long-term business, economic, and social trends. So, basically, the top managers are responsible for creating context for change, developing attitudes of commitment and ownership, creating appositive organizational culture through words and actions, and monitoring their company's business environment.

Middle managers hold positions like plant manager, regional manager or divisional manager. They are responsible for setting objectives consistent with top management's goals and for planning and implementing subunit strategies for achieving those objectives (Wiliams et.al, 2009). One specific middle management responsibility is to plan and allocate resources to meet objectives. Another major responsibility is to coordinate and link groups, departments and divisions within a company. A third responsibility of middle management is to monitor and manage the performance of the sub units and individual managers who report to them. Finally, middle managers are also responsible for implementing the changes or strategies generated by top managers. It means that the middle level managers are responsible for planning and allocating resources, coordinating and linking groups and departments, monitoring and managing the performance of subunits and managers and implementing the changes or strategies generated by top managers.

Low level managers hold positions like office manager, shift supervisor or department manager. The primary responsibility of this manager is to manage the performance of entry-level employees, who are directly responsible for producing company's goods and service. Thus, the managers are the only managers who do not supervise other managers. The

followings are low level manager's responsibilities (Wiliams et.al, 2009). First, the managers encourage, monitor and reward the performance of their workers. The managers teach entry-level employees how to do their jobs. In addition, they also make detailed schedules and operating plans based on middle management's intermediate range plans. Contrast to the long-term plans of top management (three to five years) and the intermediate plans of middle managers (6 to 18 months), low level managers engage in plans and action that typically produce results within two weeks. The managers are responsible for managing the performance of non managerial employees and teaching direct reports. Table 3.8 shows responsibility, value and activities of each of the managerial level.

Different level of manager will have different responsibility, value and activities. Because of that differentiation, they also need different information to support their daily activity and responsibility. Figure 3.2 presents the managerial levels and information requirements. As presented in the figure, strategic managerial level has unstructured decision structure. The lower the level of manager, the more structured the decisions made. In term of information requirements, the higher the level of managers the more they need information that has characteristics such as undefined, more to external, summarized, future, infrequent and less accuracy. On the opposite side, the lower the level of manager, they need information that is well defined, internal, detailed, historical, frequent and more accuracy. Characteristics of decision structure and information requirement needed by each managerial level are presented in Figure 3.2.

**Table 3.8: Managerial Levels, Responsibility, Value and Key Activities**

| | **Operational managers** | **Tactical managers** | **Strategic managers** |
|---|---|---|---|
| Responsibility | Supervise the operation of the organization | Translating the general goals and plans developed by strategic managers into more specific objectives and activities | Focus on long term issues and emphasize the survival, growth, and overall effectives of the organization. |
| Primary value | Driving business performance by focusing on productivity, innovation and growth within frontline units | Providing the support and coordination to bring large company advantage to the independent frontline units | Creating and embedding a sense of direction, commitment and challenge to people throughout the organization |

| | | | |
|---|---|---|---|
| Key activities | • Creating and pursuing new growth opportunities for the business<br>• Attracting and developing resources and competencies<br>• Managing continuous performance improvement within the unit | • Developing individuals and supporting their activities<br>• Linking dispersed knowledge, skills, and best practices across units<br>• Managing the tension between short-term performance and long-term ambition | • Challenging embedded assumption while establishing a stretching opportunity horizon and performance standards<br>• Institutionalizing a set of norms and values to support cooperation and trust<br>• Creating an overarching corporate purpose and ambition |

Adapted from: Bateman, et.al, 1997

**Figure 3.2: Management Levels and Information Requirements**

| **Managerial Level** | **Decision's Structure** | **Information requirements** | | | | | |
|---|---|---|---|---|---|---|---|
| Strategic management | Unstructured | Undefined | External | Summarized | Future | Infrequent | Less accuracy |
| Tactical Management | | | | | | | |
| Operations management | Structured | Well defined | Internal | Detailed | Historical | Frequent | More accuracy |

Adpated from: Gelinas and Dull, 2008.

## 3. 4 Information System and Competitive Advantage

An information system (IS) is a set of formal procedures by which data are collected, processed into information and distributed to users (Hall, 2007). Many organizations consider information system to be essential to their ability to compete or gain competitive advantage (Bentley & Whitten, 2007:6). The information systems usually involve data, people, procedures and information technology that interact to collect, process, store and provide information needed by an organization. The information is vital to the survival of contemporary businesses because it can support a company's daily activities and the decision

making of managers. Information itself has value, and we can see that the company often involves the exchange of information systems rather than tangible goods (Hall, 2007). Because of technology development, computers and information systems will continue to change business and the way we live.

To be valuable to managers and decision makers, information should have several characteristics. The characteristics needed are accessible, accurate, complete, economical, flexible, relevant, reliable, secure, simple, timely and variable (Stair & Reynolds, 2008). To be valuable, the information produced by an information system should be easily accessible; free from error of information; contains all the important facts; relatively economical to produce; can be used for a variety of purposes; can be depended on; secure from unauthorized users; simple; can be delivered when needed; and can be checked for correctness. Definitions of the characteristics of valuable information can be seen in Table 3.9.

Robson (1997) presented a more detailed picture of information characteristics and illustrated how they will vary by level of management hierarchy. The effectiveness of IS to each level of management depends on the quality of the IS constructed for that particular level and that of the lower levels. At the operational level, information should be up-to-date, instant, constant, highly accurate, very detailed, online, tangible and easily accessible. On the other hand, at the strategic level, managers need information that is relatively old, varies, has low accuracy, is very aggregated, has a flexible format and is mostly intangible and difficult to find. Characteristics of information needed by tactical level managers lie

**Table 3.9: Information Characteristics**

| Characteristics | Definitions |
|---|---|
| Accessible | Information should be easily accessible by authorized users so they can obtain it in the right format and at the right time to meet their needs. |
| Accurate | Accurate information is free from error. |
| Complete | Complete information contains all the important facts. |
| Economical | Information should also be relatively economical to produce. |

| | |
|---|---|
| Flexible | Flexible information can be used for a variety of purposes |
| Relevant | Relevant information can support decision making. |
| Reliable | Reliable information means that it can be depended on. |
| Secure | Information should be secure from access by unauthorized users. |
| Simple | Information should be simple, not overly complex. |
| Timely | Timely information is delivered when it is needed. |
| Verifiable | The information can be checked to make sure it is correct. |

Source: Stair and Reynolds (2008)

in between operational and strategic level information characteristics. This means that for tactical level managers, the characteristics of the information will be combination of old and new, less aggregated, less flexible in format and a combination of tangible and intangible data. Most of the time, data needed by tactical level managers are semi structured to support semi structured problems that they face. Figure 3.3 illustrates a model of information attributes for each level of management.

There are many factors that a company needs to have in order to gain competitive advantage. One of the factors is to have good information technology. New information technology can create sustainable competitive advantage (Porter & Millar, 1985). Since the 1960s, computers have been used to help companies compete by implementing a low cost strategy, differentiation strategy, or both (Porter, 2001). Low cost means that the company competes with other businesses by being a low-cost producer of a good or service. Computers can lower the cost of products or services by automating business transactions, shortening order cycle

**Figure 3.3: Model of Information Attributes**

| | **By management level** | | |
|---|---|---|---|
| **Characteristics of information** | **Operational** | ⟷ | **Strategic** |
| Timelines: | | | |
| • Currency | Up-to-date | ⟷ | Relatively old |
| • Response time | Instant | ⟷ | Slow |
| | | ⟷ | |
| | | ⟷ | |

| | | | |
|---|---|---|---|
| • Frequency | Constant | | Varies |
| Content: | | | |
| • Accuracy | High | | Relatively low |
| • Relevance | | No difference | |
| • Completeness | | No difference | |
| • Conciseness | | No difference | |
| • Aggregation level | Very detailed | | Very aggregated |
| Format: | | | |
| • Medium | Mostly online | | Mixed format |
| • Structure | Fixed | | Flexible |
| • Image | Fixed | | Flexible |
| Cost: | | | |
| • Cost | Easily assessed | | Hard to assess |
| • Benefit | Tangible | | Intangible |

Source: Robson (2007)

times and providing operational data for decision making. With differentiation, the company will compete with other businesses by offering products or services that customers prefer due to superiority in characteristics such as product or service innovativeness or quality. A company differentiates its products by developing an IS that provides sales personnel with information to help them better service a specific customer, provide just in time supplies and produce new information-based products. The competitive strategies enabled by the IS can place the organization in a strategic position (Ragowsky & Gefen, 2008).

A number of well known examples of competitive gain from the use of good information systems exist such as American Airlines with its SABRE reservation system, Dow Jones with its innovative use of Satellite Transmission, Kraft Food Service with Kraftlink. Many writers argue for the possibility of an organization consciously and deliberately exploiting information system (IS) to achieve competitive advantage. An organization will gain the competitive advantage through IS if the company develops IS key factors (Robson, 1997). The key factors are: (i) the application of available techniques to strategically spot IS; (ii) a knowledge of the effect the information revolution has on the business environment; and (iii) an understanding of the process of IS strategic planning to generate concrete and implementable plans for a strategic management information system.

A competitive advantage is a significant and (ideally) long-term benefit to a company over its competition, and can result in higher-quality products, better customer service, and lower costs (Stair & Reynolds, 2008). Establishing and maintaining a competitive advantage is complex, but a company's survival and prosperity depend on its success in doing so. An organization often uses its information system to help achieve a competitive advantage. In his book *Good to Great*, Jim Collins outlines how technology can be used to accelerate companies from good to great. Ultimately, it is not how much a company spends on information systems but how it makes and manages investments in technology. Companies can spend less and get more value. Table 3.10 shows examples of using information system in competitive advantage.

**Table 3.10: Using Information System in Competitive Advantage**

| Company | Business | Competitive Use of Information System |
|---|---|---|
| Circuit City | Consumer electronic | Developed sophisticated sales and inventory-control systems to deliver a consistent experience to customers |
| Gillette | Shaving products | Developed advanced computerized manufacturing systems to produce high-quality products at low cost |
| WalGreens | Drug and convenience stores | Developed satellite communications systems to link local stores to centralized computer systems |
| Wells Fargo | Financial services | Developed 24-hour banking. ATMs, investments, and increased customer service using information systems. |

Source: Stair and Reynolds (2008)

A number of factors can lead to attaining a competitive advantage. Michael Porter, a prominent management theorist, suggested a now widely accepted competitive forces model, also called the five-forces model. The five forces include the rivalry among existing competitor, the threat of substitute products and services, the bargaining power of suppliers. The more these forces combine in any instance, the more likely firms will seek competitive advantage and the more dramatic the results of such an advantage will be.

Typically, highly competitive industries are characterized by high fixed costs of entering or leaving the industry, low degrees of product differentiation, and many competitors. Although all firms are rivals with their competitors, industries with stronger rivalries tend to have more firms seeking competitive advantage. To gain an advantage over competitors, companies constantly analyze how they use their resources and assets. This *resource-based view* is an approach to acquiring and controlling assets or resources that can help the company achieve a competitive advantage. For example, a transportation company might decide to invest in radio-frequency technology to tag and trace products as they move from one location to another.

A threat appears when entry and exit costs to an industry are low and the technology needed to start and maintain a business is commonly available. For example, a small restaurant is threatened by new competitors in the restaurant industry. Owners of small restaurants do not require millions of dollars to start the business, food costs do not decline substantially for large volumes, and food processing and preparation equipment is easily available. When the threat of new market entrants is high, the desire to seek and maintain competitive advantage to dissuade new market entrants is also usually high.



Companies that offer one type of goods or services are threatened by other companies that offer similar goods or services. The more consumers can obtain similar products and services that satisfy their needs, the more likely firms are to try to establish competitive advantage. For example, consider the photographer industry. When digital cameras became popular, traditional film companies had to respond to stay competitive and profitable. Traditional film companies, such as Kodak and others, started to offer additional products and enhanced services, including digital cameras, the ability to produce digital images from traditional film cameras, and Web sites that could be used to store and view pictures.

To be competitive, a company must be fast, nimble, flexible, innovative, productive, economical, and customer oriented (Stair & Reynolds, 2008). It must also align its IS strategy with general business strategies and objectives (Porter, 1985). Given the five market forces

just mentioned, porter and others have proposed a number of strategies to attain competitive advantage, including cost leadership, differentiation, niche strategy, altering the industry structure, creating new products and services, and improving existing product lines and services. In some cases, one of these strategies becomes dominant. For example, with a cost leadership strategy, cost can be the key consideration, at the expense of other factors if need be. The following is strategies to attain the competitive advantage suggested by Stair and Reynolds (2008):

i) **Cost leadership**. Deliver the lowest possible products and services. Wall-Mart and other discount retailers have used this strategy for years. Cost leadership is often achieved by reducing the costs of raw materials through aggressive negotiations with suppliers, becoming more efficient with production and manufacturing processes, and reducing warehousing and shipping costs. Some companies use outsourcing to cut costs when making products or completing services.

ii) **Differentiation**. Deliver different products and services. This strategy can involve producing a variety of products and services. Many car companies make different models that use the same basic parts and components, giving customers more options. Other car companies attempt to increase perceived quality and safety to differentiate their products. Some consumers are willing to pay higher prices for these vehicles that differentiate on higher quality or better safety.

iii) **Niche strategy**. Deliver to only a small, niche market. Porsche, for example, doesn't produce inexpensive station wagon or large sedans. It makes high-performance sports cars and SUV. Rolex only makes high-quality, expensive watches. It doesn't make inexpensive, plastic watches that can be purchase for cheap price.

iv) **Altering the industry structure**. Change the industry to become more favorable to the company or organization. The introduction of low-fare airline carriers, such as Southwest Airlines, has forever changed the airline industry, making it difficult for traditional airlines to make high profit margins. To fight back, airlines such as Delta are launching their own low-fare flights. Creating strategic alliances can also alter the industry structure. A strategic alliance, also called a strategic partnership, is an agreement between two or more companies that involves the joint production and distribution of goods and services.

v) **Creating new products and services.** Introduce new products and services periodically or frequently.

Most of the success stories about gaining competitive advantage by adopting the right IS did not focus on competitive advantage per se, but upon the radical process improvements of business re-engineering (Robson, 1997). According to Robson, the examples about American Hospital Supply, McKenson, Merril Lynch, Thomsons Holiday, American Airlines, and others were told as attention grabbers and then analyzed and hence categorized in different ways in order to define the actual effects of the information revolution. There is a set of categories that are suggested by Ward and Griffiths (1996) whereby IS can contribute towards competitive advantage. The IS should: (i) link the organization to customers or suppliers; (ii) create effective integration of the use of information in a value-adding process and value-chain primary activities; (iii) enable the organization to develop, produce, market and deliver new products or services based upon information; and (iv) give senior management information to help develop and implement strategy.

From a critical review on 50 published research articles, Dedrick et al. (2003) found out that at both firm and country level, greater investment in IT is associated with greater productivity growth. According to them, IT is not simply a tool for automating existing processes, but is more importantly an enabler of organizational change that can lead to additional productivity gains. This is because IT investments can directly affect a firm's output and many operational indicators such as inventory turnover, plant productivity and product quality. Based on their review, they found that several studies show a relationship between IT investment and intermediate measures of operational performance. However, they failed to identify a direct relationship between IT investment and firm profitability. They proposed that the productivity benefits associated with IT use may be passed on to consumers through lower prices and not lead to greater profitability. Hence, they suggested measuring the impact of IT on intermediate outputs such as inventory levels, planning cycles, asset utilization and other measures of operations performance, which are known to have a direct link with profitability.

## 3. 5 Information System and Basic Theory

There are a number of theories used by researchers to support information system research. For this study, only three related theories are discussed. They are Resource-Based View Theory, Contingency Theory and Complementarities Theory.

### 3.5.1 Resource-Based View Theory

The resource-based view of the firm (RBV) is one of the most important areas of research content to emerge in the field of strategic management in the last decade. The RBV, first posited in the literature by Wernerfelt (1984), is built upon the theory that a firm's success is largely determined by the resources it owns and controls. Resources are typically defined as either assets or capabilities. Assets, which may be tangible or intangible, are owned and controlled by the firm and capabilities are intangible bundles of skills and accumulated knowledge exercised through organizational routines (Collis, 1994).

The resource-based view (RBV) argues that firms possess resources, a subset of which enables them to achieve competitive advantage, and a subset of those that lead to superior long-term performance (Barney, 1991). According to Barney, in order to hold the potential of sustained competitive advantage, a company's resources must be: (i) valuable; (ii) rare among a firm's current and potential competition; (iii) imperfectly imitable; and (iv) cannot have a strategically equivalent substitute. Resources that are valuable and rare can lead to the creation of competitive advantage. That advantage can be sustained over longer time periods to the extent that the firm is able to protect against resource imitation, transfer or substitution. In general, empirical studies using the theory have strongly supported that a company can have a sustained superior firm performance by focusing on the differential ability of the firm to develop new capabilities (Barney, 2001).

The RBV theory is applicable for IS research because IS is one of the company's resources to achieve competitive advantage. Increased dependence on IT by business in many different industries today requires IT leaders who know how to effectively manage IT assets. There are three types of IT assets in a company such as technology, relationship and human (Brown et al, 2009). Technology assets refer to the effective planning, building and

operating of a computer and communications infrastructure. Relationship assets refer to how well an organization uses joint IT-business decision making for making investments in a firm's technology asset. IT is so integral to the business today. Achieving business value from IT investment requires a strong working partnership between business managers and IT managers (Brown, 2004). Human assets refer to the people behind the IT. Today there is a high demand for IT personnel with both specialized technology skills and business knowledge because business analyst and system analyst roles require personnel who can understand the IT needs of workers in marketing, accounting, manufacturing and other business functions.

The resource-based view of the firm attributes superior financial performance to organizational resources and capabilities (Bharadwaj, 2000). Bharadwaj developed the concept of IT as an organizational capability and empirically examined the association between IT capability and firm performance. Firm specific IT resources are classified as IT infrastructure, human IT resources and IT-enabled intangibles. A matched-sample comparison group methodology and publicly available ratings were used to assess IT capability and firm performance. Based on his study, Bharadwaj (2000), indicated that firms with high IT capability tend to outperform a control sample of firms on a variety of profit and cost-based performance measures.



The concept of IT as a powerful competitive weapon has been strongly emphasized in the literature, yet the sustainability of the competitive advantage provided by IT applications is not well-explained (Mata et al., 1995). Mata et al. conducted study that examined the resource-based theory as a means of analyzing sustainability and developed a model founded on this resource-based view of the firm. This model is then applied to four attributes of IT-capital requirements, proprietary technology, technical IT skills and managerial IT skills-which might be sources of a sustained competitive advantage. From this resource-based analysis, they concluded that managerial IT skill is the only one out of these attributes that can provide sustainability. This indicates that managers who are able to work with IT to obtain information can support their decision making and finally can improve company's performance.

### 3.5.2 Contingency Theory

There are some approach that managers can use to make decision. According to Wren et.al (2002) the managers can apply the Foundations of Hendri Fayol's Administrative Theory. They are quantitqtive approach, behavioral approach, contemporary approach and contingency approach. The quantitative approach involves applications of statistics, optimization models, information models, and computer simulations to management activities. Total quality management is a management philosophy devoted to continuous improvement and responsiveness to customer needs and expectations. Today's managers use the quantitative approach especially when making decisions as they plan and control work activities such allocating resources, improving quality, scheduling work, or determining optimum inventory level.

Meanwhile, behavioral it is believed that people were the most important asset of an organization and should be managed accordingly. The Hawthorne Studies dramatically affected management beliefs about the role of people in the organization, leading to a new emphasis on the human behavior factor in managing (Wren, 2002). The behavioral has largely shaped how today's organizations are managed. Many current theories of motivation, leadership, group behavior and development and other behavioral issues can be traced to the early OB advocates and the conclusions from the Hawthorne Studies.



Contemporary approach says that an organization takes inputs (resources) from the environment and transforms or processes those resources into outputs that are distributed into the environment. It helps us understand management because managers must ensure that all the interdependent units are working together in order to achieve the organization's goals, helps managers realize that decisions and actions taken in one organizational area will affect others and helps managers recognize that organizations are not self-contained but instead rely on their environment for essential inputs and as outlets to absorb their outputs.

The contingency approach says that organizations are different, face different situations and require different ways of managing. It helps us understand management because it stresses that there are no simplistic or universal rules for managers to follow.

Instead, managers must look at their situation and determine that if this is the way my situation is, then this is the best way to manage.

Contingency theories are a class of behavioral theory that contends that there is no one best way of organizing (leading) and that an organizational (leadership) style that is effective in some situations may not be successful in others (Fiedler, 1964). In other words, the optimal organization (leadership) style is contingent upon various internal and external constraints. This means that every manager in a company can have his own creativity in order to lead an organization successfully.

According to Fiedler (1964), four important ideas of Contingency Theory are: (1) there is no universal or one best way to manage; (2) the design of an organization and its subsystems must 'fit' with the environment; (3) effective organizations do not only have a proper 'fit' with the environment but also between its subsystems; and (4) the needs of an organization are better satisfied when it is properly designed and the management style is appropriate, both to the tasks undertaken and the nature of the work group.

There are also contingency theories that relate to decision making (Vroom & Yetton, 1973). According to their model, the effectiveness of a decision procedure depends upon a number of aspects of the situation: (1) the importance of the decision quality and acceptance; (2) the amount of relevant information possessed by the leader and subordinates; (3) the likelihood that subordinates will accept an autocratic decision or cooperate in trying to make a good decision if allowed to participate; and (4) the amount of disagreement among subordinates with respect to their preferred alternatives.

The contingency model provides for MIS design leadership to be dependent upon the type of decision making (Schonberger, 1980). In his article, the author identified six MIS design approaches, ranging from no user involvement to considerable user involvement. It also examines the justification for their use under different conditions. The six approaches are merged with Gorry and Scott Morton's MIS framework and Simon's classes of decision making to create a contingency model for MIS design. A broad view of MIS design is taken wherein executives or even various stakeholder groups may assume active leadership where

warranted by the circumstances. With design leadership correctly placed, project purpose may be more carefully identified and design activities may be properly channeled to meet those objectives (Schonberger, 1980).

Strategic applications of information systems (IS) are considered by IS researchers to be determined by contextual factors such as environmental uncertainty, and influenced by attributes of the processes preceding them, such as planning and top management support (Sabherwal et al., 1992). According to them, for better management of the process leading to these applications, it is essential to understand the relationship between process attributes and contextual factors. Utilizing a contingency approach and based on successful strategic IS applications from 81 large companies, the authors examined the relationship between the context of these applications and the decision-making process leading to them. The results indicated that the IS function seems to influence the use of the decision process. However, the organization structure was not related to any decision process attribute.

One of the key elements of strategic planning for information systems (IS) is the integration of information systems planning (ISP) with business planning (BP) (Teo & King, 1997). This integration enables IS to support business strategies more effectively. According to Teo and King, although this issue has received significant attention in recent years, empirical research focusing specifically on BP-ISP integration is still relatively sparse. Their research extended existing results by examining the evolution of BP-ISP integration and the contingency variables that may influence BP-ISP integration. The results confirmed the existence of an evolutionary pattern that can be defined in terms of movement through four types of BP-ISP integration: administrative integration to sequential integration to reciprocal integration to full integration. Only a few firms indicated that they had reached full integration. Bypassed phases and reverse evolution, though observed, were uncommon. Among the contingency variables, the business competence of the IS executive appeared to be a key factor in influencing the extent of integration. This means that the competence of managers at all levels will contribute to a company's performance.

In addition, Hai (1999) found that as ERP systems tend to permeate every level and business area of the organization. Therefore, proper change management procedures need to be put in place to assimilate the user community into the new systems order. He further revealed that no single software can meet all of an organization's requirements and market leader software may not have the best fit. Organizations should also avoid an overkill feature when evaluating software as this will result in paying for functionality which are nice to have and may not be fully utilized and quite often sacrificing ease of use.

### 3.5.3 Complementarities Theory

As mentioned before, one of the key elements of strategic planning for information systems (IS) is the integration of information systems planning (ISP) with business planning (BP) (Teo & King, 1997). This integration enables IS to support business strategies more effectively. Complementarities theory argues that while some business benefits accrue from information system innovation and some benefits accrue from management system innovation, benefits are maximized when information system innovation occurs parallel with management system innovation (Neely, 2009). The combined development of organisational and technological infrastructures leads to a 34% performance improvement, compared with an 8% improvement when only the management or the information system is improved (Bloom et al., 2007).



Research conducted in 2007 by Oracle, together with the Cranfield School of Management and four other Universities around the world, found out that there are nine gaps that prevent companies from achieving the full potential value of their enterprise performance management systems (Neely et al., 2008). They are execution gap, advocacy, trust, credibility, technology, alignment, perception, insight and performance gap. Based on their research, 40% of 633 companies surveyed around the world did not think that their performance measures were based on good quality data. One of the reasons for concerns over data quality is the lack of integrated technology used, as spreadsheet applications are still widely used in performance management. In addition, the authors found that organizations are still struggling to integrate their various operational and management systems. The findings by Bloom, et al. (2009) in a study on technology-skill complementarity

showed that US firms had higher level of productivity because of people management which was complementary with IT. This accounted for the American advantage in IT usage.

### 3. 6 Evolution of Manufacturing Information System

An information system is a set of formal procedures by which data are collected, processed into information and distributed to users. Information is vital to the survival of the contemporary business organization. Every business day, vast quantities of information flow to decision makers and other users to meet a variety of internal needs. Nowadays, information is one of the resources that can be used to achieve competitive advantage for a firm (Porter & Millar, 1985). In addition, information flows out of an organization to external users, such as customers, suppliers and other stakeholders who have an interest in the firm. Most companies use accounting information systems to process transactions into financial statements, and management information systems are used to support decision making.

In order to produce information, the firm needs information systems that match the users' need. There are some applications that can be used to produce information for the firm, such as Accounting Information Systems, Management Information Systems, Executive Information Systems, Decision Support Systems and Expert Systems. Management often requires information that goes beyond the capability of Accounting Information Systems. As organizations grow in size and complexity, specialized functional areas emerge requiring additional information for production planning and control, sales forecasting, inventory warehouse planning and market research.

Some management decisions require information that integrates financial and non-financial data. For example, a purchasing manager, evaluating the performance of suppliers, may need to know the number and financial value of inventory orders placed with specific vendors during a period of time. In addition, the manager may need to know the number of deliveries that exceed the normal lead time, and any inventory stock out conditions that result from late deliveries.

Such integrated information, if it could be provided at all, would traditionally come from separate information system applications functioning independently. The Accounting Information Systems application would supply day to day transaction data such as selling or purchasing. On the other hand, the delivery time and stock out data would come from the Management Information System. The two sets of data would then need to be integrated and reported to the manager. The task of supplying managers with integrated information is inefficient and expensive when the supporting information systems are not integrated. Also, lack of coordination between financial and non financial systems can produce unreliable information, resulting in poor management decisions.

To improve operational efficiency and gain competitive advantage in the market place, many organizations have reengineered their information systems to include both Accounting Information Systems and Management Information Systems features. Table 3.11 presents the evolution of the information system in manufacturing companies. The following section will discuss evolution of information systems that were used by manufacturing companies from 1960s to today's practice.

### 3.6.1 Reorder Point System

Computers in the 1960s did not have the storage capacity or the processing power to bring so much data to bear on the solution of a problem. Communications were not available to link data capture to the geographically dispersed places of business. Programming of information systems was not sufficiently developed to make enterprise systems even a remote dream. The first information systems in the 1960s were transaction processing systems (McLeod, 2004). They dealt with the recording and accounting for the actions of the firm that generated large volumes of paperwork.

After the first computers were successfully applied in the accounting area, they were given the task of managing the firm's inventory. The simplest approach was a reactive one of waiting for an item balance to reach a particular level, which then triggered a purchase order or a production process. A system that based the purchasing decision on the reorder point was called reorder point system (McLeod, 2004).

### 3.6.2 Material Requirements Planning (MRP)

Material Requirements Planning (MRP), a proactive materials management strategy, was devised by Joseph Orlicky of the J.I. Case Company (McLeod, 2004). Rather than waiting until it is time to order, MRP looks into the future and identified the materials that will be needed, their quantities and the dates on which they will be needed. MRP enables the firm to do a better job of managing its materials. It can avoid stock outs caused by waiting until the last minute and learning that replenishment stock is unavailable. In addition, knowing their future material needs,

**Table 3.11: Evolution of Manufacturing Information Systems**

| No | Year | Types of Systems | Purposes | Systems |
|---|---|---|---|---|
| 1 | **1960s** | Reorder point systems | Used historical data to forecast future inventory demand; when an item falls below a predetermined level, additional inventory is ordered | Designed to manage high-volume production of a few products, with constant demand; focus on cost |
| 2 | **1970s** | Material Requirements Planning (MRP) | Offered a demand-based approach for planning manufacture of products and ordering inventory | Focus on marketing; emphasis on greater production integration and planning |
| 3 | **1980s** | Manufacturing Resource Planning (MRP II) | Added capacity planning; could schedule and monitor the execution of production plans | Focus on quality; manufacturing strategy focused on process control, reduced overhead costs and detailed cost reporting |
| 4 | **1990s** | MRP-II with manufacturing execution (MES) systems | Provide ability to adapt production schedules to meet customer needs; provide additional feedback with respect to shop floor activities | Focus on the ability to create and adapt new products and services on a timely basis to meet customers' specific needs |

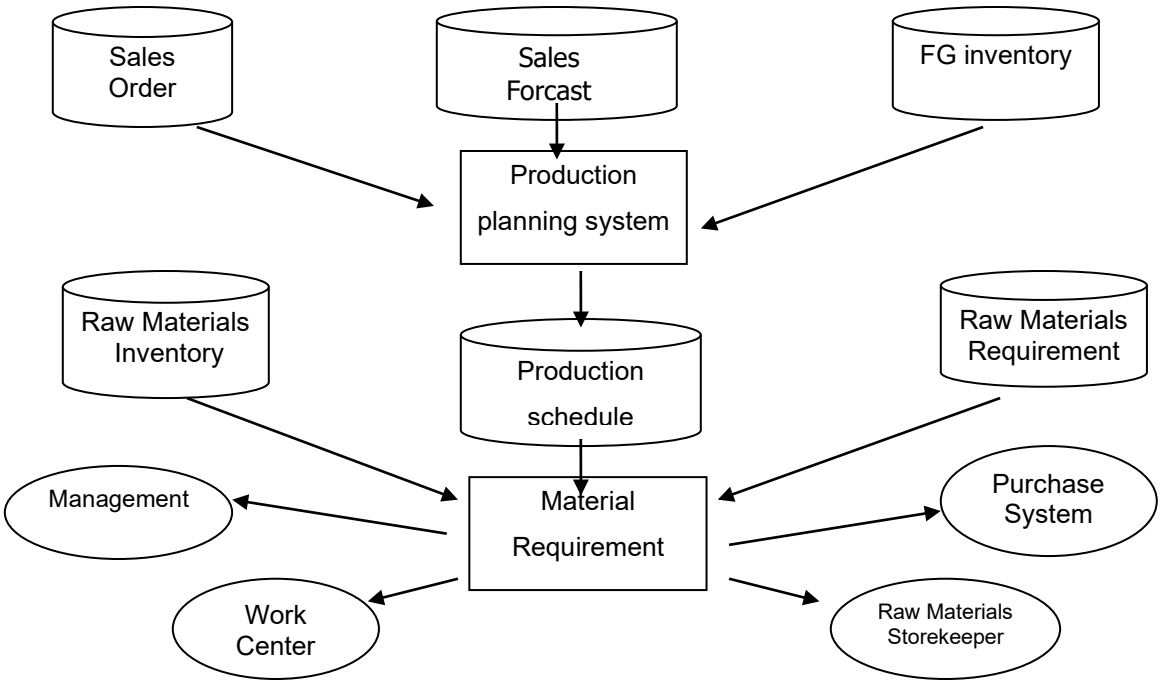
| | | | | |
|---|---|---|---|---|
| 5 | **Late 1990s and onward** | Enterprise Resource Planning (ERP) systems | Integrate manufacturing with supply chain processes across the firm; designed to integrate the firm's business processes to create a seamless information flow from suppliers, through manufacturing, to distribution to the customer | Integrate supplier, manufacturing and customer data throughout the supply chain |

Adapted from: Summer (2005)

buyers can negotiate purchase agreements with suppliers and receive quantity discounts. Figure 3.4 illustrates the major components of an MRP system.

As we can see from the figure, material requirement planning is provided based on the production schedule in addition to raw material (RM) data. The production schedule itself is generated based on the production planning system that was generated earlier. The production planning was prepared based on previous sales experiences and finished goods (FG) inventory data. The system used in MRP is not integrated, so it will need time to prepare the information for the needs of each of the systems which is stand alone. This creates an information delay in decision making or sometimes data redundancy among the departments or units.

**Figure 3.4: Major Components of an MRP System**




Source: Hall (2007)

### 3.6.3 Manufacturing Resource Planning (MRP II)

Manufacturing Resource Planning (MRP II), an extension of MRP and expanded the MRP concept beyond the manufacturing area to encompass the entire firm (McLeod, 2004). MRP II is a reengineering technique that integrates several business processes. It is not confined to the management of inventory; it is both a system and a philosophy for coordinating the activities of the entire firm. The system incorporates techniques to execute the production planning, provide feedback and control process.

The MRP II system produces a bill of materials for the product, fit the production of the product into the master production schedule, produce a rough-cut capacity plan based on machine and labor availability, produce a materials requirements plan that will schedule the delivery of the raw materials on a just-in-time basis, design a final capacity plan for the factory, and manage the raw materials and finished goods inventories (Hall, 2007).

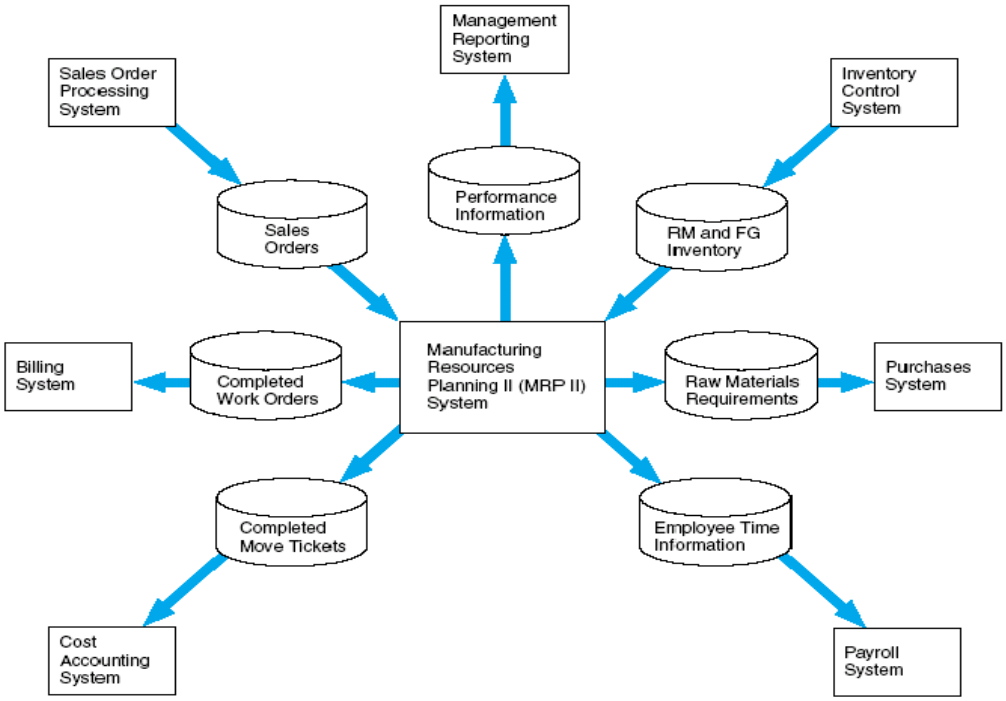
The MRP II integrates product design and the factory production process with the order entry, accounting information and activity-based costing systems, which will allow the manufacturer to establish, communicate and execute production schedules while controlling costs and maintaining the lowest level of inventory possible. A considerable number of significant benefits from a highly integrated MRP II system was observed, such as improved customer service, reduced inventory investment, increased productivity, improved cash flow, assistance in achieving long-term strategic goals, help in managing change (that is, new product development or specialized product development for customers or by vendors) and flexibility in the production process (Hall, 2007). Figure 3.5 shows the integration of the manufacturing and financial systems in the MRP II environment.

### 3.6.4 Enterprise Resource Planning (ERP)

ERP systems are multiple module software packages that evolved primarily from traditional Manufacturing Resource Planning (MRP II) systems (Hall, 2007). An ERP system can be defined as a customizable, standard application software which includes integrated business solutions for the core processes such as production planning and control, warehouse management and the main administrative functions (e.g. accounting, human resource management), of an enterprise (Roseman & Wiese, 1999).



**Figure 3.5: Integration of Manufacturing and Financial Systems within the MRP II Environment**




Source: Hall (2007)

The term ERP was coined by the Gartner Group and has become widely used in recent years (Hall, 2007). The ERP system is a business management system that comprises integrated sets of comprehensive software, which can be used, when successfully implemented, to manage and integrate all the business functions within an organization. These packages have the ability to facilitate the flow of information between all supply chain processes (internal and external) in an organization (Al-Mashari & Zairi, 2000). Furthermore, an ERP system can be used as a tool to help improve the performance level of a supply chain network by helping to reduce cycle times (Gardiner et al., 2002). There are several ERP definitions that have been stated by experts, as can be seen in the Table 3.12.

After comparing these perspectives, it is clear that the ERP is a set of highly integrated applications, which can be used to manage all the business functions within the organization. It is a commercial software package that promises the seamless integration of all the information flowing throughout the company, including financial, accounting, human resources, supply chain and customer

**Table 3.12: ERP Descriptions**

| ERP Description | Reference |
|---|---|
| An ERP system can be thought of as a company-wide Information System that tightly integrates all aspects of a business. It promises one database, one application and a unified interface across the entire enterprise. | Bingi et al., 1999, p.8 |
| ERP systems are highly integrated enterprise-wide standard Information Systems (software packages) that automate core corporate activities (business processes) such as finance, human resources, manufacturing and supply and distribution. | Holland et al., 1999A, P.289; Holland et al., 1999b, p.273 |
| ERP is an integrated package of software applications designed to automate and integrate a company's business processes throughout its entire supply chain and to provide immediate access to business information. ERP systems can be thought of as wide-ranging, general-purpose management information systems (MIS) for business. | Maher, 1999, p. 36 |
| ERP systems, a form of Enterprise-Wide Information System (EWIS), represent sets of business applications that allow for an organization-wide management of operations. ERP systems are seen as optimization and integration tools of business processes across the supply chain (within and beyond organizational boundaries) implemented through modern information management systems. | Al-Mashari, 2000, p.3 |
| ERP is known as a large-scale, cross-functionality integrated, packaged system. | Brown et al., 2000, p. 1029 |
| ERP systems are software packages that integrate information across the entire organization. This integration removes inconsistencies and enables the organization to attain consolidated reports. | Shakir, 2000, p. 1033 |
| ERP is an integrated comprehensive Enterprise-Wide Information System. | Milford and Stewart, 2000, p. 951 |
| ERP is a comprehensive Information Technology package built on the promise that all critical information should be totally integrated in a single information database. | Wood & Caldas, 2001, p. 387 |
| ERP links all areas of a company with external suppliers and customers into a tightly integrated system with shared data and visibility. ERP systems are designed to solve the problem of the fragmentation of information over many systems in large business organizations. | Chen, 2001, p.374 |
| ERP systems are comprehensive, fully integrated software packages that provide automated support for most of the standard business | Shanks et al., 2000, p. 537 |

| | |
|---|---|
| processes within organizations. | |
| ERP system is a packaged business software system that enables a company to manage the efficient and effective use of resources (materials, human resources, finance, etc.) by providing a total, integrated solution for the organization's information-processing needs. It supports a process-oriented view of the business as well as business processes standardized across the enterprise. | Nah et al., 2001, p.285 |
| ERP systems allow a company to share common data and practices across the enterprise and produce and access information in a real-time environment. These systems are designed to solve the fragmentation in large business organizations and to integrate information flow within a company. | Themistocleous et al., 2001, p.195 |
| ERP plays a critical role in improving or reengineering outdated infrastructures, gaining tighter control over internal operations and driving down costs. | Turban et al., 2001, p.303 |
| ERP consists of massive computer applications that allow a business to manage all of its operations (finance, requirements planning, human resources and order fulfilment) on the basis of a single, integrated set of corporate data. | James & Wolf, 2000 |
| ERP systems are large and complex integrated software packages that support standard business activities. | Oliver & Romm, 2000, p. 1039 |
| ERP is an information system model that enables an organization to automate and integrate its key business processes. ERP breaks down traditional functional barriers by facilitating data sharing, information flows and the introduction of common business practices among all organizational users. | Hall, 2007 |

Source: Adapted from Adam and Sammon (2004)

information. ERP systems are large computer systems that integrate application programs in accounting (e.g. accounts receivable), sales (e.g. order booking), manufacturing (e.g. product shipping) and the other functions in the firm. This integration is accomplished through a database shared by all the application programs. ERP systems work in real-time, meaning that the exact status of everything is always available. Further, many of these systems are global. Since they can be deployed at sites around the world, they can work in multiple languages and currencies.

ERP allows companies to integrate various departmental information. It has evolved from a human resource management application to a tool that spans IT management. For many users, an ERP is a "do it all" system that performs everything from entry of sales orders to customer service. It attempts to integrate the suppliers and customers with the manufacturing environment of the organization. For example, a purchase entered in the order module passes the order to a manufacturing application, which in turn sends a materials request to the supply-chain module, which gets the necessary parts from suppliers and uses a logistics module to get them to the factory. The traditional application systems, which organizations generally employ, treat each transaction separately. They are built around the strong boundaries of specific functions that a specific application is meant to cater for. ERP stops treating these transactions as stand-alone activities and considers them to be a part of interlinked processes that make up the business (Gupta, 2000).

An ERP system is also capable of external communications with its customers and suppliers through electronic data interchange (EDI). The EDI communication link will allow the firm to electronically receive sales orders and cash receipts from customers, send invoices to customers, send purchases orders to vendors, receive invoices from vendors and pay them, as well as send and receive shipping documents (Hall, 2007).



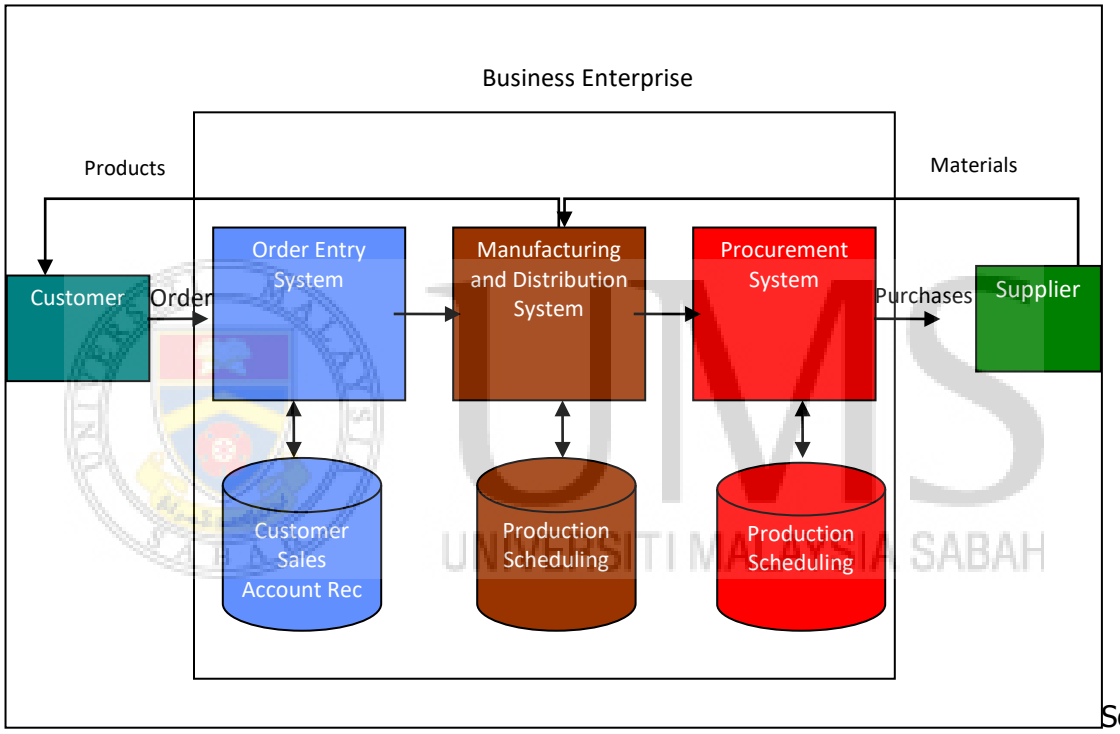
### 3. 7 Enterprise Resource Planning System

The Enterprise Resource Planning (ERP) system is an improvement of Manufacturing Resource Planning (MRP II) that is usually used only by manufacturing companies. The ERP is a business management system that comprises integrated sets of comprehensive software, which can be used, when successfully implemented, to manage and integrate all the business functions within an organization (Shehab, 2004). On the other hand, under the traditional model, each functional area or department has its own computer system optimized to the way that it does its daily business (Hall, 2007).

Figure 3.6 is the traditional model for a manufacturing firm. The model employs a closed database architecture, which is similar to the basic flat file model concept. The data remains the property of the application that causes a high degree of data redundancy in a

closed database environment. The sales clerk will store his or her own data in the customer and accounts receivable database. When other departments need the data, the clerk will send it by sending the soft copy or hard copy. This process will take time, and some times, the receiver needs to retype data that is received in the form of a hard copy. As a result, data will not be up-to-date to every department and there is data dependency between the said departments.

**Figure 3.6: Traditional Information System**




Source: Hall (2007)

The lack of effective communication between systems in the traditional model is often the consequence of a fragmented systems design process. Each system tends to be designed as a solution to a specific operational problem rather than as part of an overall strategy. Furthermore, systems designed in-house usually emerge independently and over time, they are often constructed on different and incompatible technology platforms. Thus special procedures and programs need to be created so that older mainframe systems using flat files can communicate with newer distributed systems that use relational databases. Special

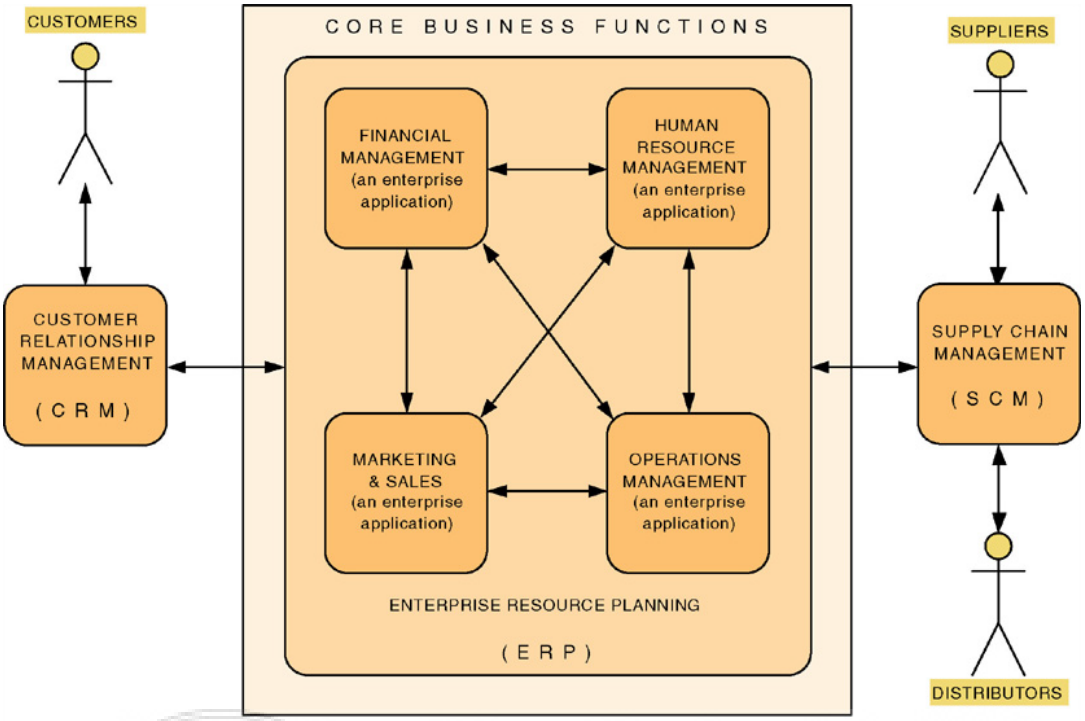
software are also needed to enable commercial systems from different vendors to communicate with each other as well as with custom systems developed in-house (Hall, 2007).

### 3.7.1 ERP System Modules and Functions

Virtually, all organizations, large and small, require a core set of enterprise applications to conduct business (Bentley & Whitten, 2007). For most businesses, the core applications include financial management, human resource management, marketing and sales and operations management. As we can see in Figure 3.7, the internal core applications are being supplemented with other enterprise applications that integrate an organization's business processes with those of its suppliers and customers. These applications are called customer relationship management and supply chain management. Supply chain management is a software application that optimizes business processes for raw material procurement through directly integrating the logistical information systems of organizations with those of their supplies and distributors. Meanwhile, customer relationship management is a software application that provides customers with access to a business's processes from initial inquiry through after sales service and support.



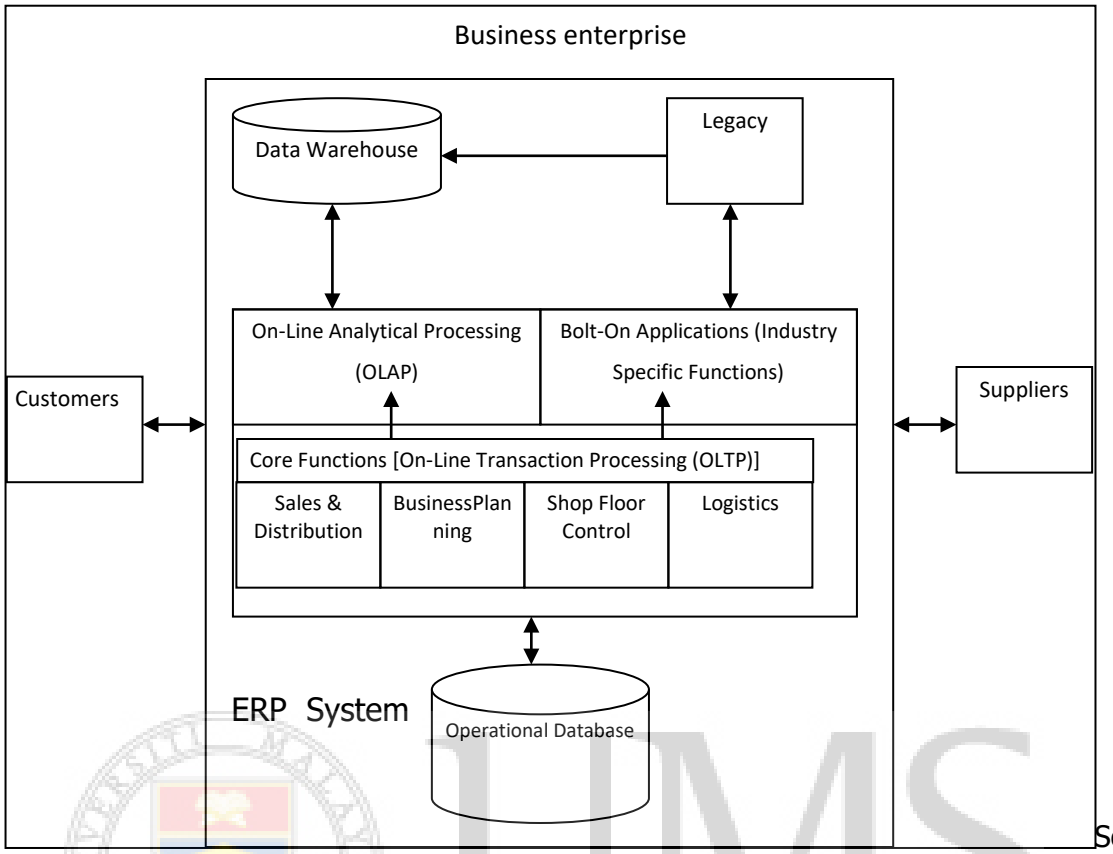
**Figure 3.7: Enterprise Application**




Source: Bentley and Whitten (2007)

ERP systems support a smooth and seamless flow of information across the organization by providing a standardized environment for a firm's business processes and a common operational database that supports communications. An overview of ERP is presented in Figure 3.8. Data in the operational database are modeled, structured and stored in accordance with the internal attributes of the data needs (Hall, 2007). They remain independent of any specific application. Extensive data sharing among users occurs through application-sensitive views that present the data in a way that meets all user needs.

**Figure 3.8: ERP System Environment**



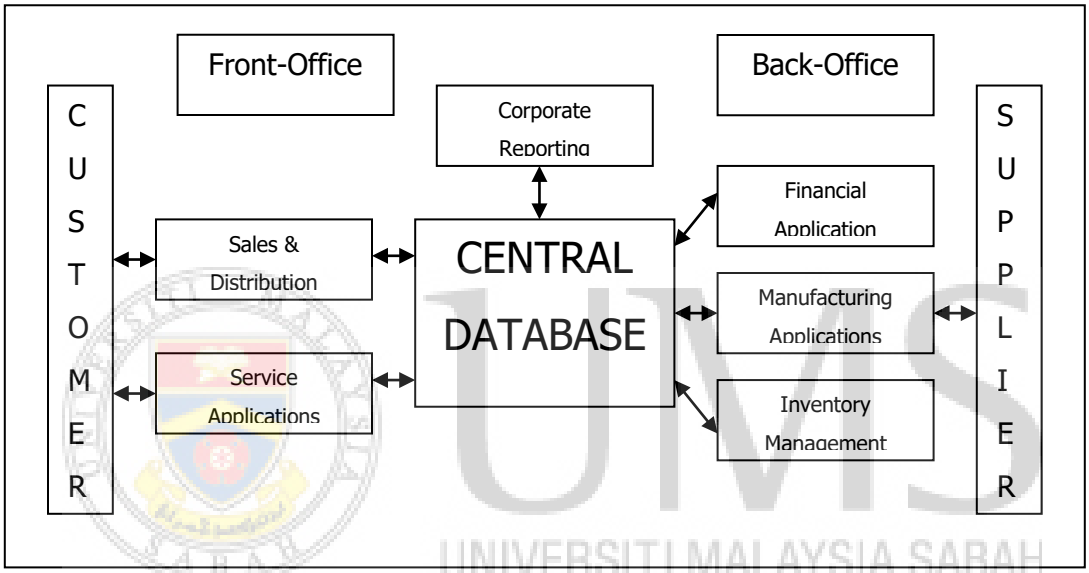

Source: Hall (2007)

ERP functionality falls into two general groups of applications: core applications and business analysis applications. Core applications are those applications that operationally support the day-to-day activities of the business, and have transaction processing functions. These applications support mission-critical tasks through simple queries of operational database, and include sales and distribution, business planning, production planning, shop floor control and logistics modules. Core applications are also called on-line transaction processing (OLTP) applications (Hall, 2007).

Business analysis applications that are called on-line analytical processing (OLAP) and include decision support, modeling, information retrieval, ad hoc reporting/analysis and what-if analysis. The applications supply management with "real time" information and permit timely decisions to improve performance and achieve competitive advantage. They also support management-critical tasks through analytical investigation of complex data

associations captured in data warehouses with consolidation, drill down and slicing and dicing capabilities. Consolidation is the aggregation or roll up of data. Drill-down allows the user to see data in selective increasing levels of detail. Slicing and dicing enables the users to examine data from different viewpoints often performed along a time axis to depict trends and patterns. The concept of ERP system can be illustrated, following Davenport (1998), with the diagram in Figure 3.9.

**Figure 3.9: ERP System Concept**




Source: Rashid et al. (2002)

The figure shows us how a central database is related to modules that a company has such as inventory management, manufacturing application, financial application, corporate reporting, sales distribution, and service applications. The system can serve front-office and back-office activities. Some ERP systems support these functions with their own industry-specific modules that can be added to the core system. Other ERP vendors have designed their systems to accept and communicate with specialized bolt-on packages that are produced by third-party vendors (Hall, 2007). Sometimes the user organization's decision support requirements are so unique that they need to integrate in-house legacy systems into the ERP.

ERP systems can be used to manage business information for corporate resources planning. Generally speaking, ERP can be applied to such fields as finance, human resources, manufacturing and logistics, supply chain management, and data analysis. Finance functions have facilities such as general ledger, accounts receivable, accounts payable, fixed assets, treasury management and cost control. Human resource function has facilities such as human resource administration, payroll and self-service HR. At manufacturing and logistics, the ERP has functions for production planning, order entering, warehouse management, transportation management, project management, plant maintenance and customer service management. Functions and facilities that an ERP can provide to specific fields are listed in Table 3.13. The various modules of ERP include engineering data control (bill of materials, process plan and work centre data); sales, purchase and inventory (sales and distribution, inventory and purchase); material requirement planning (MRP); resource flow management (production scheduling, finance and human resources management); works documentation (work order, shop order release, material issue release and route cards for parts and assemblies); shop floor control and management and others like costing, maintenance management, logistics management and MIS.

Different experts have different opinions about the modules needed for the ERP. According to Siriginidi (2000), the model of ERP includes areas such as finance (financial accounting, treasury management, enterprise control and asset management), logistics (production planning, materials management, plant maintenance, quality management, project systems, sales and distribution), human

**Table 3.13: Functions and Facilities in ERP System**

| Function | Facilities | Description |
|---|---|---|
| Finance Functions | General ledger | ERP can keep track of the centralized accounts and corporate financial balances |
| | Accounts receivable | ERP can keep track of payment due from customers. |
| | Accounts payable | ERP can schedule bill payments to suppliers and distributors |
| | Fixed assets | ERP can manage depreciation and other |

| | | |
|---|---|---|
| | | costs associated with tangible assets such as buildings, property and equipment |
| | Treasury management | ERP can monitor and analyze cash holdings, financial deals and investment risks |
| | Cost control | ERP can analyze corporate costs that are related to overhead, products and manufacturing order |
| The Human Resources (HR) Department | Human Resource administration | ERP can automate personnel management processes such as recruitment, business travel and vacation time |
| | Payroll | ERP can handle the accounting process and preparation for checks related to employee salaries, wages and bonuses |
| | Self-service HR | ERP can allow workers to change their personal information and beneficial allocations online. |
| The Manufacturing and Logistics Department | Production planning | ERP can perform capacity planning and create a daily production schedule for manufacturing plants |
| | Order entering | ERP can automate data entry, process customer ordering, and keep track of order status. |
| | Warehouse management | ERP can keep track of goods and process movements in corporate warehouses |
| | Transportation management | ERP can schedule and monitor the delivery of products to customers |
| | Project management | ERP can monitor costs and work schedule on a project-by-project basis |
| | Plant maintenance | ERP can set the plan and oversee upkeep of internal facilities |
| | Customer service management | ERP can administer service agreements and check contracts and warranties when needed |
| Supply Chain Management | ERP can advance planning applications, monitor production constraints and demand forecasting, and keep order delivery promises | |
| Data Analysis | ERP's decision support software can allow managers to | |

| | |
|---|---|
| | analyze transaction data and business performance |

Source: Yen, Chou and Chang (2002).

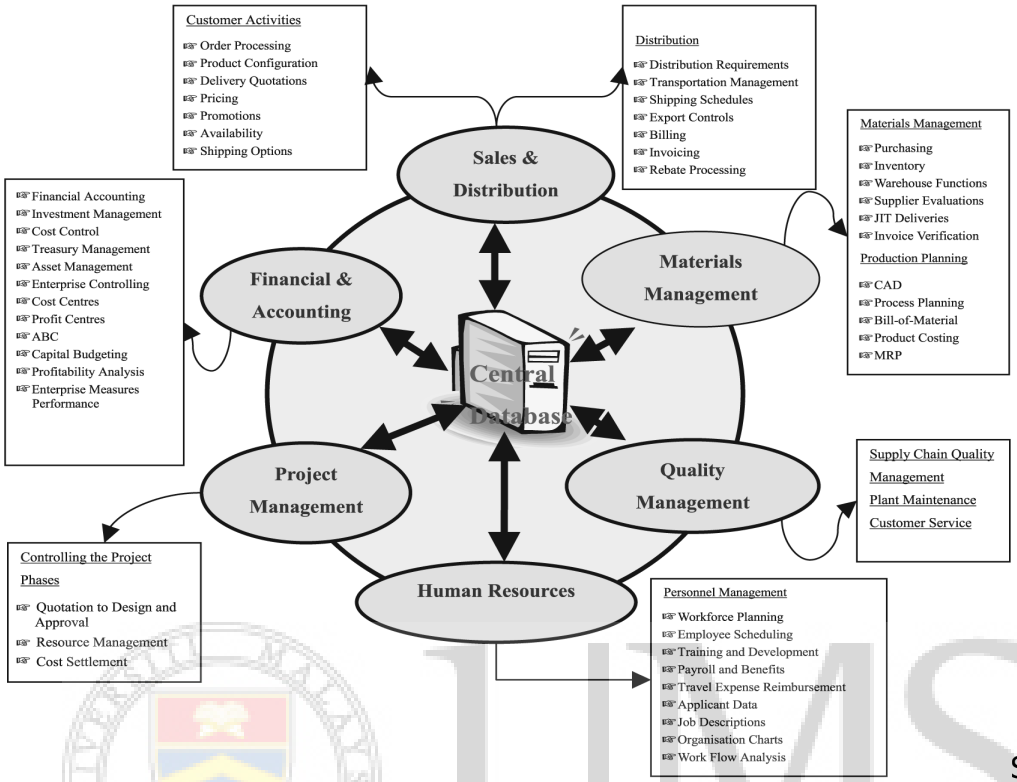
resources (personnel management, training and development and skills inventory) and workflow (integrates the entire enterprise with flexible assignment of tasks and responsibilities to locations, positions, jobs, groups or individuals). In addition tothose functions, ERP systems provide an integrated marketing support system, which includes contact files, order entry files and sales history files (Summer, 2005). The purpose of this module within ERP is to identify sales prospects, to process sales orders, to manage inventory, to handle deliveries, to provide billing and to accept and process payments.

An overview of ERP systems includes some of the most popular functions within each module. Shehab (2004) introduced seven modules within the ERP system. The modules are shown in Figure 3.10. However, the names and numbers of modules in an ERP system provided by various software vendors may differ. A typical system integrates all these functions by allowing its modules to share and transfer information freely by centralizing information in a single database accessible by all modules (Chen, 2001).

There some research conducted about ERP system characteristics to identify whether a company adopts ERP system or not. An ERP system is required to have the following characteristics (Rashid et al., 2002):

i. the use of a modular design comprising many distinct business modules such as financial, manufacturing, accounting, distribution etc;
ii. the use of centralized common database management system (DBMS);

**Figure 3.10: ERP System Module**




Source: Shehab (2004)



iii. the modules are integrated and provide seamless data flow among the modules, increasing operational transparency through standard interfaces;

iv. they are generally complex systems involving high cost;

v. they are flexible and offer best business practices;

vi. they require time-consuming tailoring and configuration setups for integrating with the company's business functions;

vii. the modules work in real time with online and batch processing capabilities; and

viii. they are internet-enabled.

Meanwhile, Yen, Chou and Chang (2002) indicated that ERP characteristics consist of standardized data definitions in which the ERP business processes share the same data definition across all ERP application modules. According to the authors, before using ERP, a

company may implement multiple application systems using non-standardized data across business processes. The ERP system also has common access to a single set of data where a basic design objective of ERP is to have a single set of data maintained across all business processes within an organization. System flexibility means that an ERP system should be flexible to the changing needs of an enterprise. Open system architecture implies that any module in the ERP system can be interfaced or detached whenever required without affecting the other modules. The ERP system supports an organization's online services to external entities. The characteristics and the explanation of each characteristic can be seen in Table 3.14.

**Table 3.14: Key Characteristics of ERP system**

| Characteristics | Explanations |
|---|---|
| Standardized Data Definitions | ERP business processes share the same data definition across all ERP application modules. Before using ERP, a company may implement multiple application systems using non-standardized data across business processes. |
| Common Access to A Single Set of Data | A basic design objective of ERP is to have a single set of data maintained across all business processes within an organization. Before using ERP, multiple versions of data were maintained and processed across an organization. Under such circumstances, vital business decisions were based on inaccurate and non-normalized data. |
| System Flexibility | An ERP system should be flexible to the changing needs of an enterprise. The client/server technology enables ERP to run across various database back-ends through Open DataBase Connectivity. |
| Open System Architecture | This implies that any module in the ERP system can be interfaced or detached whenever required without affecting the other modules. ERP systems should support multiple hardware platforms for companies that use heterogeneous systems, including some third-party add-ons. |
| Beyond the Company Scope | The ERP system should not be confined to an organization's boundary. Instead, it should support an organization's online services to external entities. |

Source: Yen, Chou and Chang (2002)

### 3.7.2 ERP Vendors and Selection Criteria

There are some ERP vendors that can be chosen by companies if they want to implement an ERP system. SAP, JD Edwards, Oracle, PeopleSoft and Baan are industry leaders in the world

(Hall, 2007). They are called the "Big Five" of ERP vendors. There are other ERP vendors such as SSA, BPCS, Inertia Movers, QAD, MFG, PRD, etc. In 1996, SAP earned revenues of US$2.4 billion, Oracle earned US$1.2 billion, PeopleSoft's revenues were US$450 million and Baan earned US$416 million. The top four ERP products have a 60–70% feature overlap, which makes it difficult to accurately differentiate between the systems (Gupta & Kohlil, 2006). SAP dominates the ERP software market. The company provides two main products in the ERP market: R2 and R/3. These products are designed to help organize manufacturing and accounting processes (Yen, Chou & Chang (2002).

SAP R/3 has a function set and data dictionary that is approximately five times larger than Baan IV, which is the number four player in the market. SAP sales are more than the sales of its three closest competitors combined. SAP spent more on research and development in 1996 as a percentage of sales than any of its competitors. The amount spent was US$382 million, which is three times more development dollars spent than its nearest competitor and is almost equal to Baan's total sales (Gupta & Kohlil, 2006).

Oracle is the number one manufacturer of database software (http://www.oracle.com/global/ea/contact/malaysia.html). The company is a leading database software provider that sells most of its applications to manufacturing and consumer goods companies (Yen, Chou & Chang (2002). They are the number two software manufacturer in the world behind Microsoft. Oracle focuses on areas other than the ERP market. Their ERP product earns less than one-quarter of the company's total revenue. For SAP, PeopleSoft and Baan, Oracle is a competitor and a partner. They can provide an organization with the sole source for the database and application layers of their IT infrastructure.

PeopleSoft is the number three vendor in the ERP market. They differentiate themselves by facilitating an incremental approach to technology acquisition and deployment for their customers. A middle market solution offered by PeopleSoft through direct sales channels has been a huge hit with their customers. SAP and Oracle, on the other hand, rely on reseller channels and consulting partners. PeopleSoft dedicates its products to human

resource and client server technology. They continue to prove its value in enterprise-wide application and financial and supply chain applications (Yen, Chou & Chang, 2002).

Baan is best known in the aerospace, automotive, defense and electronics industries for their ERP software (Summer, 2005). Baan competes with larger ERP vendors by focusing on customizability. This ERP vendor continues to develop enterprise applications in areas where SAP and Oracle are less competitive (Yen, Chou & Chang, 2002). Baan provides a tool called Orgware that uses customized business processes to automatically configure its enterprise software to a customer's unique way of doing business. It is predicted by analysts that Orgware could cut implementation times by up to 50%. The success of Orgware is due to Baan separating business processes from the software product. SAP and other vendors are now working on extracting business processes from their software to make the systems more flexible.

From a company's perspective, several choices are available when choosing the best system (Summer, 2005). For example, it can decide (i) to have one vendor for all ERP modules, (ii) to combine existing legacy programs and new ERP modules, or (iii) to create a system based on the vendors' specialized strengths. For instance, PeopleSoft is known for its human resource applications and SAP for its manufacturing applications. Table 3.15 shows the comparison module functions among the vendors. Based on a comparison made by Summer (2005), we can see that SAP has more complete ERP functions compared to Oracle and PeopleSoft. Oracle does not provide controlling modules for Management Accounting like the one in SAP function. PeopleSoft on the other side, does not have modules for the production and planning function, as well as controlling modules for Management Accounting. Based on the functions provided by the vendors, a company can choose to select one of the vendors based on the functions needed for each company. However, a company should also consider the amount of budget approved by its IS steering committee to conduct IS development. The more modules adopted, the more funds are needed to support the IS development. Table 6.15 shows the comparison among the major ERP vendors.

**Table 3.15: Comparison Module Functions among Major ERP Vendors**

| Function | SAP | Oracle | PeopleSoft |
|---|---|---|---|
| Sales Order Processing | Sales and Distribution (SD) | Marketing, Sales and Supply Chain | Supply Chain Management |
| Purchasing | Materials Management (MM) | Procurement | Supplier Relationship Management |
| Production Planning | Production Planning (PP) | Manufacturing | |
| Financial Accounting | Financial Accounting (FA) | Financials | Financial Management Systems |
| Management Accounting | Controlling (CO) | | |
| Human Resources | Human Resources (HR) | Human Resources | Human Capital Management |

Source: Summer (2005)

### 3.7.3 Implementation Steps/ Approaches

The ERP systems design process is different from the traditional systems development process. The ERP systems development process includes planning, requirements analysis, design, detailed design, implementation and maintenance (Summer, 2005). Table 3.16 shows the ERP system development processes developed by the author.



Planning starts with a needs assessment, which provides a business justification for the purchase of the software. This needs assessment phase is important because of the major investment in an ERP system and its business impact. Tool techniques needed is by conducting interviews and cost justifications. The requirements analysis phase of an ERP project involves specifying the business processes to be supported by the ERP package. Most ERP vendors offer "best practice" which refer to models of functions supported by the ERP system in the requirement analysis and designing steps. In the detailed design step, activities conducted will be the re-engineering of business processes around the best practices model of the ERP system or the customization of the software with interactive prototyping as a technique used. At the implementation step, activities conducted will be to configure the system; migrated data from the old system to

**Table 3.16: ERP System Design Process**

| No | Step | Activities | Tools and Techniques |
|---|---|---|---|
| 1 | Planning | Conduct a needs assessment; provide a business justification, based upon the difference between the existing system and the proposed system | Interviewing; cost justification |
| 2 | Requirement Analysis | Analyze current business processes and specify the processes to be supported; select the ERP system | Use best practices models to see what the company can gain by implementing the new system |
| 3 | Design | Re-engineer business processes around the best practices model of the ERP system or customize the software | Use the ERP methodology's best practices or customize |
| 4 | Detailed Design | Choose standard models, processes, inputs, and outputs (e.g., customer lists, vendor lists) | Interactive prototyping |
| 5 | Implementation | Configure the system; migrate data from the old system to the new system; develop interfaces; implement reporting systems; conduct testing; implement controls, security; train end-users | Work with vendors to correct any bugs in the software; clean processes and data. Use reporting tools |
| 6 | Maintenance and Continuous Improvement | Provide technical support; provides upgrades and enhancements | Add enhanced functionality to existing modules |

Source: Summer (2005)

the new system; develop interfaces; implement reporting systems; conduct testing; implement controls and security; and train end-users. In this step, the users will work with vendors to correct any bugs in the software, clean processes and data. In the final steps, maintenance and continuous improvement, the vendors will provide technical support; provides upgrades and enhancements through the adding of enhanced functionality to existing modules.

ERP systems can be complex and difficult to implement, but a structured and disciplined approach can greatly facilitate the implementation (Umble, et al, 2003). The authors have compiled a list of 11 recommended steps for a successful implementation. These steps have been integrated from several works. The steps can be seen in the following:

1. *Review the pre-implementation process to date.* Make sure the system selection process has been satisfactorily completed and all factors critical to implementation success are in place.
2. *Install and test any new hardware.* Before attempting to install any software, it is essential to make sure that the hardware is reliable and is running as expected.
3. *Install the software and perform the computer room pilot.* A technical support person from the software supplier will often install the software and run a few tests to make sure it is installed correctly.
4. *Attend system training.* Software training will teach users the keystrokes and transactions required to run the system.
5. *Train on the conference room pilot.* The conference room pilot exercises the systems and tests the users' understanding of the system. The project team creates a skeletal business case test environment which takes the business processes from the beginning, when a customer order is received, to the end, when the customer order is shipped.
6. *Establish security and necessary permissions.* Once the training phase is finished, during the conference room pilot, the security and permissions necessary are set to ensure that everyone has access to the information they need.
7. *Ensure that all data bridges are sufficiently robust and the data are sufficiently accurate.* The data brought across from the old system must be sufficiently accurate for people to start trusting the new system.
8. *Document policies and procedures.* The policy statement is a statement of what is intended to be accomplished; the procedural steps to accomplish that statement may be detailed in a flowchart format.
9. *Bring the entire organization on-line, either in a total cutover or in a phased approach.* In a "cold turkey" approach, the whole company is eventually brought onto the new system. The entire company prepares for the cutover date, which would preferably be during a plant shutdown of one to two weeks. In a phased approach, modules/products/plants are

brought on-line sequentially. After the first module/product/plant is live, procedures may be refined and adjusted, the remaining modules/products/plants are sequentially implemented. The phased approach may allow for improvements to be made during the implementation.

10. *Celebrate.* This can be the most important step. The company has just completed a major project; the celebration recognizes this and clearly demonstrates the importance of the project to the organization.
11. *Improve continually.* The organization can only absorb a limited amount of change during a finite time period. Change is an on-going process; successful companies understand this and encourage their employees to use the system to continue to improve.

Planning for ERP systems and their implementations requires an integrated strategy and approach to meet the requirements of various functional areas. The important strategies one must consider are pre-implementation, implementation and post-implementation strategies (Mandal & Gunasekaran, 2003). Pre-implementation (planning) strategies are: incorporate the risk and quality management plans in the change management plan; breakdown the project into natural phases or subsystems for modular planning and for development of cross-functional communications; consider a phase-based approach for gradual implementation rather than a radical approach; use appropriate planning styles for different tasks, detailed task plans for tangible tasks, iterative plans for evolving tasks, and personal communications plans for change management; and prepare plans for the recruitment, selection, and training of the necessary personnel for the project team.

Implementation strategies are: formulate a network for collecting user requirements and user feedback; set-up monitoring and feedback network for collecting control information at each stage of the implementation process; prepare to handle expected or unexpected crises and deviations from plans; provide a strong leadership with concerns for the welfare of people and resource commitment; provide a professionally stimulating work environment; obtain top management support for the project and plan for an adequately resourced and proficiently executed launch; promote client consultation and user participation and obtain approval from parties for what is being undertaken throughout the project; use pro-active

communications to establish more realistic expectations about the technology's capabilities while communicating in a tailored way to each division or unit; promote collaborative system development between users and developers; use multi-functional project teams to bring complementary capabilities together during the total life of the project; familiarize the staff about the incoming technology and train the people involved with the system; use intra-project teams and intra- and inter-industry networking for technology transfer; provide stakeholders with a detailed plan of the implementation process, explain how it achieves business objectives, and keep them informed about the system and progress of its implementation; and propose possible ways for restructuring personnel and systems to accommodate the new technology, including maximization of system integration and interfacing.

Post-implementation activities are critical for the acceptance (adoption) of ERP systems. Requirements of IT systems and structures tend to change continuously even after the completion of a project. Post-project evaluation strategy could be followed in measuring the effectiveness of an ERP system, where questions such as those listed below could be used for further improvement: (i) whether the objectives of the ERP system were realized fully; (ii) whether the scheme options were considered adequately; (iii) whether the estimates and project information were accurate; (iv) whether or not the agreed practices and techniques were complied with; and (v) any other factors which are considered appropriate (Mandal & Gunasekaran, 2003).



According to Mandal and Gunasekaran (2003), such evaluations could concentrate on, firstly, cost estimates against actual and reasons for variations. Secondly, the evaluation could suggest any possible improvements to the IT system. Thirdly, the degree of staff consultation could be assessed and improvements suggested. Finally, post-implementation evaluation can suggest improved procedures in avoiding failure in similar projects in the future.

The fundamental decision in ERP systems design is re-engineering versus customizing (Summer, 2005). In the re-engineering approach, the team selects a commercial off-the-shelf

ERP and re-engineers business processes to fit the package. In the customizing approach, the team selects a commercial ERP and customizes the ERP to meet unique requirements. Any approach chosen will have advantages and disadvantages. If a company chooses to use a re-engineering approach: it will be supported by an ERP solution; takes advantage of shared or generic processes within industries (e.g. industry templates); best practices may represent improved process changes; documents best practices; works well when there is minimal organizational change. However, it does not support strategic or unique business processes; and resistance occurs when there is extensive organizational change. Other characteristics of re-engineering are support re-engineering processes to fit the software system's best practices; and it works well with minimal organizational change, but extensive re-engineering may disrupt the organization; evolution depends upon vendor upgrades and enhancements to the system; software is available and ready to implement; implementation is cost-effective; puts boundaries on the design; design conform with business models and best practices; other firms have access to the same design; requirements will be supported by an ERP system and more of turnkey approach, particularly using a vanilla implementation.

On the other side, a customizing approach supports unique business processes; strategic processes are maintained. Unfortunately, the ERP system may not support these unique business processes; re-inventing the wheel; customization is difficult, since modules are integrated; difficult to upgrade the software to newer versions, since upgrades are based on vanilla versions. This approach may disrupt the organization less because the software is designed to support current methods of work organization and structure; evolution can support unique user requirements; may involve lengthy systems development activities; may involve extensive cost of custom implementation; provides greater flexibility for meeting unique requirements; not constrained by the tools' best practices; no boundaries for the design and do not have to use software to which everyone in the industry. Table 3.17 details the pros and cons of the re-engineering and customizing approaches.

Firms are more successful in implementing ERP systems under budget or on-budget when the amount of customizing is kept to a minimum (Mabert, Soni & Venkataramana, 2000). In their study of ERP implementation, Mabert et al. noted that making modifications in

the ERP software contributed to a 50% increase in project duration. When an ERP system is customized, the time and cost of the project increases along with the risk associated with successful implementation. This is because the customized software cannot be as easily integrated with new versions of the ERP, which are introduced by the vendor over time. Nevertheless, many organizations customize ERP modules. A large percentage of firms surveyed in Sweden (Olhager & Selldin, 2003) decided to customize the ERP system they selected.

Although various commercial ERP systems are available, a company should select a system by carefully weighing various factors, e.g. support, functionality, user interface, flexibility, reliability and integration (Gupta & Kohlil, 2006). The ERP system usually contains many modular applications, e.g. sales and distribution, financial investments, production planning, material management, human resource management. Depending upon organizational size (e.g. small to large firms), structure (e.g. centralized to decentralized), and complexity (e.g. low to high variety of products), the company should decide whether to implement these modular applications as an entire suite of applications or in a phased manner (O'Leary, 2000).



### 3.7.4 ERP Implementation Success Criteria

A large number of studies have been conducted during the past two decades to identify factors that contribute to the success of information systems (IS). However, the dependent variable of IS success is difficult to define and a cumulative research is not easy (Zhang, Lee, Huang, Zhang & Huang, 2005). Delone and McLean (1992) conducted an extensive literature review on 180 empirical studies and

**Table 3.17: Detailed Comparison: Re-engineering vs. Customizing Approach**

| | Re-engineering approach | Customizing approach |
|---|---|---|
| Pros | Is supported by an ERP solution; takes advantage of shared or generic processes within industries(e.g. industry templates); best practices may represent improved process changes; documents best practices; works well when there is minimal organizational change | Supports unique business processes; strategic processes are maintained |
| | **Re-engineering approach** | **Customizing approach** |
| Cons | Does not support strategic or unique business processes; resistance occurs when there is extensive organizational change | An ERP may not support these unique business processes; re-inventing the wheel; customization is difficult, since modules are integrated; difficult to upgrade the software to newer versions, since upgrades are based on vanilla versions |
| Re-engineering business processes | Support re-engineering processes to fit the software system's best practices | Re-engineering is independent of the tool being implemented (e.g. its models, processes, outputs) |
| Organizational fit | Works well with minimal organizational change, but extensive re-engineering may disrupt the organization | May disrupt the organization less because software is designed to support current methods of work organization and structure |
| Evolution | Evolution depends upon vendor upgrades and enhancements to the system | Evolution can support unique user requirements |
| Timelines | Software is available and ready to implement | May involve lengthy systems development activities |
| Cost | Implementation is cost-effective | May involve extensive cost of custom implementation |
| Requirements | Puts boundaries on the design; design conforms with business models and best practices | Provides greater flexibility for meeting unique requirements; not constrained by the tools' best practices; no |

| | | |
|---|---|---|
| | | boundaries for the design |
| Competitiveness | Other firms have access to the same design | Do not have to use software to which everyone in the industry has access |
| Fit | Requirements will be supported by an ERP system | Unique requirements may not be supported by an ERP system |
| External consulting | More of a turnkey approach, particularly using a vanilla implementation | May entail the expense of much external consulting |

Source: Summer (2005)

classified dimensions of IS success into six categories:

i. System Quality: The desired characteristics of an IS itself;
ii. Information Quality: The desired characteristics of the product of an IS itself;
iii. Use: The receipt consumption of the product of an IS;
iv. User satisfaction: The receipt response to the use of the product of an IS;
v. Individual impact: The effect of information on the behavior of a receipt; and
vi. Organizational impact: The effect of information on organizational performance;

Due to the firm-wide impact of ERP systems, practitioners and theorists are still grappling with the question of which constructs best represent ERP success. Markus et al. (2000) indicated that different measures are needed at different stages in the system life cycle and a minimum set of ERP success metrics should include project metrics, early operational metrics and long-term business results. In the implementation stage, business managers usually target project metrics such as shortened implementation timeframes, because anything that takes a longer period costs more. Hence, the sooner a system is implemented, the better. Most ERP projects start with a basic management-driven impetus to target a faster implementation and more cost-effective project.

Mabert et al. (2003) report that firms which over budget for ERP implementation tend to view the system as less successful in meeting desired company goals. Their results imply that process success (e.g. budget and schedule control) manifests the cost-effectiveness of a project. Their findings then indicate that firms whose ERP implementation is under/on budget

tend to rate the system value (goal success and business case attainment) higher than the firms which overbudget. Such a result seems reasonable; a project overrun in cost and time discloses a potentially troubled venture and the likelihood of unfulfilled promises. The study of Mabert et. al. (2003) also suggests that the under/on budget group of firms not only manage their ERP implementation better but also do a better job of running their business. This viewpoint is supported by their field interviews with a number of ERP adopters. According to a consultant they interviewed, "from the consultants' viewpoint, the definition of ERP success is on-time installation". Consequently, they define ERP project success from the project implementation perspective and focus on the process indexes of projects.

ERP key user satisfaction is closely related to perceived system success (Wu & Wang, 2005). Their research approved to employ user satisfaction as a measure of system success in an ERP environment. In addition, the research identifies that key users' satisfaction evaluation for an ERP system uses multidimensional constructs (i.e. ERP product, contractor service and knowledge and involvement). ERP product satisfaction includes accuracy, reliability, response time, completeness, system stability, auditing and control and system integrity. Contractor service satisfactions include domain knowledge of consultants/suppliers, related experience of consultants/suppliers, project management of consultants/suppliers, technical competence of consultants/suppliers and training. Knowledge and involvement refers to a feeling of user involvement and system understanding.

Zhang et al. (2005) developed an ERP implementation success framework by adopting Delone and McLean's IS success model to identify success measures. Based on their study, they found that ERP implementation success measures are user satisfaction, individual impact, organizational impact and intended business performance improvement. Meanwhile, the factors that contribute to ERP implementation success are organizational environment (top management support, company-wide support, business process redesign, effective project management and organizational culture), user environment (education and training, user involvement and user characteristics), system environment (ERP software suitability, information quality, and system quality) and ERP vendor environment (ERP vendor quality).

### 3.7.5 Critical Success Factors of ERP

Although the ERP system possesses certain advantages, it also holds some disadvantages. ERP has the following disadvantages: its high cost prevents small businesses from setting up an ERP system; the privacy concern within an ERP system and lack of trained people may affect ERP's efficiency; implementation of an ERP project is painful; and customization is costly and time-consuming (Yen et al, 2002). These disadvantages are further discussed below.

- High cost: The high cost makes an ERP system out of reach for many small businesses. Moreover, implementing costs are much higher than setting up costs. Therefore, a company which plans to invest in an ERP needs to have a good strategy and a clear idea about the cost of the ERP system.
- Privacy concerns within an ERP system: Many companies have no clear answer to questions such as: who owns the access rights to the system; and who can change the information within the system. The best way to solve this problem is to clearly define the access scope and responsibility of the ERP system, and also keep updating the rules accordingly.
- ERP implementation is a long and painful process: Implementing a new ERP system may slow down the routine works within an organization. Therefore, providing good training and appropriate preparation to corporate employees can prevent such a drawback.
- ERP system customization is costly and time-consuming: Customizing an ERP system for a particular organization is costly and time-consuming. Thus, ample preparation can make adaptation quick and smooth.

Implementing an ERP is risky, given the length of the implementation effort required and the cost of the technology Davenport (1998). The implementation environment is affected by the numerous software and technology systems available to managers, the complexity of the requirements from those systems and the need to adapt any existing or future software to the core ERP technology. This is particularly true for organizations with multiple site implementations in geographically dispersed locations (Markus et al., 2000).

According to Tchokogué et al. (2005), there are some considerations inherent in an ERP implementation that are prerequisites to effective organizational transformation required

by a system implementation. They are strategic, tactic and operational considerations. At the *strategic level*, top managers establish a clear vision of the role of the ERP project in the business model, along with strategic priorities. The managers should create a feeling of urgency, and precisely determine the scope and scale of the project. Top management then commit substantial resources by allocating sufficient human and financial resources and persevere in backing a structured and disciplined approach to implementation until the completion of the project.

*At the tactical level*, according to the author, managers should define the project as the capability of the organization to reconceptualize its business processes. Consideration should be taken of the technological potential while reserving the integrity of value added processes that make up the organization's expertise. Processes were then redesigned in keeping with manager's vision and the target identified. *At the operational level*, appropriation was made by mastering human issues. The Change Leadership and Knowledge Transfer teams play a crucial role in this process. The change management strategy is mobilized by decentralizing change sessions within the business units where information can circulate between individuals.

In a study conducted by Tchokogué, Bareil and Duguay (2005) at Pratt and Whitney Canada, a large aeronautics company, participations of employees was studied extensively and integrated in the action strategies. Change sessions were decentralized within business units. A massive training program was deployed using many of the company's own employees as instructors to ensure a better appropriation of the technology. The experience of Pratt and Whitney Canada reconciles both the requirements of a large-scale project and the capacity of an organization to successfully meet the challenges associated with such an implementation. In particular, this experience demonstrates that success is conditional on adequate management of the complex context of an ERP implementation.

A major conclusion of this study is that both the perceived usefulness and ease of use of the ERP system contribute significantly to a behavioral intention to use the technology. In addition, the arguments advanced for changing the technology and the intrinsic involvement

of users are very important in influencing the perceived usefulness of the technology. At the same time their data suggests that perceived usefulness has the greatest impact on behavioral intention among the factors examined. A managerial implication of this observation is that the users place a great deal of emphasis on the usefulness of the technology. Wu and Wang (2005) suggest that ERP vendors, consultants and IS managers should pay attention not only to improve the quality of ERP products, but also to improve users' knowledge and involvement. The managers should also select suitable consultants and suppliers to ensure the success of ERP implementation.

Based on their study, Sun et al. (2005) conclude that as the implementation schedule increases, the cost increases accordingly. In addition, they propose that people (education, training, skills development and knowledge management) get the highest priority when it comes to ERP implementation, and the second highest is data (master files, transaction files, data structures and maintenance and integrity). There are some lessons learnt that can be suggested to increase the success of future ERP implementations (Kakouris & Polychronopoulos, 2005). These success factors are:

i. Selection of the right people to be the key-users, who, in turn, will be the liaison between the company and the consultant;

ii. Consultants are treated as employees and are not allowed to manage the company;

iii. Detailed description of the working scenarios, including even the rarest cases;

iv. Agreement on the statistical data needed by each function in order to prepare grouping structures and coding;

v. Awareness of both management and employees that extra working effort should be made for a long period of time, on top of the daily operations;

vi. Data preparation should start as soon as the organizational structure of the ERP has been established;

vii. Business organizational chart and present operation practices should be evaluated and modified against the workflow and interoperability of the system;

viii. The more effort that the user puts in the early stages of implementation, the easier its daily routine will be when the system goes live;

ix. An understanding that the selection and implementation process of a project of such magnitude should not be treated as just another company project;

x. A radical shifting from functional to process approach; and

xi. Careful handling of the migration process as it should run parallel with the running of a profitable business.

### 3.7.6 Barriers to Successful ERP and Reasons for Implementation Failures

Through statistics and an analysis of questionnaires and interviews from Chinese respondents with 45 valid questionnaires, Yusuf et al. (2006), noted that difficulties in ERP implementation in China. In order of importance, they are: (i) lack of top management support; (ii) significant cost and time recurred; (iii) cultural differences; (iv) technical complexity; (v) lack of professional personnel; and (vi) inner resistance. Inner resistance is the least serious in Chinese context. Some difficulties are affected by enterprise's ownership and size. According to them, to ensure that ERP implementation does not fail, there should be: a good ERP implementation team; suitable Business Process Reengineering (BPR); appropriate training; and a reliable Outsourcing-Application Service Provider.



In addition, Wu and Wang (2005) identify multidimensional constructs to evaluate key-user's satisfaction with ERP system (i.e. ERP product, contractor service, and knowledge and involvement). The three factors are interwoven, and one must not focus exclusively on any single factor in assessing overall ERP success. The results enhance our understanding of the nature and dimensionality of the key-user satisfaction of ERP system. The research further provides some implications for implementing and managing ERP systems. ERP vendors, consultants and IS managers should pay attention not only to improve the quality of ERP products, but also to improve users knowledge and involvement and to select suitable consultants and suppliers. The reason why ERP implementations fail can be placed into ten categories (Umble et al., 2003):

i. Strategic goals are not clearly defined;

ii. Top management is not committed to the system;

iii. Implementation project management is poor;
iv. The organization is not committed to change;
v. A great implementation team is not selected;
vi. Inadequate education and training results in users that are unable to satisfactorily run the system;
vii. Data accuracy is not ensured;
viii. Performance measures are not adopted to ensure that organization changes;
ix. Multi-site issues are not properly resolved; and
x. Technical difficulties can lead to implementation failures.

By conducting a survey of 48 IS professionals that had had experience in using ERP systems in Australia, Hawking and Stein (2004) noted that some barriers to ERP implementation success. They are lack of discipline, lack of change management, inadequate training, poor reporting procedures, inadequate process reengineering, misplaced benefits ownership and inadequate internal staff. In addition, they have poor prioritization of resources, poor software functionality, inadequate ongoing support, poor business performance and underperforming project teams. Hence, in order to be successful in implementing the ERP system, a company should avoid such barriers.

# CHAPTER 4

# HYPOTHESIS DEVELOPMENT AND RESEARCH MODEL

## 4. 1 Introduction

This chapter discusses the hypothesis development and research model that related to the proposed of the study. Issues on effect of ERP system adoption were discussed first, followed by ERP scorecards and issues on managerial levels and ERP system adoption's benefits. Next, issues on ERP system adoption's benefits and business performance, internal process performance, customer performance, financial performance and innovation and growth performance were discussed. This chapter ends with the presentation of integrating of ERP system and balanced scorecards and the theoretical framework of the study.

## 4. 2 Effects of ERP System Adoption

Since the 1960s, computers have been used to help companies compete by employing low cost strategy, differentiation strategy, or both (Porter & Millar, 1985). Low cost strategy means that the company competes with other businesses by being a low-cost producer of a good or service. Computers can lower the cost of products or services by automating business transactions, shortening order cycle times and providing operational data for decision making. With the differentiation strategy, the company will compete with other businesses by offering products or services that customers prefer due to superiority in characteristics such as product innovativeness, quality or services. IS will be used by a company to differentiate their products by providing sales personnel with information to help them better service a specific customer, to ensure just in time supplies, and to produce new information-based products. Both competitive strategies enabled by the ERP, together with specific operational characteristics, can place the organization in a strategic position (Ragowsky & Gefen, 2008). When this happens, the IT unit is more likely to be under the authority of senior management.

Kalakota and Robinson (1999) put forward four reasons why managers are prepared to spend so much money on ERP systems: (i) ERP systems create a framework that will improve customer order-processing systems, which were neglected in recent years; (ii) ERP systems consolidate and unify business functions, such as manufacturing, finance, distribution and human

resources; (iii) ERP systems integrate a broad range of disparate technologies into a common denominator of overall functionality; and (iv) ERP systems create a foundation on which next-generation applications can be developed.

Information integration is a key benefit of Enterprise Systems (Hendricks et al., 2007). This integration can replace functionally oriented and often poorly connected legacy software, resulting in savings in infrastructure support costs. Furthermore, improvements in operational integration enabled by ES can affect the entire organization and therefore can positively impact firm performance. ERP implementation is successful if the system can create faster information response time, increase interaction across the enterprise, accelerate business processes, improve order management and order cycle and lower inventory levels (Wang et al., 2006).

ERP systems replace complex and sometimes manual interfaces between different systems with standardized, cross-functional transaction automation. Order cycle times (the time from when an order is placed until the product or service is delivered) can be reduced, resulting in improved throughput, customer response times and delivery speeds (Cotteleer & Bendoly, 2006 and McAfee, 2002). Similarly, automated financial transactions can reduce cash-to-cash cycle times and the time needed to reconcile financial data at the end of the quarter or year (Mabert et al., 2003). The result is a reduction in operating capital and the headcount of the financial area.



Another benefit of ERP systems is that all enterprise data are collected once during the initial transaction, stored centrally and updated in real time (Bancroft et al., 1998). This ensures that all levels of planning are based on the same data and that the resulting plans realistically reflect the prevailing operating conditions of the firm. For example, a single, centrally developed forecast ensures that operational processes remain synchronized and allows the firm to provide consistent order information to customers.

Hendricks et al. (2006) tried to find out the effect of investments in ERP systems on a firm's long term stock price performance. They found out that during the two year implementation period, the stock price performance of the sample firms fared poorly relative to the benchmark portfolios. Of the 186 sample firms studied, only 40% of the sample firms did better than the median return of the firms that belong to their assigned portfolio. The abnormal stock price

performance during the implementation period was negative and statistically significant. The evidence suggests that over a five-year period, the stock price performance of firms that invest in ERP system is no different from that of their benchmark portfolios. Hitt et al. (2002) analyzed a sample of SAP's ERP implementations using accounting and stock market-based performance measures. They found evidence of improved financial performance during implementation, but were unable to estimate the long-run impact of ERP systems due to a lack of post-implementation data at the time they conducted their study.

Other academic studies have examined the effect of ERP investments on performance using in-depth case studies, data collected from surveys or experiments. A survey by Mabert et al. (2003) found some improvements in managers' perceptions of performance (mainly in financial close cycles and order management) but found that few firms had reduced direct operational costs. Hunton et al. (2002) experimentally test the relationship between ERP and performance by presenting 63 certified financial analysts at a financial services firm with a hypothetical case of a company and comparing these analysts' initial earning forecasts with the forecasts after they were told that the hypothetical firm had committed to investing in an ERP system. The results of the experiment indicate that the revisions in earnings were positive, thereby providing support for the hypothesis that implementation of ERP systems has a positive effect on performance. The results from survey-based and experimental research could be further supported by triangulation with findings based on objective performance data.



ERP systems are programs that aim to provide single integrated software to handle multiple corporate functions including finance, human resources, manufacturing, materials management and sales and distribution. ERP systems allow companies to: integrate and synchronize all their activities within the supply chain and help in the management of the supply chain and its attendant benefits such as faster response to customers, reduced cycle times and productivity increases; design an integrated information system that eliminates multiple sources of data, eliminates multiple data entries and provides more accurate and timely data; facilitate information flows and communication among different organizational units so as to help meet the needs of both employees and customers; and reduce the costs required to maintain previously segregated legacy systems that provide incompatible data (Gyampah, 2005).

Gupta and Kohlil (2006) have endeavored to provide operations managers a brief overview of ERP systems and highlight its implications for operations function. Specifically, the objective of their paper is to give a broad based overview of enterprise resource planning systems. Using SAP R/3 as an example, they discuss how an ERP system can assist in enhancing and strengthening business strategy and making consistent operations decisions: process design, production planning and scheduling, inventory management, quality management and human resource management. According to them, one of the greatest benefits of an ERP system is the integration of processes, data and organizational elements, i.e. it unites all of a company's major business processes (from order processing to product distribution) within a single family of software modules. This tight integration makes simultaneously satisfying operational, financial and managerial principles possible. ERP systems have potential to make a company stronger and successful but it also has the potential to kill a company. Thus, in order to obtain benefits and avoid serious difficulties, companies need to solve the ERP implementation problems. ERP systems have been used to improve internal operations and efficiencies. Today's dynamic business environment requires companies to internally monitor and make decisions in response to changes in the marketplace. To effectively compete in the international business world, companies must position themselves to quickly access both internal and external market information and make prudent business decisions by using the ERP system (Gupta & Kohlil, 2006).

The Enterprise System is not just a "system" but becomes more of an "actor" in the organization defining possibilities, costs, benefits, behavior, integration, and the relationship between other organizational actors (Rikhardson & Kraemmergaard, 2006). Their research was based on six qualitative exploratory case studies and the basic assumptions were embedded within the interpretive paradigm. They found that the organizational impact of ES implementation and use are: changes in the IT function, increased IT literacy, coordination of accounting process, integration of business processes, better understanding of the business processes, changes in financial performance and maintenance of competitive position. Rikhardson and Kraemmergaard (2006) noted the impacts of the ERP system implementation in the participating companies of their research in Table 4.1.

ERP provides the enterprise-wide solution to deliver many benefits such as low operating costs and improved customer service, thus enhancing business operations in many areas (Yen, Chou & Chang, 2002). According to them, the pros for ERP include:

a. Promotion of integration: ERP automatically updates data among different business components and functions. Therefore, communication and integration among different business processes are improved, and the scope of improvement is business-wide.
b. Adaptation to globalization: ERP allows the flexible use of language, currency and accounting standards. It thus improves adaptation to multinational business environments.
c. Data integration: ERP performs real time filing and data analysis from a variety of sources. It then allows a more comprehensive and unified management of data.

**Table 4.1: Impact of Enterprise System to Company's Performance**

| Organization | Baseline | Main stated impacts of ES |
|---|---|---|
| LEGO | Financial crisis, complicated business processes; many old legacy systems | Streamlined business processes |
| | | Better integrated processes |
| | | Changed business practices |
| The Municipality of Copenhagen | Old fragmented IT architecture; ineffective accounting processes | Increased business process efficiency |
| | | Increased IT literacy |
| | | Increased flexibility regarding adapting to political decisions |
| Martin Group | Management crisis and old legacy systems | Better integrated processes |
| | | Tool for the new management |
| Hydro Automotive Structures | Old non-integrated legacy system, low user acceptance | Increased transparency of processes |
| | | Increased data quality |
| Bang and Olufsen | Many old legacy systems, Y2K problems | Reduced stock |
| | | Increased flexibility |
| Fritz Hansen | Strategic change, old non-integrated system | Better support of business processes |
| | | Better support of strategic initiatives |
| | | Better supplier control |

Sources: Rikhardson and Kraemmergaard (2006)

d. Utilization of the latest information technology: ERP utilizes the latest information technology such as the Internet and e-commerce. It allows businesses to quickly adapt to the latest information technology and fit in the future business environment.
e. Enabling process improvement: ERP system needs to enter data only once. Therefore, operation efficiency can be increased and its operational cost will be decreased.

Mabert et al. (2003) report that ERP implementation benefits the most from (i) business processes integration; (ii) information availability; and (iii) information quality. In addition, ERP implementation improves inventory management and supplier management/ procurement. Other internal benefits of ERP include (i) support for production capacity planning; (ii) increased accuracy in market demand forecast; and (iii) improved manufacturing flexibility (Hsu & Chen, 2004). Benefits are further categorized into tangible benefits and intangible benefits (Table 4.2).

Based on a survey conducted on 48 IS professionals in Australia, Hawking and Stein (2004) found out that ERP adoption can generate some benefits to company. The highest benefit was financial cycle close reduction followed by productivity improvements, procurement cost reduction, order management improvement, on time delivery improvement, personnel reduction, IT cost reduction, cash management improvement, inventory reduction, maintenance reduction and increase in revenue and profit.



Benefits generated from ERP implementation include inventory reduction, labor cost reduction, improved customer service and improved visibility (Kakouris & Polychronopoulos, 2005). Kakouris and Polychronopoulos identify the causes of the benefits. A company can reduce inventory by implementing ERP because with ERP, the company can: net demand against inventory to determine market net requirement; buy what is needed through correct Bill of Materials (BOM), using parametrical optimum quantity algorithms ; encounter all changes in the BOM, thus preventing obsolete inventories; process production orders faster, resulting in better control for the work-in-process inventories; deliver the actual quantities on the right dates; and produce what is demanded from time phased plans.

The reasons for labor cost reduction are: fewer shortages, disruptions, and interruptions; less rework, overtime, and rush jobs; better visibility of required work, so that capacity is properly

scheduled to meet demands; and more free time for production personnel who are now used better and more constructively. The company can improve customer service because the ERP system can integrate among forecasting (sales) and production planning and inventory planning that can create better customer service and fewer lost sales. In addition, as the system provides a basis for linking operations, it allows for real time visibility. For example,

**Table 4.2: Tangible and Intangible Benefits of ERP System Implementation**

| Tangible benefit | Intangible benefits |
|---|---|
| • Support capacity planning<br>• Provide more accurate market demand forecasts.<br>• Facilitate mass customization and improve manufacturing flexibility.<br>• Increase inventory turnover rate.<br>• Decrease inventory level and cost.<br>• Control and improve product quality.<br>• Speed up new product development cycle and time-to-market.<br>• Reduce the cycle time of order fulfillment.<br>• Achieve operational excellence. | • Allocate enterprise resources better.<br>• Increase communications among departments.<br>• Integrate information across the enterprise.<br>• Increase the ability of critical operational and decision support information to provide visibility of enterprise planning activities.<br>• Access to real-time business intelligence.<br>• Improve information flow among departments.<br>• Increase response time to customer order and inquiries.<br>• Improve service quality.<br>• Improve customer satisfaction and loyalty.<br>• Growing purchase from customers. |

Source: Hsu and Chen (2004)

production planners can now view what and where the orders are, thus allowing them to schedule against the forecast. This visibility has triggered co-operation and co-ordination between operations and allowed for a better decision-making. Other benefits are: flexibility and better access to information, less prone to errors; elimination of most of the manual (paper) work; applying the "one set of data" principle; and integrating a holistic corporate attitude. Causes of ERP system implementation benefits can be found in Table 4.3.

Meanwhile, Shang and Seddon (2002) provided a comprehensive list of ES implementation benefits based on stories published on the web and interviews of managers of ES adopters. The list consists of five dimensional levels of benefits: operational, managerial, strategic, informational

technology (IT) infrastructural and organizational. At the operational level, ES adoption will cause cost reduction, cycle time reduction, productivity improvement, quality improvement and customer services improvement. At the managerial level, ERP adoption will provide better

**Table 4.3: Causes of ERP System Implementation Benefits**

| Benefit | Cause of the benefit |
|---|---|
| Inventory reduction | • Netting: by netting demand against inventory to determine market net requirement.<br>• Purchasing: the company buys what is needed through correct Bill of Materials (BOM), using parametrical optimum quantity algorithms.<br>• BOM: all changes in the BOM are encountered, thus preventing obsolete inventories.<br>• Planning: production orders are processed faster, resulting in better control for the work-in-process inventories.<br>• Manufacturing: Manufacturing produces what is demanded from time phased plans.<br>• Delivering: deliveries match the actual quantities on the right dates. |
| Labor cost reduction | • Fewer shortages, disruptions and interruptions.<br>• Less rework, overtime and rush jobs.<br>• Better visibility of required work, so that capacity is properly scheduled to meet demands.<br>• More free time for production personnel who are now better and more constructively used. |
| Improved customer service | • Integration among forecasting (sales) and production planning and inventory planning can create better customer service and fewer lost sales. |
| Improved visibility | • As the system provides a basis for linking operations, it allows for real time visibility. For example, production planners can now view what and where the orders are, thus allowing them to schedule against the forecast. This visibility has triggered co-operation and co-ordination between operations and allowed for a better decision-making. |
| Others | • Flexibility and better access to information, less prone to errors.<br>• Elimination of most of the manual (paper) work.<br>• Applying the "one set of data" principle.<br>• Integrating a holistic corporate attitude. |

Adapted from: Kakouris and Polychronopoulos (2005)

resource management, improved decision making and planning and performance improvement. At the strategic level, the adoption will support business growth, support business alliances, build business innovations, build cost leadership, generate product differentiation (including customization) and build external linkages (customers and suppliers). Benefits at the IT infrastructure can build business flexibility for current and future changes, cause IT cost reduction and increase IT infrastructure capability. However, the framework of measurements developed by Shang and Seddon (2002) do not identify the benefits in terms of customer, internal processes, financial and growth ability perspectives. The five dimensions of the ERP benefits can be seen in Table 4.4.

## 4. 3 Theoretical Framework

The ERP systems provide real time information (Rashid et al., 2002) and thus, allow for timely decisions to drive competitive advantages (Hall, 2007). When combined with strategic key performance indicators using the BSC concept, ERP further aligns individual, organizational and cross-departmental initiatives toward common goals (Kaplan & Norton, 1996:25). Chand et al. (2005) apply the balanced scorecard as a tool to assess the impact of ERP on organizational performance. They suggest an improved performance management tool called ERP Scorecard. The tool integrates Kaplan & Norton's original Balanced Scorecards (BSC) with the basic goals of using information systems, which are (i) automate; (ii) informate, and (iii) transformate. The following will discuss studies pertaining to integrating the balanced scorecard to assess information system success.



Utilizing a balanced scorecard approach requires the company and each of its departments to become organizationally ready to implement this new framework (Keyes, 2005). This means that the process performance improvement, measurement and management must first be intimately understood. There will be some positive effects when implementing BSC unit by unit in a company. For example, when implementing BSC programs within the IT department, the implementation will affect the organization as a whole.

**Table 4.4: Five Dimensional Levels of ERP Benefits**

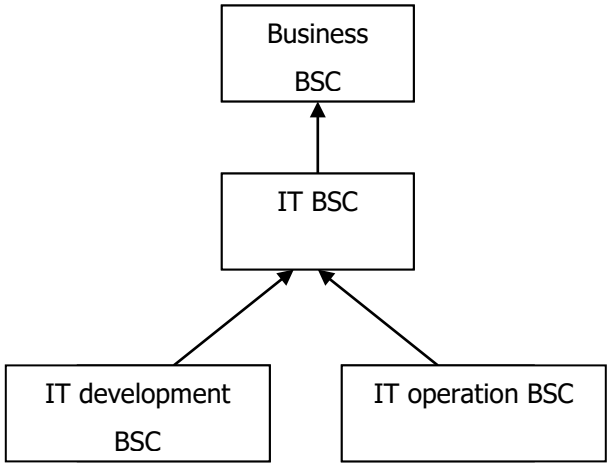
| Dimensions | Sub-dimensions |
|---|---|
| **1. Operational** | 1.1 Cost reduction |

| | |
|---|---|
| | 1.2 Cycle time reduction<br>1.3 Productivity improvement<br>1.4 Quality improvement<br>1.5 Customer services improvement |
| **2. Managerial** | 2.1 Better resource management<br>2.2 Improved decision making and planning<br>2.3 Performance improvement |
| **3. Strategic** | 3.1 Support business growth<br>3.2 Support business alliances<br>3.3 Build business innovations<br>3.4 Build cost leadership<br>3.5. Generate product differentiation (including customization)<br>3.6 Build external linkages (customers and suppliers) |
| **4. IT Infrastructure** | 4.1 Build business flexibility for current and future changes<br>4.2 IT costs reduction<br>4.3 Increased IT infrastructure capability |
| **5. Organizational** | 5.1 Support organizational changes<br>5.2 Facilitate business learning<br>5.3 Empowerment<br>5.4 Built common visions |

Source: Shang and Sheddon (2002)

For Information Technology (IT) managers, the BSC is an invaluable tool that will finally permit IT to link to the business side of the organization using a cause-and-effect approach. Some have likened the balance scorecard to a new language, which enables IT and business line managers to think together about what IT can do to support business performance. A beneficial side effect of the use of the BSC is that, when all measures are reported, one can calculate the strength of the relationship between the various value drivers (Keyes, 2005). The author proposed that the relationship between IT and business can be more explicitly expressed through a cascade of BSC as shown in Figure 4.1.

**Figure 4.1: Cascade of IT Balanced Scorecard**




Source: Keyes (2005)

Rosemann and Wiese (1999) use a modified balanced scorecard approach to evaluate the implementation of ERP software and to evaluate the continuous operation of the ERP installation. Along with the four BSC perspectives of financial, customer, internal processes, and innovation and learning, they have added a fifth for the purposes of ERP installation-the project perspective. The individual project requirements such as identification of critical path, milestones, etc. are covered by this fifth perspective, which represents all the project management tasks.

Rosemann and Wiese contend that most ERP implementers concentrate on the financial and business process aspects of ERP implementation. Using the ERP balance scorecard would enable them to also focus on customer and innovation and learning perspectives. The Rosemann-Wiese approach implementation measures include financial, internal processes, customer and innovation and learning. For the financial perspectives, they used compliance with budget as a measurement. For the customer perspective, they used coverage of business processes and reduction of bottlenecks. For internal processes perspective, theylooked at reduction of operational problems, availability of the ERP system, avoidance of operational bottlenecks, improvement in system development and avoidance of developers. For innovation and learning, they suggested using the qualifications and independency of the consultant. Measurements used by Rosemann and Wiese can be found in Table 4.5. Unfortunately, the Rosemann and Wiese study focused on evaluating the information technology (IT) department only, and the study was not based on empirical research results. They provided the benefits generated in adopting ERP by using

scorecards, but they did not identify the benefits generated for each level of managers because their study was limited to measure the success of IT department only.

Chand et. al (2005) conducted case study research on the benefits of ERP systems from BSC perspectives. Their interviews brought out that the SAP implementation in the case organization (1) streamlined the internal business processes, (2) required innovative training to ensure that users could use the systems effectively, (3) impacted customer needs and (4) positively impacted the key financial parameters. They discuss the impact of the SAP outcomes and the eventual contributions of the SAP system to the strategic goals of the case organization. In their study, since the ERP system integrates disparate processes across the organization, this resulted in more streamlined business processes and a smooth and transparent flow of information. The end-user training process developed by the SAP business process consultants relied on the standard SAP business processes. This new training process was very effective and replaced the old training process. Similarly, the implementation of the ERP system in the engine service centers streamlined the engine overhaul process leading to improved engine turn-around time to the customer. Thus, the impact of process efficiency in this case was improved customer satisfaction.

According to Chand et al. (2005), another area that impacts the customer is quality control. Today, quality control activities and related analyses are performed daily, leading to better attendance to customers' quality demands. The company also indicated that the cost of doing business was dramatically reduced. The reduction of work stoppages, the timeliness of data availability and better controls improved corporate performance and promoted labor efficiencies. Also, better inventory and supply chain management resulted in decreased costs.

**Table 4.5: ERP Implementation Measurement Using BSC**

| Perspectives | Goal | Measure |
|---|---|---|
| Financial | Compliance with budget | • Hardware cost<br>• Software cost<br>• Consulting cost |
| Customer | Coverage of business processes | • % of covered processes types<br>• % of covered business transaction<br>• % of covered transactions valued good or fair |
| | Reduction of bottlenecks | • % of transactions not finished on schedule<br>• % of cancelled telephone order processes due to |

| | | |
|---|---|---|
| | | non-competitive system response time |
| Internal process:<br>• Operational View | Reduction of operational problem | • % of problems with customer order processing<br>• % of problems with warehouse processing<br>• % of problems with standard reports<br>• Reports on demand |
| | Availability of the ERP-system | • Average system availability<br>• Average down time<br>• Maximum down time |
| | Avoidance of operational bottlenecks | • Average response time in ordering processing<br>• Average response time in ordering processing in the peak time<br>• Average of number of OLTP-transaction<br>• Maximum of number of OLTP-transaction |
| • Development view | Actually of the system | • Average time to upgrade the system<br>• Release levels behind the actual level |
| | Improvement in system development | • Punctually index of system delivery quality index |
| | Avoidance of developer bottleneck | • Average workload per developer<br>• Rate of sick leave per developer<br>• % of modules covered by more than 2 developers |
| Innovation and learning | Qualification of a developer | • % of training hours per user<br>• % of training hours per developer<br>• Qualification index of developer |
| | Independency of consultants | • Number of consultant days per module in use > 2 years<br>• Number of consultant days per module in use < 2 years |
| | Reliability of software vendor | • Number release per year<br>• Number of functional additions<br>• Number of new customers |

Source: Rosemann and Wiese (1999)



Simultaneously, the ability to make accurate commitments to trading partners and improve turn-around time had increased the customer satisfaction, thereby resulting in increased revenue.

In addition, Chand et al. (2005) mentioned that at the operational level, the ERP benefits include improved process efficiency, the ability to meet current needs of customers more efficiently, cost reduction and increased productivity. At the tactical level, ERP adoption can improve tactical decision making, identify and meet customer needs proactively, increase revenues and enable workers to become more effective decision makers. At the strategic level, the benefits are derived from the capability to meet the needs of existing and new customers, routine aadaptation to radical environment changes, routine adaptation of radical changes and improved market value. Simultaneously, the ability to make accurate commitments to trading partners and improve turn-around time has increased the after-market business, thereby resulting in increased

revenues. The matrix of benefits classification based on the BSC perspective developed by Chand et al. (2005) is presented in Table 4.6.

Alignment between ERP and business strategy will contribute to the success of ERP projects (Velcu, 2007). Based on interviews conducted with eight Finnish companies, the author found out that there is an interrelationship between ERP motivations and the benefits of ERP. In addition, there are immediate benefits to companies successfully implementing ERP systems in operations (Velcu, 2007). According to the author, in the first two years of post-implementation, the successful companies can increase the sales by better managing their assets compared to less successful companies implementing ERP. In addition, the author also found that ERP scorecards offer a systematic perspective on the analysis of ERP effects on business performance.

Based on the previous findings by previous researchers, a summary of ERP system adoption benefits can be developed. The benefits of ERP Scorecard can be found in APPENDIX A. The benefits are grouped for further analysis, based on the four perspectives of balanced scorecard. They are grouped into benefits generated to improve internal processes, customer services, financial and innovation and growth performance. Each of the perspectives are further grouped into three levels of benefits (operational, tactical and strategic levels) as described in Table 4.7.



**Table 4.6: ERP Benefits Framework**

| | | Process | Customer | Finance | Innovation |
|---|---|---|---|---|---|
| Operational benefits (Automate) | Goal | Improved process efficiency | Meet current needs of customers more efficiently | Reduced costs | Increased productivity |
| | Outcomes | Error/rework reduction, faster processing, consistent data, reduction in processing time, increase in throughput | Improved response time, reduced customer complaints, reduced errors | Reduced inventory-carrying cost, lower labor cost | Power user involvement in user training for operational tasks |
| Tactical benefits (Informate) | Goal | Improved tactical decision making | Identify and meet customer needs proactively | Increased revenues | Make workers more effective decision makers |
| | Outcomes | Improved work | Better | Better | Training for |

| | | | | | |
|---|---|---|---|---|---|
| | | scheduling, work assignment, access to information, quality management, and improved control | customer expectation setting, improved customer satisfaction, improved engine repair scheduling and delivery | forecasting, increased market share | access of enterprise information, training for decision making skills, worker empowerment for taking action |
| Strategic benefits (transformate) | Goal | Adapt to radical environment changes routinely | Meet new customer needs or new needs of customers | Improved market value | Absorb radical change routinely |
| | Outcomes | Technology changes, regulatory changes, competition changes | Increased customer base, partnership with customers | Growth capitalization and new markets | Change management processes, breadth and broader horizon |

Source: Chand et al. (2005)



**Table 4.7: Benefits of Enterprise Resource Planning Scorecards and Business Performance**

| | Customer | Internal Process | Innovation | Finance |
|---|---|---|---|---|
| Operational | • Access customer data and customer inquiries easily<br>• Improve customer response time<br>• Reduce customer complaints<br>• Reduce customer processing errors<br>• Ease customer order and service | • Reduce error in production processing<br>• Reduce time to purchase from supplier<br>• Reduce time to serve customer<br>• Reduce time to process employees administration<br>• Improve data accuracy and reliability<br>• Improve work scheduling<br>• Improve information access speed | • Increase user involvement in training<br>• Increase products produced per employee<br>• Increase customer served per employee<br>• Increase accessability of enterprise information | • Reduce administrative cost<br>• Remove redundant processes<br>• Reduce inventory-carrying cost<br>• Lower labor cost |

| | | | | |
|---|---|---|---|---|
| | • Improve customer satisfaction | | | |
| Tactical | • Improve production scheduling<br>• Increase customer product demands<br>• Improve flexibility of customer services<br>• Expand customer base to other regions<br>• Increase partnership with customers | • Improve decision quality<br>• Improve the frequency of staff monitoring<br>• Improve asset management<br>• Improve production management<br>• Improve workforce management | • Increase decision making skills<br>• Support worker ability for taking action quickly<br>• Support management processes efficiency<br>• Increase manager knowledge | • Conduct better forecasting<br>• Improve profit and cost control<br>• Increase market share<br>• Increase financial control<br>• Increase equity capitalization |
| | **Customer** | **Internal Process** | **Innovation** | **Finance** |
| Strategic | • Enable e-business through the web integration capability<br>• Support interactive customer services<br>• Improve product design through customer direct feedback<br>• Expand to new e-market easily<br>• Build virtual co-operation with virtual supply and demand | • Build external linkages with related business parties easily<br>• Adapt to technology changes easily<br>• Support business growth in competition<br>• Support business growth in capability<br>• Support business growth with new products<br>• Support business growth with increasing numbers of | • Build new process chain<br>• Build new market strategy<br>• Create new business lines<br>• Customize product or services<br>• Provide lean production | • Increase new markets<br>• Enable worldwide expansion with global resource management.<br>• Enable worldwide expansion with foreign currency capability<br>• Enable worldwide expansion with global market penetration<br>• Enable worldwide expansion by deploying solutions |

| | | | | |
|---|---|---|---|---|
| | consortium | employees<br>• Support business growth in new markets<br>• Enable worldwide expansion with centralized world operation | | quickly<br>• Build cost leadership by increasing processes efficiency |
| Business Performance | • Quality of customer service<br>• Quality of products<br>• Gain competitive advantage<br>• On-time delivery<br>• Increased customer partnership | • Efficiency ratio<br>• Complaints amount<br>• Production ratio Failure amount<br>• Reduced cycle time<br>• Reduced employee turnover | • Training amount<br>• Empowerment<br>• Better employee morale<br>• Development of workers' qualification | • Return on investment<br>• Return on assets<br>• Operating profits<br>• Sales growth rate<br>• Cost reduction<br>• Economic Value Added |

Hence, the theoretical framework for this study was developed and showed in Figure 4.2.

**Figure 4.2: The Theoretical Framework**


The current research attempts to contribute from a developing country's perspectives. Malaysia as an emerging economy will notably provide some invaluable insight that could further develop ERP system. Detail discussion on the relationship between variables and statement hypothesis are presented in the following sections.

## 4. 4 Development of Research Hypothesis

This section presents the hypothesis of the current research. It discusses the relationships among the constructs (main hypotheses) and dimensions of the respective constructs based on previous findings. In addition, inherited by the limited availability of empirical evidences with regards to ERP

system, it will apparent that theoretical argument appears in some parts of the hypotheses development.

### 4.4.1 The Managerial Levels and ERP System Adoption's Benefits

A traditional organizational structure, also called *hierarchical structure*, is like a managerial pyramid where the hierarchy of decision making and authority flows from the strategic management at the top down to operational management and non management employees. Compared to lower level, including the president of the company and vice presidents, has a higher degree of decision authority, more impact on corporate goals, and more unique problems to solve. In most cases, major department heads report to president or top level manager. The major departments are usually divided according to function and can include marketing, production, information system, finance and accounting, research and development, and so on. The positions or departments that are directly associated with making, packing, or shipping goods are called *line positions.* A production supervisor who reports to a vice president of production is an example of a line position. Other positions might not be directly involved with the formal chain of command but instead assist a department or area. These are staff position, such as legal counsel reporting to the president.

Today, the trend is to reduce the number of management levels, or layers, in the traditional organizational structure. This type of structure, often called a flat organizational structure, empowers employees at lower level to make decisions and solve problem without needing permission from midlevel managers. Empowerments give employees and their managers more responsibility and authority to make decision, take action, and have more control over their jobs. For example, an empowered sales clerk could respond to certain customer requests or problems without needing permission from supervisor. On a factory floor, empowerment might mean that an assembly-line worker can stop the production line to correct the problem or defect before the product is passed to the next station. Policies and programs that let employees share ownership in a company flatten the organizational structure. Information system can be a key element in empowering employees because they provide the information employees need to make decision. The employees might also be empowered to develop or use their own personal information system, such as a simple forecasting model or spreadsheet.

Management practices have actually been used from the earliest times of recorded history. Early on, the Greeks Fayol, who was a managing director (CEO) of a large steel company in the early 1900s, was one of the founders of the field of management. Based on 20 years experiences of experiences as a CEO, Fayol argued that the success of an enterprise generally depends much more on the administrative ability of its leaders than on their technical ability (Wren et.al, 2002). According to Fayol, to be successful, a manager needs to perform five managerial functions: planning, organizing, coordinating, commanding, and controlling. However, Henry Fayol's classic management functions are known today as planning, organizing, leading and controlling (Wiliams et.al, 2009). Planning is determining organizational goals and a means for achieving them. Organizing is deciding where decisions will be made, who will do what jobs and tasks, and who will work for whom. Leading is inspiring and motivating workers to work hard to achieve organization goals. Controlling is monitoring progress toward goal achievement and taking corrective action when needed.

Top managers hold positions like chief excecutive officer (CEO), chief operating officer (COO), chief financial officer (CFO), and chief information officer (CIO) and are responsible for the oferall direction of the organization. Top managers have the following responsibilities (Wiliams et.al, 2009). First, they are responsible for creating a context for change. Creating a context for change includes forming a long range vision or mission for the company. Second, much more than used to be the case, top managers are responsible for developing employee's commitment to and ownership of the company's performance. Third, top managers are responsible for creating a positive organizational culture through language and action. Top managers impart company values, strategies, and lessons through what they do and say to others, both inside and outside the company. Finally, top managers are responsible for monitoring their business environment. This means that top managers must closely monitor customer needs, competitor moves, and long-term business, economic, and social trends. So, basically, the top managers are responsible for creating context for change, developing attitudes of commitment and ownership, creating appositive organizational culture through words and actions, and monitoring their company's business environment.

Middle managers hold positions like plant manager, regional manager or divisional manager. They are responsible for setting objectives consistent with top management's goals and for planning and implementing subunit strategies for achieving those objectives (Wiliams et.al,

2009). One specific middle management responsibility is to plan and allocate resources to meet objectives. Another major responsibility is to coordinate and link groups, departments and divisions within a company. A third responsibility of middle management is to monitor and manage the performance of the sub units and individual managers who report to them. Finally, middle managers are also responsible for implementing the changes or strategies generated by top managers. It means that the middle level managers are responsible for planning and allocating resources, coordinating and linking groups and departments, monitoring and managing the performance of subunits and managers and implementing the changes or strategies generated by top managers.

Low level managers hold positions like office manager, shift supervisor or department manager. The primary responsibility of this manager is to manage the performance of entry-level employees, who are directly responsible for producing company's goods and service. Thus, the managers are the only managers who do not supervise other managers. The followings are low level manager's responsibilities (Wiliams et.al, 2009). First, the managers encourage, monitor and reward the performance of their workers. The managers teach entry-level employees how to do their jobs. In addition, they also make detailed schedules and operating plans based on middle management's intermediate range plans. Contrast to the long-term plans of top management (three to five years) and the intermediate plans of middle managers (6 to 18 months), low level managers engage in plans and action that typically produce results within two weeks. The managers are responsible for managing the performance of non managerial employees, teaching direct reports.

At the strategic management level, the information needs are more external and broader based compared to the first two levels. Tactical management, on the other hand, requires more aggregated and externally oriented information than the operational managers. At the low or operational level, the nature of information is mostly internal, detailed and frequent (Gelinas & Dull, 2008). In addition, based on 233 ERP-vendor success stories and interviews with 34 ERP cases, Shang and Seddon (2002) divided ERP system benefits into operational, managerial, strategic, IT infrastructure and organizational. They found that ERP system implementation can give benefits to operational, tactical and strategic level of managers as well as to the organization. Since information requirements differ according to decision purposes, it is predicted that the

benefits of ERP also differ according to managerial levels. Thus, the following hypothesis is proposed:

*H1: The effect of the ERP system adoption benefits differs according to managerial decision levels.*

### 4.4.2 ERP Systems Adoption's Benefits and Business Performance

Hendricks et al. (2007) found that information integration is the key benefit of Enterprise Systems (ES) and results in savings in infrastructure support costs and improved firm performance. In addition, a survey by Mabert et al. (2003) found some improvements in managers' perceptions of performance but found that few firms had reduced direct operational costs. This finding is supported by Hunton et al. (2002) who tested the relationship between ERP and performance by using a hypothetical case. Comparing analysts' initial earning forecasts with the revised forecasts after knowing these firms have committed to invest in ERP, their results suggested improved earnings revisions. Thus, the study supports the positive relationship between ERP implementation and performance.

Gupta and Kohlil (2006) provided operations managers with a brief overview of ERP systems and highlighted its implications for operations function. Specifically, the work gives a broad based overview of enterprise resource planning systems. Using SAP R/3 as an example, they elaborated on how ERP systems assist in strengthening business strategy and operational decisions, process design, production planning and scheduling, inventory management, quality management and human resource management. ERP provides the enterprise-wide solution to deliver many benefits such as low operating costs and improved customer service, thus enhancing their business operations in many areas (Yen, Chou & Chang, 2002). In conclusion, the studies which show a direct relationship between ERP systems and business performance agree on the fact that ERP implementations enable companies to improve their productivity and profitability. In this research, effect of ERP system adoption benefits on business performance will be tested by conducting regression analysis toward the four BSC dimensions. The following sections are hypothesis development on the effect of ERP system adoption benefits on internal processes performance, financial performance, customer service performance and innovation and growth performance. Based on analysis at each of balanced scorecard dimensions, the analysis on business performance will be conducted at the end. When ERP system adoption benefits at the three managerial have

positive relationship with the four BSC dimensions, it is hypothesized that ERP system adoption benefits has relationship with business performance.

### 4.4.3 ERP Systems Adoption's Benefits and Internal Processes Performance

According to Davenport (1998), ERP system implementation can standardize and accelerate a company's business processes. The system implementation can save time (direct and easy access to essential data, improve information management and integrate system and information within the enterprise). It can also increase productivity (reduced administrative overhead for some business functions, simplified business processes, reduced paper work), and can manage multiple sites as a single entity. In addition, it can reduce inventory and integrate the supply chain (reduce inventory obsolescence, integration with suppliers and standardize human resource information). One of the greatest benefits of the ERP system is the integration of processes, data and organizational elements, i.e. it unites all of a company's major business processes (from order processing to product distribution) within a single family of software modules (Gupta & Kohli, 2006). This tight integration make simultaneously satisfying operational, financial and managerial principles possible.

Organizational impacts of ERP system implementation include changes in IT function, increases informational technology literacy, integration effect and a better understanding of the business (Rikhardson & Kraemmergaard, 2006). Coordination of accounting processes, integration of business processes and better understanding of the business processes can be used to increase internal processes performance. They found that ERP system implementation enables managers to access accounting data themselves through an advanced business analysis software.

In addition, by conducting case study research on 18 manufacturing companies and a survey of 193 companies as the ERP sample, Mabert et al. (2003) found that integration of business processes, availability of information and quality of information are the areas benefiting the most from ERP system implementation. They also found that ERP implementation can improve inventory management and supplier management/ procurement. This means that ERP implementation can affect the internal business processes of a company. ERP system implementation can support production capacity planning, provide more accurate market demand forecasts and improve manufacturing flexibility (Hsu & Chen, 2004).

Based on these findings, it is concluded that ERP system implementation can improve operating processes, customer management process, innovation processing and regulatory and social processes. At the operational level, ERP reduces errors in production processing, purchasing lead time, customer service-time, processing of employee administration and improve information access speed. At the tactical level, the system improves decision quality, staff monitoring, asset, production and human resource management. At the strategic level, the ERP system assists in building external linkages, adapting to technological changes and supporting business growth. Thus, the following hypothesis is proposed:

*H2: ERP system adoption's benefits is positively related to the performance of internal processes.*

*H2a: ERP system adoption's benefits at operational level is positively related to the performance of internal processes.*

*H2b: ERP system adoption's benefits at tactical level is positively related to the performance of internal processes.*

*H2c: ERP system adoption's benefits at strategic level is positively related to the performance of internal processes.*

### 4.4.4 ERP Systems Adoption's Benefits and Customer Service Performance

According to Davenport (1998), ERP system implementation can integrate customer order information. As a consequence of that integration, an order can be directly processed without delay. Also, easier coordination and sharing of information are experienced by departments, and better customer service is achieved. In addition, based on in-depth interviews with four companies, Hsu and Chen (2004) found that ERP implementation affects customer satisfaction. Based on their research results, ERP implementation can control and improve product quality, reduce the cycle time of order fulfillment, increase response time to customer order and inquiries, improve service quality, improve customer satisfaction and loyalty, and increase customer purchases. Even though they differentiate the benefits into tangible and intangible benefits, the effect of ERP system implementation can be traced in detail. McAfee (2002) provides evidence for improvements in throughput, customer response time, and delivery speeds. Hsu and Chen (2004) reported that customer satisfaction increases with ERP implementation through improved product quality, order cycle time, response time, service quality and loyalty.

At the operational level, ERP adoption can be used to access customer data and customer inquiries easily; improve customer response time; reduce customer complaints; reduce customer processing errors; ease customer order and service; and improve customer satisfaction. At the tactical level, the adoption can improve production scheduling; increase customer product demands; improve flexibility of customer services; expand customer base to other regions and increase partnership with customer. Meanwhile, for the strategic level, ERP adoption can enable e-business through the web integration capability; support interactive customer services; improve product design through customer direct feedback; expand to new e-market easily; and build a virtual co-operation with a virtual supply and demand consortium. Based on these research findings, the following hypothesis is thus proposed:

*H3: ERP system adoption's benefits is positively related to the customer service performance.*

*H3a: ERP system adoption's benefits at operational level is positively related to the customer service performance.*

*H3b: ERP system adoption's benefits at tactical level is positively related to the customer service performance.*

*H3c: ERP system adoption's benefits at strategic level is positively related to the customer service performance.*

### 4.4.5 ERP Systems Adoption's Benefits and Financial Performance

Rikhardson and Krammergaard (2006) conducted a research to find out the impact of enterprise system implementation and use. The data collection approach applied is based on interviews and management case writing. They discovered that the financial impact of ES implementation can be classified into income effects and cost effects. In their study, Rikhardson and Krammergaard (2006) noted that identifying the impact of the ES on costs is often easier than identifying its impact on revenues. The companies participating in the survey mentioned several specific cost effects. Reduced inventory costs and a related reduction in cost of capital were most often mentioned. The reasons for reduced inventory costs were attributed to better planning; better coordination with suppliers and customers; better integration between purchasing, production and sales; and shorter order cycle times. Companies could order smaller quantities at a time and thereby reduce inventory costs by up to 25%. Some managers also reported reduced costs due to the lower error rate experienced in purchasing, production and sales.

Hunton et al (2003) searched the SEC database and annual reports via Lexis-Nexis using the name of the firm from the Hayes et. al. study (2001). Using a sample of 21 out of 63 firms (33.33%) that announced ERP adoption which responded to the survey, they found that return on assets (ROA), return on investment (ROI) and asset turnover (ATO) were significantly better over a 3-year period for adopters as compared to non-adopters. Mabert at al. (2003) described an attempt to find the impact of ERP implementation through a series of 18 case studies and 482 usable responses of an extensive survey. The key finding from their study is that ERP system improves direct operating costs, inventory levels and cash management.

According to Poston and Grabski (2001), ERP systems affect firm coordination and transaction costs. ERP systems are expected to: (1) reduce costs by improving efficiencies through computerization; and (2) enhance decision-making by providing accurate and timely enterprise-wide information. These effects should be associated with improved firm performance. However, using 50 ERP system adopters, their research found that no significant improvement was associated with residual income or the ratio of selling, generally and administrative expenses in each of the 3 years following the implementation of the ERP system. However, a significant improvement in firm performance resulting from a decrease in the ratio of cost of goods sold to revenue was found 3 years after the ERP system implementation (but not in the first or second year after implementation). Further, there was a significant reduction in the ratio of employees to revenue for each of the 3 years examined following the ERP implementation.



Hendricks et. al. (2006) studied the impact of enterprise systems on corporate performance. In the case of adopters of ERP systems, they found some evidence of improvement in company profitability but not in stock returns. The results for improvements in profitability are stronger in the case of early adopters of ERP systems. In addition, by using structured questionnaires for pre- and post-implementation in the frame of longitudinal research, Spathis and Ananiadis (2005) found that ERP system implementation can reduce information technology cost and decrease total operation costs. Shang and Seddon (2000) also found that ERP system implementation can reduce the operational cost of a company. ERP implementation can decrease inventory levels and costs, which can increase profit (Hsu & Chen, 2004).

Based on those findings, it is concluded that the ERP system reduces administrative cost, inventory-carrying cost and labor cost at the operational level. At the tactical level, the benefits

include improved profit, cost control, market share, financial control and equity capitalization. At the strategic level, the system can increase new markets, enable worldwide expansion and build cost leadership by increasing process efficiency. Hendricks et al. (2006) provide evidence that ERP adopters experience improvement in return on asset. Overall, the evidence suggests that profitability improves over the combined implementation and post-implementation periods and the following hypothesis is proposed:

*H4: ERP system adoption's benefits is positively related to the company's financial performance.*

*H4a: ERP system adoption's benefits at operational level is positively related to the company's financial performance.*

*H4b: ERP system adoption's benefits at tactical level is positively related to the company's financial performance.*

*H4c: ERP system adoption's benefits at strategic level is positively related to the company's*

### 4.4.6 ERP Systems Adoption's Benefits and Innovation and Growth Performance

By using a sample of 126 senior managers in medium to large manufacturing companies in Taiwan, Wang et al. (2006) found that group cohesion of an ERP project team is important to the attainment of organizational benefits of the project. Cohesive groups are better able to achieve goals because they know the members of the group better and are motivated to complete the task successfully. In addition, willingness to participate and commitment to learning have significant effects on the outcome of group cohesion in implementing organizational innovations. Since a collective participation capability is critical to the realization of innovation benefits, it is important for management to develop appropriate participation mechanisms for organizational innovation. According to Wang, an organization that implements an ERP should be aware that their participation level is dependent not only on a user's individual willingness but also on his/her commitment to learn.

Organizational impacts of ERP system implementation include changes in IT function, increase informational technology literacy, coordination of accounting processes, integration of business processes and a better understanding of thesaid in business processes (Rikhardson &

Kraemmergaard, 2006). These impacts can increase the company's ability to grow. Based on their study, they found that as a result of ERP system implementation, an organization can simplify its system processes. The organization could also increase employee training which resulted in higher IT awareness and skill level, and a better understanding of the issues involved in the company. In addition, employees suddenly had to think beyond their departments. The ERP implementation can improve personnel management (Mabert et al., 2006).

ERP system implementation can increase knowledge sharing of a company (Jones et al., 2006). According to them, opportunities for knowledge sharing are present in the ERP team because the knowledge that individuals must have for ERP implementation is more diverse than the knowledge required for traditional jobs. In addition, an ERP implementation team interacts with other organizational members to gather relevant information and keep them informed about changes when the ERP is implemented. The ERP system integrates business processes across functions and units, thereby creating a divergence in the required knowledge of organizational members (Baskerville et al., 2000; Jones et al. 2006).

Benefits of ERP implementation include increased communication among departments, increased availability of critical operational and decision support information to provide visibility of enterprise planning activities, and access to real-time business intelligence (Hsu & Chen, 2004). In addition, Spathis and Ananiadis (2005) found that ERP implementation can improve IT infrastructure, such as personnel re-organization, improved maintenance of common database, improved document circulation and improved communication between employees and management. Those benefits can improve the ability of a company to grow.

ERP systems provide an enticing solution to managers who struggle with incompatible information systems and inconsistent operation policies (Gupta & Kohli, 2006). However, Gupta and Kohli stated that successful implementation of ERP systems requires active participation from senior-level managers from various functional areas so as to delineate its impact on the business level as well as functional level strategies, because the ERP system can assist in enhancing and strengthening business strategy and making consistent operation decisions. By increasing employees' participations, the company can develop its ability to growth its potential growth. This is why the actual use of ERP and online procurement is positively correlated with labor productivity growth (Falk, 2005).

Based on these findings, it is concluded that ERP system implementation can increase employee capability, information capability, and improve organization alignment. It means that the implementation can affect the company's ability to grow. This study will empirically test the effect of ERP system implementation on a company's innovation and growth. Therefore, the following hypothesis is proposed:

*H5: ERP system adoption's benefits is positively related to a company's innovation and growth performance.*

*H5a: ERP system adoption's benefits at operational level is positively related to company's innovation and growth performance.*

*H5b: ERP system adoption's benefits at the tactical level is positively related to company's innovation and growth performance.*

*H5c: ERP system adoption's benefits at strategic level is positively related to company's innovation and growth performance.*

### 4.4.7 Integrating ERP System and the Balanced Scorecard

Complementarities theory argues that while some business benefits accrue from information system innovation and some benefits accrue from management system innovation, the benefits are maximized when information system innovation occurs in parallel with management system innovation (Neely, 2009). In addition, the combined development of organisational and technological infrastructures leads to a 34% performance improvement, compared with an 8% improvement when only the management or the information system is improved (Bloom et al., 2007).

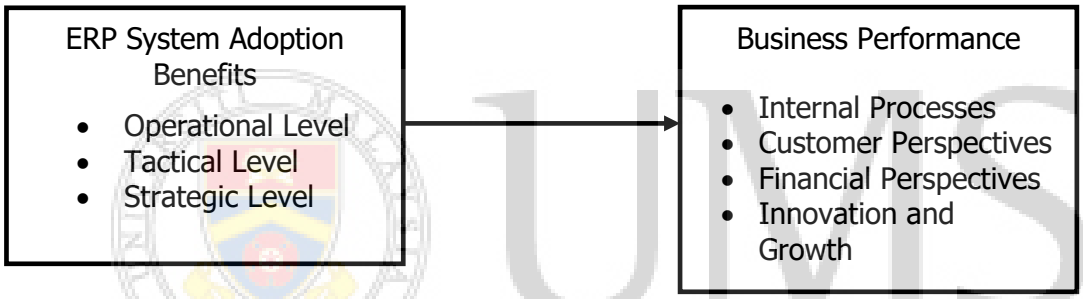
Chand et al. (2005) suggest an improved performance management tool called the ERP Scorecard. The benefits of ERP are evaluated not only in financial terms but also in terms of process level performance, customer value and organization learning value. The combination of financial and non financial values offers a deeper analysis of the sources of benefits of ERP systems and the future impact on the bottom line. The ERP scorecard offers a systematic perspective on the analysis of the ERP effects on business performance (Velcu, 2007). Therefore, the following proposition is proposed:

*Proposition 1: The benefits of adopting the ERP system increase when the system is integrated with the Balanced Scorecard*

## 4. 5 Research Theoretical Framework

As mentioned in Chapter One, the general purpose of this study is to investigate the effects of ERP system adoption's benefits on company's business performance. The research framework that was tested during this study can be seen in Figures 4.2. It also wants to find out the effect of ERP system adoption benefits at the three different managerial levels on internal process performance, customer performance, financial performance and innovation and growth performance of company.

**Figure 4.2: Basic Conceptual Model**




The following specific issues are depicted in the model. The first deals with the effects of ERP system adoption benefits at the three different managerial levels namely: operational, tactical and strategic level adoption's benefits on business performance. It is hypothesized that the effect of the ERP system adoption benefits differs according to managerial decision levels. It is also hypothesized that ERP adoption's benefits are positively related to a company's business performance. In this relationship, operational, tactical and strategic level adoption's benefits serve as the independent variable while all the four business performance serve as dependent variable.

The second involves the effects of ERP system adoption benefits at the three different managerial levels on internal processes performance. In this relationship, operational, tactical and strategic level of ERP system adoption's benefits are independent variables and internal process performance is dependent variable. It is hypothesized that ERP system adoption's benefits are positively related to the performance of internal processes. It is also hypothesized that ERP system adoption's benefits at operational level is positively related to the performance of internal

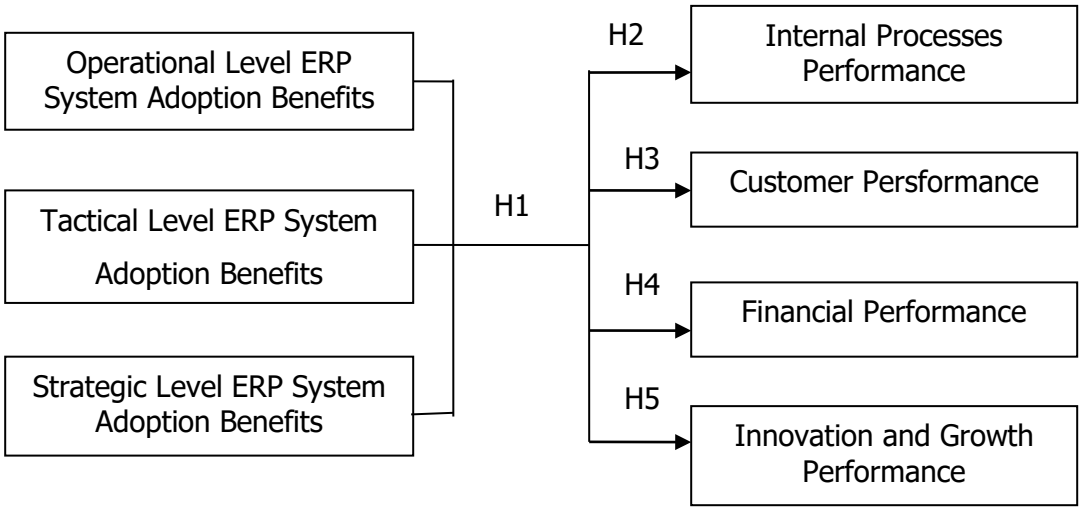
processes; ERP system adoption's benefits at tactical level is positively related to the performance of internal processes and ERP system adoption's benefits at strategic level is positively related to the performance of internal processes.

The third issue involves the effects of ERP system adoption benefits at the three different managerial levels on customer performance. In this relationship, operational, tactical and strategic level of ERP system adoption's benefits are independent variables and customer performance is dependent variable. It is hypothesized that ERP system adoption's benefits are positively related to the customer performance. It is also hypothesized that ERP system adoption's benefits at operational level is positively related to customer performance; ERP system adoption's benefits at tactical level is positively related to customer performance; and ERP system adoption's benefits at strategic level is positively related to the customer performance.

The fourth issue involves the effects of ERP system adoption benefits at the three different managerial levels on financial performance. In this relationship, operational, tactical and strategic level of ERP system adoption's benefits are independent variables and financial performance is dependent variable. It is hypothesized that ERP system adoption's benefits are positively related to the financial performance. It is also hypothesized that ERP system adoption's benefits at operational level is positively related to financial performance; ERP system adoption's benefits at tactical level is positively related to financial performance; and ERP system adoption's benefits at strategic level is positively related to the financial performance.

The last issue involves the effects of ERP system adoption benefits at the three different managerial levels on innovation and growth performance. In this relationship, operational, tactical and strategic level of ERP system adoption's benefits are independent variables and innovation and growth performance is dependent variable. It is hypothesized that ERP system adoption's benefits are positively related to the innovation and growth performance. It is also hypothesized that ERP system adoption's benefits at operational level is positively related to innovation and growth performance; ERP system adoption's benefits at tactical level is positively related to innovation and growth performance; and ERP system adoption's benefits at strategic level is positively related to the innovation and growth performance. The hypotheses of the present study have been presented in the previous discussion of this chapter. Figure 4.3 shows the expanding framework for this study.

**Figure 4.3: Research Framework Model**




Basically, there are two types of hypotheses testing conducted in this study. First, hypotheses testing were conducted to find out whether a different effect exists among the three levels of ERP adoption benefits towards business performance. Second, hypotheses testing were conducted to find out the effect of independent variables (operational, tactical and strategic level ERP adoption benefits) on a company's business performance, internal processes, customer service, financial and innovation and growth performance. In addition to that this study has one proposition. Table 4.8 shows hypotheses and corresponding variables used in this study.



**Table 4.8: Hypotheses and Corresponding Variables**

| Hypothesis | Independent Variable | Dependent Variable |
|---|---|---|
| H1 | • Operational Benefits<br>• Tactical Benefits<br>• Strategic Benefits | • Internal Processes Performance<br>• Customer Service Performance<br>• Financial Performance<br>• Innovation and Growth Performance |
| H2 | • Operational Benefits<br>• Tactical Benefits<br>• Strategic Benefits | • Internal Processes Performance |
| H3 | • Operational Benefits<br>• Tactical Benefits<br>• Strategic Benefits | • Customer Service Performance |

| | | |
|---|---|---|
| H4 | • Operational Benefits<br>• Tactical Benefits<br>• Strategic Benefits | • Financial Performance |
| H5 | • Operational Benefits<br>• Tactical Benefits<br>• Strategic Benefits | • Innovation and Growth Performance |
| Proposition 1 | Integrating ERP system and BSC increases company's performance | |

## 4. 6 Summary

This chapter has presented the theoretical framework of the current research and the underlying explanation of choosing independent and dependent variables. The underlying theory adopted to frame the theoretical framework has also been presented. The hypotheses will tested to answer the main thesis and research problem of the current research 3have also been presented in this chapter.

# CHAPTER 5

# RESEARCH METHODOLOGY

## 5.1 Introduction

This chapter discusses the research methodology of the study. The study was designed to comprise steps to gather information, test the hypothesis and find results. The steps are initial interviews, questionnaire design, pilot study, empirical study and confirmatory interviews with CEOs. Each of the steps is discussed in detail in this chapter. The chapter will commence with the design of the study, followed by initial interview with CEO, variables and measurements and questionnaire design. Next, issues about pilot study was explained, followed by instrument validity and reliability and survey method of the study. In the survey method, issues about population and sample selection, data collection techniques and data analysis were described. This chapter was ended with issue about confirmatory interview.

## 5.2 Research Design

A research design is a plan, structure and strategy of investigation to answer to a research question or problem (Kerlinger, 1986). Similarly, Zikmund (1997) defines a research design as a master plan specifying the methods and procedures for collecting and analyzing needed information. Research design must meet the research objectives to ensure that the information collected is appropriate for solving the problem (Zikmund, 1997). This research was design to use mixed methods research.

Mixed methods research is the type of research in which a researcher combines elements of qualitative and quantitative research approaches in one study (Johnson et al., 2007). According Johnson, there are some advantages that can be gained if a study applies the mixed methods research. They are:

i. At the design stage: qualitative data can assist the quantitative component of study by helping instrument development.

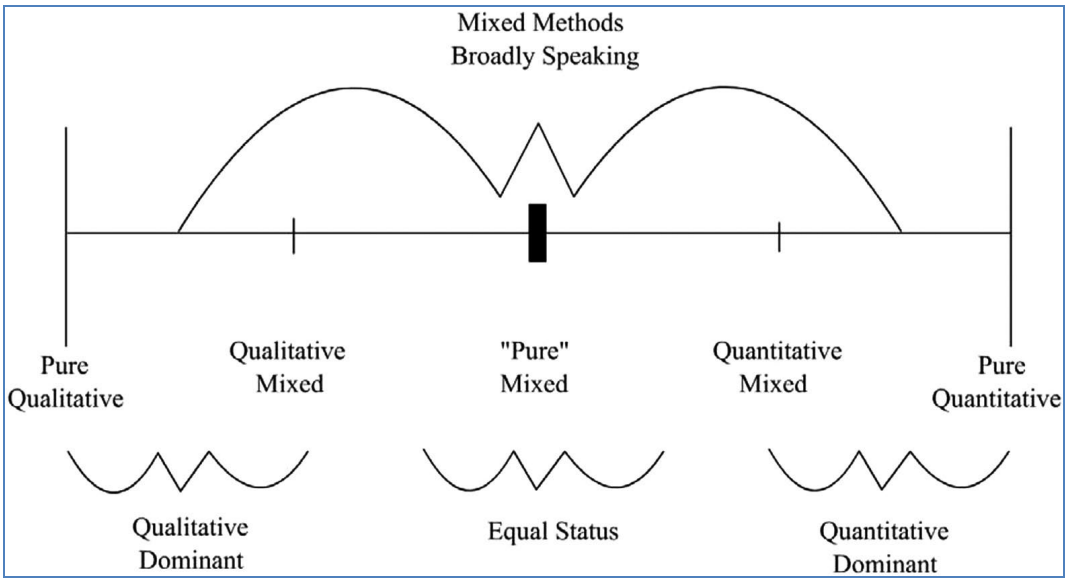
ii. At the data collection stage: quantitative data can play a role in providing base-line information and helping to avoid "elite bias" and qualitative data can help in facilitating in data collection process.
iii. During data analysis: Qualitative data can play an important role by interpreting, clarifying, describing, and validating quantitative results.

According to Johnson et.al (2007), there are three types of mixed research method. They are pure mixed method, qualitative dominant mixed method and quantitative dominant mixed method research. Figure 5-1 shows Graphic of the three major research paradigms of mixed methods research. The area around the center of the continuum, equal status, is the home for the person that self-identifies as a purely mixed methods researcher. These mixed methods researchers are likely to believe that qualitative and quantitative data and approaches will add insights as one considers most, if not all, research questions. Another type of mixed methods research that results from the continuum shown is qualitative dominant mixed methods research. This area on the continuum would fit qualitative or mixed methods researchers who believe it is important to include quantitative data and approaches into their otherwise qualitative research projects. Qualitative dominant mixed methods research is the type of mixed research in which one relies on a qualitative, constructivist-poststructuralist-critical view of the research process, while concurrently recognizing that the addition of quantitative data and approaches are likely to benefit most research projects (Johnson et.al (2007).



Another type of mixed methods research that results from the continuum shown in Figure 5.1 is quantitative dominant mixed methods research. This area on the continuum would fit quantitative or mixed methods researchers who believe it is important to include qualitative data and approaches into their otherwise quantitative research projects. Quantitative dominant mixed methods research is the type of mixed research in which one relies on a quantitative, while concurrently recognizing that the addition of qualitative data and approaches are likely to benefit most research projects.

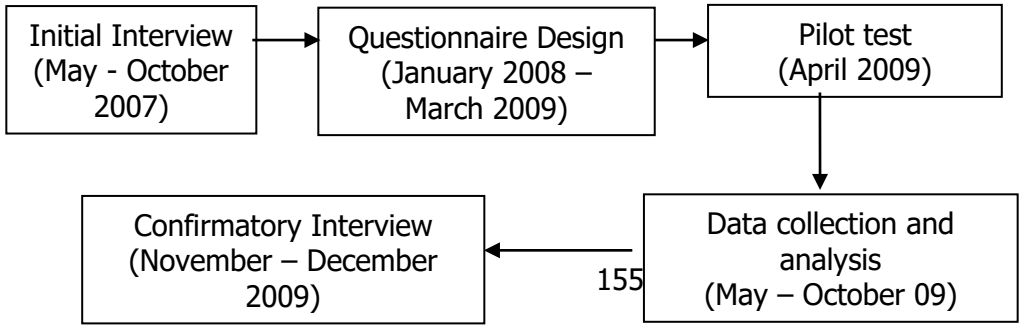
**Figure 5.1: Graphic of the Three Major Research Paradigms of Mixed Methods Research**




Source: Johnson, Onwuegbuzie and Turner (2007)

This research was conducted through a series of data collection that includes qualitative and quantitative data. The first step was to interview Malaysian CEOs to obtain information on integrating the ERP system and BSC implementation. At the second stage, questionnaire was designed based on input from the CEOs and previous research conducted that related to this study. Pilot test was conducted to test the reliability of the questionnaire designed. Survey was done after validity and reliability testing had been conducted for the questionnaire. At the final stage, confirmatory interviews were performed with Malaysian manufacturing CEOs and Managing Directors of ERP vendors in Malaysia to reconfirm the survey results. This research is considered as quantitative dominant mixed methods research. Qualitative data was collected in order to build the questionnaire to collect quantitative data. After quantitative data analysis, interview to gather qualitative data was conducted to make confirmation about the quantitative analysis results with Malaysian manufacturing companies CEOs. Figure 5.2 shows the steps conducted during this research project.

**Figure 5.2: Research Phases of the Study**



## 5.3 Initial Interview with CEOs

Before conducting the empirical study for this research, initial interviews were conducted in order to gauge the current state of ERP implementation in Malaysia. Initially, the study was focused to all Malaysian industries. A series of interviews was conducted involving the CEOs of Malaysian government-linked companies (GLCs). Malaysian GLCs was chosen for initial interview because it represents roughly 44% of the total market capitalization of Bursa Malaysia and are collectively worth more than RM200 billion. These companies are relatively large in size and mostly global in operations. In addition, they are well organized because they are controlled by the Malaysian Government and follow best practices under Khazanah Bhd. The interviews were conducted in May to October 2007 and 8 companies were involved. They were MISC Berhad, MAYBANK, CIMB Group, Golden Hope Plantations Berhad, Tenaga Nasional Berhad, Petronas Dagangan Berhad, Chemical Company Berhad and Boustead Holdings Berhad.

The GLCs were chosen based on their willingness to participate in this study. Initially, formal letters were sent to CEOs of Malaysian GLCs, informing them of the objectives of the research and requesting for face-to-face interviews. Each CEO who agreed to be interviewed was asked to choose the most convenient date and time for the session on the reply slip attached with the introductory letter. Once the reply slip was received, the proposed session was confirmed in writing. At the same time, the general guidelines and topics to be covered during the interview were sent via facsimile to the prospective respondents. Each interview session took an estimated time of one hour and was conducted in an informal setting. The main objective of the interview is to assess the opinion of the highest level management with regard to the benefits and relationship of ERP to the companies' performance. Aside from that, the interviewer also attempted to gather CEOs' opinions and exposure to the BSC perspectives and their application in the design of the performance evaluation system. Equally important, the CEOs were asked to describe the preferred approach if they were to integrate the ERP systems with the performance management systems of their companies. These additional insights provide the basis for developing the proposed framework for the integrated ERP and BSC system.

A total of 8 publicly listed GLCs responded positively to the requests and indicated their preferred dates and time for the sessions. All but two are among the top 10 largest GLCs in the country. These companies are involved in various industries including financial (37.5%), petroleum, shipping, plantation, timber and energy (12.5% each). All of these GLCs have

undergone restructuring or are in the process of doing so. This preliminary study indicates that ERP was initially implemented by one of the GLCs as early as 2003. Interestingly, 2 of them (22%) are yet to implement integrated information systems in their organizations. The remaining 62.5% currently uses some form of ERP-based information systems for operational purposes.

All interviews took place at the respective offices of the respondents. Generally, the CEOs expressed their organizational support for the research. All of them are in the opinion that integrated information systems do contribute to performance improvement. The benefits are derived basically in terms of the speed of information retrieval and the quality of decisions achieved. Further, it was noted that all of the CEOs were exposed to and familiar with the four BSC perspectives in performance management through workshop and training. CEOs representing the petroleum and electricity companies indicated the use of consultants to develop customized, in-house ERP systems that are linked with the performance measures. All of the CEOs agree that non-financial measures of performance are as important as the financial indicators for the purpose of performance evaluation. Based on the interviews, all CEOs view the use of BSC perspectives as an encouragement for them to focus on balancing their performance. Overall, the CEOs support a research proposal that combining ERP and BSC leads to improvement in companies' performance. The findings encouraged the researcher to conduct further study by using an empirical study that is focused on manufacturing companies in Malaysia.



## 5.4 Variable and Measurements

The followings are definition and measurements of all variables used in this research:

### 5.4.1 Company's Business Performance

Business performance is defined as degree to which strategic goals are achieved by a business organization (Houghton Mifflin Harcourt Publishing Company, 2010). Various methodologies are existing to be chosen by managers for a business performance measurement. A business performance measurement system refers to the use of a multi-dimensional set of performance measures for the planning and management of a business (Bourne et al., 2003). For the purpose of the present study, the definition of business performance as proposed by Kaplan and Norton (1996) was used. According to Kaplan and Norton (1996), a comprehensive set of performance measures defined from four different measurement perspectives (internal processes, customer, financial and innovation and growth) provide a framework for translating the business strategy into

operational terms. The four performance measurement perspectives are called Balanced Scorecard (BSC). Kaplan and Norton (1992, 1996, 2001) define the BSC as a framework to facilitate the translation of business strategy into controllable performance measures. In the internal-business-process perspective, executives identify the critical internal processes in which the organization must excel to achieve customer and shareholder objectives. In the customer perspective of the BSC, companies identify the customers and market segments in which they have chosen to compete. Since companies create value through customers, understanding how they view performance becomes a major aspect of performance measurement. Financial performance measures indicate whether a company's strategy, implementation and execution are contributing to bottom-line improvement. The learning and growth perspective identifies the infrastructure that the organization must build to create long-term growth and improvement.

Niven (2002) suggests some generic measures to be used in performance measurement based on BSC. However, business performance measurements used in this study adopt a combination of measurements used by Fernandes et al. (2006) and organizational benefits introduced by Shang and Seddon (2002). The measurements can be found in APPENDIX B. The respondents were asked about their perception toward company's business performance in the company they worked. Measurements for internal business processes performance are efficiency ratio, complaints amount, production ratio, failure amount, reduced cycle time and reduced employee turnover. Customer service performance is measured by quality of customer service, quality of products, competitive advantage gained, on-time delivery and increased customer partnership. Measurements for financial performance are return on investment, return on assets, operating profits, sales growth rate, cost reduction and Economic Value Added. Meanwhile, measurements for innovation and growths are training amount, empowerment, better employee morale and development of workers' qualifications.



### 5.4.2 Enterprise Resource Planning (ERP) Systems

The Enterprise Resource Planning (ERP) system is a business management system that comprises of integrated sets of comprehensive software. When successfully implemented, the ERP can manage and integrate all the business functions within an organization (Shehab, et al. 2004). A company can be grouped as ERP system implementers if the information system adopted has the following characteristics: (i) information is generated on real time basis; (ii) common data are shared throughout company; and (iii) IS software are integrated and automated (Rashid, 2002).

Thus, in this study, respondents were asked to identify the characteristics of information system adoption, by using similar characteristics, to be classified as an ERP adopter. In order to indentify that the respondent adopt ERP system, they were asked whether the information system that they use characteristics such as: information is generated real time; common data are shared throughout the company; and IS software are integrated and automated.

### 5.4.3 Operational Level Benefits of ERP System Adoption

The definition of operational level benefits in this study is a combination of definitions by Shang and Seddon (2002) and Chand et al. (2005). According to Shang and Seddon, at the operational level, the ES adoption will cause cost reduction, cycle time reduction, productivity improvement, quality improvement and customer service improvement. According to Chand et al. (2005), the goals of ERP system at this level are to improve process efficiency, meet current needs of customers more efficiently, reduce cost and increase productivity. Operational level benefits are measured and grouped as internal processes benefits, customer benefits, financial benefits and innovation and growth benefits. In this study, the respondents were asked about their perception toward benefits of ERP adoption at the operational level in term of internal processes benefits, customer benefits, financial benefits and innovation and growth benefits.

### 5.4.4 Tactical Level Benefits of ERP System Adoption

Based on the Shang and Seddon (2002) study, at the managerial (tactical) level, ERP adoption provides better resource management, improves decision making and planning, and performance improvement. According to Chand et al. (2005), the goals of ERP system at this level are to improve tactical decision making, identify and meet customer needs proactively, increase revenues and make workers more effective decision makers. Tactical level benefits are measured and grouped as internal processes benefits, customer benefits, financial benefits and innovation and growth benefits. In this study, the respondents were asked about their perception toward benefits of ERP adoption at the tactical level in term of internal processes benefits, customer benefits, financial benefits and innovation and growth benefits.

### 5.4.5 Strategic Level Benefits of ERP Adoption

Based on Shang and Seddon (2002), at the strategic level, the ERP adoption supports business growth, business alliance, build business innovations, cost leadership, generate product differentiation (including customization), and build external linkages (customers and suppliers).

According to Chand et al. (2005), the goals of ERP system at this level are to adapt to radical environment changes routinely, meet new customer needs or new needs of customers, improve market value and absorb radical change routinely. Strategic level benefits are measured and grouped as internal processes benefits, customer benefits, financial benefits and innovation and growth benefits. In this study, the respondents were asked about their perception toward benefits of ERP adoption at the strategic level in term of internal processes benefits, customer benefits, financial benefits and innovation and growth benefits.

## 5.5 Questionnaire Design

This study used a questionnaire as one of the research instruments. In addition to collecting data through interview, this study also used a questionnaire as the research instrument research survey. The questionnaire items were developed based on previous research results and input from initial interviews with CEO of GLC in Malaysia. To get knowledge from previous research, a comprehensive search through the relevant literature was conducted in 2006 to 2008. In this study, articles from journals, conference proceedings, doctoral dissertations and textbooks were identified, analyzed and classified. For this research, the researcher only focused only on ERP benefits and conducted searches through a wide range of studies from different sources. The scope of search was not limited to specific journals, conference proceedings, doctoral dissertations and textbooks, but also covered online journals. To provide a comprehensive bibliography of the literature on ERP, the research was conducted through online journals, conference databases and dissertation databases such as ACM Digital Library, EBSCOHost, Emerald Management Extra, Google Scholar, IEEE Xplore, ProQuest, Science Direct and Springer Link. The literature search was based on the descriptors "enterprise resource planning implementation" AND "benefits"; while the time frame was based on the availability of the resources in these online databases.



An initial search through the literature yielded more than 850 articles related to ERP implementation and benefits. Most of the articles found were related to critical success factors in ERP implementations. The full text of each article was reviewed to eliminate those articles that were not actually related to ERP implementation benefits. Many of the articles were excluded because they did not meet the following selection criteria:

- Only empirical studies published in English that followed either a quantitative or qualitative approach, with an explicit description of where the research was conducted and how the benefits for ERP implementation were experienced.

- In order to avoid duplication, in the case where conference proceedings with the same sources and results were published in more than one different volume, only the one with the more detailed contents was included.
- Similarly, if a journal article was based on an earlier version published as conference proceedings, the earlier version was excluded, as journals represent the highest level of search.

Additional articles were identified through a manual search of the references in the articles that were initially selected. Finally, 51 articles on studies conducted in various regions and countries were identified. Each article was carefully reviewed, and the benefits are classified based on management level as proposed by Shang and Seddon (2002) and the four performance measurement perspectives introduced by Kaplan (1993). The benefits of ERP adoption were also identified and classified based on ERP Scorecards introduced by Chand et al. (2005). Based on selection criteria, 51 articles were investigated in this study. The matrix of benefits classification based on balanced scorecard perspectives and three levels of management can be seen in Table 4.7.

The types of questions varied for every part. Some were open-ended questions but most were fixed-alternative questions. For the open-ended questions, the respondents had to answer using his or herown words. Most of questions of this type were about the facts of the information system adoption and must be filled by the respondents. For the fixed-alternative questions, the respondents were given specific limited alternative responses and asked to choose the one closest to their own viewpoints. The following explanation refers to a variety of question type used in this study.

a. The determinant-choice question: a type of fixed-alternative question that required a respondent to choose one (and only one) response from among several possible alternatives. For example:

   Your current IS was developed by:

   □ Internal Information Technology staff

   □ Outside consultant

   □ Combination of inside IT staff and outside consultant

   □ Other, (specify): _____

b. Attitude rating scales: Likert scale and numerical scale. The Likert scale allowed the respondent to indicate how high or low the benefits were generated by the company after adopting the ERP. The Likert scale was used for parts II and III.

The questionnaire (as seen in APPENDIX B) was divided into four parts. The first part was about description of information system adopted by the company. The second part of the questionnaire asked about the levels of benefits experienced by the three levels of managers such as operational benefits, tactical benefits and strategic benefits. The benefits were further categorized into four balanced scorecard perspectives, namely internal processes, customer, financial and innovation and growth. Part three of the questionnaire asked about business performance using balanced scorecard perspectives. For parts two and three, the answers were elicited by choices on a Likert scale. The range is between 1 and 5, where 1 is chosen if the benefit is low and 5 is chosen where the benefit is high. Part four obtained the respondent's description such as position of the respondent in the company, level of decision making, number of years the respondent worked for the company and the respondent's education level. It was also asked if the respondent would like to receive the final research findings later. The overall number of questions in the questionnaire was one hundred and one. The summarized details of the questionnaire are illustrated in Table 5.1.

Part I of the questionnaire was about information system adoption in the company. This part contained ten questions. The items were about characteristics of the IS adoption such as: (1) number of years of the IS adoption, (2) details of IS

**Table 5.1: Summary of the Questionnaire**

| Part | Variable | Indicators | Number of items | Question Number | Source |
|---|---|---|---|---|---|
| I | Information System Profile | | 10 | 1 to 10 | - |
| II | Operational Level Benefits | Operational Benefits of ERP Adoption in Innovation and Growth | 4 | a - d | Shang & Seddon (2002); Chand et.al (2005) |
| | | Operational Benefits of ERP Adoption on Financial Performance | 4 | a - d | Shang & Seddon (2002); Chand et.al (2005) |

| | | | | | |
|---|---|---|---|---|---|
| | | Operational Benefits of ERP Adoption on Customer | 6 | a - f | Shang & Seddon (2002); Chand et.al (2005) |
| | | Operational Benefits of ERP Adoption on Internal Processes | 7 | a - g | Shang & Seddon (2002); Chand et.al (2005) |
| | | | | | |
| | Tactical Level Benefits | Tactical Benefits of ERP Adoption on Innovation and Growth | 4 | e - h | Shang & Seddon (2002); Chand et.al (2005) |
| | | Tactical Benefits of ERP Adoption on Financial Performance | 5 | e - i | Shang & Seddon (2002); Chand et.al (2005) |
| | | Tactical Benefits of ERP Adoption on Customer | 5 | g - k | Shang & Seddon (2002); Chand et.al (2005) |
| | | Tactical Benefits of ERP Adoption on Internal Processes | 5 | h - l | Shang & Seddon (2002); Chand et.al (2005) |
| | | | | | |
| | Strategic Level Benefits | Strategic Benefits of ERP Adoption on Innovation and Growth | 5 | i - m | Shang & Seddon (2002); Chand et.al (2005) |
| | | Strategic Benefits of ERP Adoption on Financial Performance | 6 | j – o | Shang & Seddon (2002); Chand et.al (2005) |
| | | Strategic Benefits of ERP Adoption on Customer | 5 | l - p | Shang & Seddon (2002); Chand et.al (2005) |
| | | Strategic Benefits of ERP Adoption on Internal Processes | 6 | m - r | Shang & Seddon (2002); Chand et.al (2005) |
| | | | | | |
| III | Business Performance | Internal Processes Perspectives | 6 | Aa – Af | Fernades et.al (2006) |
| | | Customer Perspectives | 5 | Ba – Be | Fernades et.al (2006) |
| | | Financial Perspectives | 6 | Ca – Cf | Fernades et.al (2006) |
| | | Innovation and Growth Perspectives | 4 | Da – Dd | Fernades et.al (2006) |
| IV | Respondent Profile | | 6 | 1 - 6 | - |

developer, (3) name of software vendor, (4) IS adoption approach, (5), (6), (7) refer to IS characteristics, (8) modules adopted, (9) whether the IS is integrated, and (10) whether the company adopts ERP. This part was not directly related to the hypothesis tested but the information was needed to control the sample characteristics and to identify the characteristics of information system for each company. Question numbers 9 and 10 are very important to identify whether the respondent adopts ERP. If the respondent replies that the company does not adopt ERP, it will be excluded from the analysis.

Part II refers to information system benefits and was further divided into four subparts. The first sub part was about the benefits of IS on innovation and growth. This sub part contained 13 items. Four questions pertained to operational benefits, a further four pertained to tactical benefits and five pertained to strategic benefits. Question (a - d) in innovation and growth benefits were for operational, (e - h) for tactical and (i - m) for tactical. The respondents were asked about their opinion to rank the benefits of information system in terms of innovation and growth of the company. The second subpart was about the benefits of IS on financial performance. This subpart contained 15 items. Four questions pertained tooperational benefits, five pertained to tactical benefits and another five were on strategic benefits. Question (a - d) in financial benefits were for operational, (e - i) for tactical and (j - o) for strategic. The respondents were asked about their opinion to rank the benefits of information system in terms of financial performance.



The third subpart was about the benefits of IS on customers. This subpart contained 16 items. Six questions pertained to operational benefits, five of them were on tactical benefits and another five on strategic benefits. Question (a - f) in customer benefits were for operational, (g - k) for tactical and (l - p) for strategic. The respondents were asked about their opinion to rank the benefits of information system in terms of customer performance. The fourth subpart asked about benefits of IS on internal processes. This subpart contained 17 items. Six questions pertained to operational level benefits, five were on tactical level benefits and six were on strategic benefits. Question (a - g) in internal processes were for operational, (h - l) for tactical and (m - r) for strategic. The respondents were asked about their opinion to rank the benefits of information system in terms of internal processes. The items for each question were scored on a 5-point scale from 1 for the lowest to 5 for the highest. This scale indicated that the higher the score of a sample, the higher the benefits generated by the company after adopting the ERP.

Part III referred to the business performance of the company according to the respondents' opinion. This part had four subparts that asked for the respondents' opinion on the company's business performance based on balanced scorecard perspectives. The first subpart was about business performance in terms of internal processes perspectives with 6 items. The second subpart referred to business performance in terms of customer perspectives with 5 items. The third subpart referred to business performance in terms of financial perspectives with 6 items. The fourth subpart referred to business performance in terms of innovation and growth perspectives with 4 items. The respondents were asked to rank the company's business performance on a 5-point scale from 1 for the lowest to 5 for the highest. This scale indicated that the higher the score of a sample, the higher the performance of the company.

Part IV was about respondent profile. In this part, the respondents were asked about (1) the respondent's position in the company, (2) the level of respondent's position in the company, (3) the number of years the respondent has worked in the company, (4) the respondent's education level, (5) whether the respondent is involved in IS development, and (6) whether the respondent is interested to receive the final result of the research. This part was not directly related to the hypothesis tested but the information was needed to control the sample characteristics and to ensure that the questionnaire was completed by a respondent fulfilling the sampling unit characteristics. The complete set of the questionnaire is attached in APPENDIX B.



## 5.6 Pilot Study

After discussing a few times with the supervisor, a final draft of the questionnaire was tested through a pilot study. In general, pre-test (pilot test) was conducted to find out the quality of the instrument designed. The main purposes of a pilot test are to (1) check the instrument's validity; and (2) to find out the reliability of research instrument used. Validity refers to the extent to which a test measures what we actually wish to measure (Cooper & Schindler, 2005). Instrument validity tests can show the validity of each items used in a pilot test. Reliability has to do with the accuracy and precision of a measurement procedure. It is concerned with estimates of the degree to which a measurement is free of random or unstable error (Cooper & Schindler, 2005). According to the authors, reliable instruments can be used with confidence that transient and situational factors are not interfering. It means that if the instruments are used for many times to the same object, we will have relatively similar results. In order to check the validity and reliability of the instruments

used to fulfil research criteria, a pilot test must be conducted. The pilot test should be conducted on at least 30 respondents (Pallant, 2005).

A pilot test of the questionnaire was conducted in April 2009 with two objectives. The first objective was to determine the content validity of the questionnaire and the second was to find out the reliability of the research instrument. In order to find out the content validity, the drafts of the questionnaire were sent to seven accounting expert from Universiti Malaysia Sabah, universitas Gajah Mada and Universitas Andalas. In addition to that, opinions by two PhD students, three managers and three accountants that work in manufacturing companies were also taken. They gave their opinions on the indicators used, the wording used for each item in the questionnaire, the physical appearance and also the layout of the questionnaire. Their constructive feedback was taken into consideration. Based on the feedback received, some items had been modified and re-worded to be more understandable by respondents.

## 5.7 Instrument Validity and Reliability

Prior to the performance of the regression analysis, the construct validity and reliability of each scale used in the research instrument were examined. Hair et al. (1998) state that validity is the extent to which the concept one wishes to measure is actually being measured by a particular scale or index and is concerned with how well the concept is defined by the measure(s). Two strategies for determining the measure's validity were provided in this study: (1) content validity and (2) face validity which relies on the internal logic of the measure. As reported earlier, the instrument of this study was considered to have both content and face validity. Content validity test is to ensure that the measure includes an adequate and representative set of items that would tap the concept (Sekaran, 2003). Meanwhile, face validity tells us to what extent the measure used seems to be a reasonable measure for what it is supposed to measure. Both validity tests were checked by asking a group of experts to give their opinions. To assess the construct validity, the examination of factor analysis for each variable was performed. Factor analysis was done to validate the scale by demonstrating that its constituent items loaded on the same factor. According to Kerlinger and Lee (2000), the major steps involved in calculating a factor analysis are: (1) data; (2) correlation; (3) factor extraction; and (4) factor rotation.

In this study, the factor analysis was calculated using SPSS version 16. The first and second order factor analysis was done. In the first order, principal component analysis with direct

oblimin rotation was chosen. From the principal component analysis, a set of full of factors that had common and unique variance was extracted from a set of variables. The result of extraction was shown in a factor (component matrix). The matrix contained the correlation between the variables (also called factor loading). However, according to Kerlinger and Lee (2000), most factor extraction methods produce factor matrix in a form that is difficult or impossible to interpret, so it is necessary to rotate factor matrix to make adequate interpretation. As mentioned above, the direct oblimin rotation was chosen. In direct oblimin rotation, the factors are allowed to be correlated. In this study, the factors are meant to be correlated since single scales of all variables were used in further analysis. The rotated factor matrix was showed in a pattern matrix and a structure matrix. According to Garson (2004), the structure matrix is simply the factor loading matrix representing the variance in a measured variable explained by a factor on both a unique and common contributions basis meanwhile the pattern matrix contain coefficients which just represent unique contributions.

After the first order factor analysis was done for every variable, the analysis is continued to the second order factor analysis. The primary purpose of the second order factor analysis was to ensure that the first order factors can actually be combined into single scale. In the second order factor analysis, the most common form of factor extraction was chosen. Factor loadings in rotated matrix were then used to consider whether a variable belonged to a factor or not. According to Garson (2004), in social science practice, it is common to use a minimum factor loading of .30 or .35. in addition, Hair et.al (1998) also mentioned that when an item loads heavily on two or more factors, the highest factor loading or at least 20 percent higher loading should be chosen. In this study, a variable that had a minimum factor loading of .55 and additional criteria from Hair et al. (1998) were considered to belong to a particular factor.

The rules for determining how many factors are appropriate for the data in the present study will be done using two criteria: Kaiser's Criterion or eigen value greater than 1 which is a default in SPSS. Kaiser-Mayer-Olkin (KMO) and Barlett's test of sphericity were also examined in the analysis. The KMO measures of sampling adequacy tests whether the partial correlations among items are small. Barlett's test of sphericity tests whether the correlation matrix is an identity matrix, which would indicate that the factor model is inappropriate. According to Garson (2004), the KMO statistic is found in two forms, individual and overall. The KMO varies from 0 to

1.0. The overall KMO should be .60 or higher to proceed with factor analysis, if not, drop the variables with the lowest individual KMO statistics values until the overall KMO rises above .60.

In conducting a test on the instrument's validity, the degree of confidentiality used was 95%, so standard error estimated used was $\alpha$=0.05. Each item statement in a questionnaire will be valid if correlation Pearson Product Moment coefficient ($r_{xy}$) is higher than $t_{table}$, that is suitable for N≥30. Based on those criteria, r-table was 0.361 and all Pearson Product Moment coefficients were higher than 0.361.

The reliability of a measure is an indication of the stability and consistency with which the instrument measures the concept and helps to assess the goodness of a measure (Sekaran, 2003). Consistency indicates how well the items measuring a concept hang together as an asset. The Cronbach's alpha coefficient was used to examine the consistency of the scale. The cut-off .70 suggested by Sekaran (2003) and Hair et al. (1998) was used.

## 5.8 Survey

In this stage, a non-experimental quantitative research was conducted. Non-experimental research is defined as a "systematic, empirical inquiry in which the scientist (researcher) does not have direct control of independent variables because their manifestations have already occurred or because they are inherently not manipulable" (Kerlinger, 1986). A sample was used as the method of data collection. A sample survey is a research technique in which information is gathered from people by use of a questionnaire (Zikmund, 1997). A questionnaire was used as the research instrument. The primary source of information was the responses from managers in the manufacturing sector in Malaysia. The data of the study were collected during the period of May 2009 to October 2009. The questionnaire used can be found in APPENDIX B. Managers were chosen as the key informants because they could provide proper and accurate information about their experience and perception about benefits in using information systems in their company. Every set of the questionnaire package included a cover letter and a self-addressed return envelope, and was mailed to the Human Resource (HR) Managers of the sampled companies. In the letter, the HR Manager was requested to assign one manager from each of the three levels to fill in the questionnaires.

### 5.8.1. Population and Sample

The study involves a survey of Malaysian manufacturing companies which have implemented the ERP system. Manufacturing companies were selected because their operating processes and information requirements are generally more comprehensive than the merchandising and service sectors. According to Buonanno, et.al (2005), most small manufacturers will not implement ERP because they either do not have sufficient resources or are not willing to commit a huge fraction of their resources to do so, due to the long implementation times and high fees associated with ERP implementation.

Population was large manufacturing companies in Malaysia. Large size firms are likely to have more resources in terms of personnel, capital and existing technologies (Gover & Segars, 1996). Hence, collecting data from large manufacturing companies was appropriate. The list of the company names and addresses were obtained from Federation of Malaysian Manufacturers (FMM) 2008. According to FMM (2008) there were 2,136 manufacturing companies in Malaysia in 2008 and 37% of them were large manufacturing companies. Based on the percentage, there were 790 large manufacturing companies in 2008. Simple random sampling was conducted where a set of questionnaires was sent to all large manufacturing companies in Malaysia. Large manufacturers are manufacturers that have sales turnover of more than RM25 million or have full time employees of more than 150 persons (Bank Negara Malaysia, 2005). Only manufacturers with more than 150 full time employees and involved in the export market were included in this study. The sample criteria were chosen to increase the response rate from companies that have adopted ERP. Based on the list found from FMM 2008, there were 236 manufacturing companies that fulfilled the study criteria. One package of questionnaires was sent to each of the company selected that consisted of 3 sets of questionnaires.

There were 708 sets of questionnaire were sent due to the number population for study. Unit analysis is managers as respondents. Managers are chosen because they are responsible for better performance of the company and has experience in using the ERP system. In addition, manager can give their perception to company's situation due to their experience working at the company by using the ERP system. Respondents are managers at the three levels, namely strategic level, tactical level and operational level managers. The three different levels of managers have been chosen because different level of managers have different obligation toward company's achievements. It cannot be dependent on strategic level managers only. It is in line with contingency theory. Contingency theories are a class of behavioral theory that contends that there

is no one best way of organizing (leading) and that an organizational (leadership) style that is effective in some situations may not be successful in others (Fiedler, 1964). In other words, the optimal organization (leadership) style is contingent upon various internal and external constraints. This means that every manager in a company can have his or her own creativity in order to lead an organization successfully.

### 5.8.2. Data Collection Techniques

The quantitave data of the study was collected during the period of May 2009 until October 2009. The questionnaires were distributed in two ways: by post and by personal delivery. In the former, packets of questionnaires were mailed to the manufacturing companies nationwide. A return stamped envelope and a copy of the letter from the supervisor were included in each questionnaire package. One month after the initial mailing, a phone call reminder was made to the respondents who did not respond to the questionnaires. If they agreed, another set of questionnaire would be sent to them.

In the second method, the questionnaires were personally delivered to the respondents. 15 enumerators were hired to perform this task. Before sending out, they were trained to conduct the data collection. It was not difficult to train them because they were accounting students who have learned the terms used for this research. There were two scenarios here. The first, a packet of questionnaires were given to the human resource manager of the company to be distributed to managers in the company. A period of one week was given for them to complete. A telephone call was made in one week to ask whether the questionnaires were completed. If he or she asked for extra time, it was given to them. If the questionnaires were completed, they were obtained directly from the human resource manager of the company. The second scenario was to ask managers of a manufacturing company to fill in the questionnaires on the spot after obtaining permission from human resource manager of the company. Approximately fifteen or thirty minutes were needed to complete the questionnaire.

### 5.8.3. Evaluation of Assumption

Before conducting the regression analysis, Pallant (2005) mentioned prerequisite conditions that must be met, which are sample size, multicollinearity, outliers, normality, linearity and heteroscedasticity. The following are requirements for each of the prerequisite:

### a. Sample size

The issue about sample size is generalisability (Pallant, 2005). That is, with small samples we may obtain a result that does not generalise (cannot be repeated) with other samples. According to the author, if the results do not generalise to other samples, then they will have little scientific value. So how many cases or subjects do we need? Different authors tend to give different guidelines concerning the number of cases required for the multiple regressions. Tabachnick and Fidell (2001) proposed a formula for calculating sample size requirements, taking into account the number of independent variables that we need to use: N > 50 + 8m (where m = number of independent variables). If there are five independent variables, number of respondents needed are 90. For this study, the respondents needed will be 50 + 8(3) = 74. So, at least 74 respondents should be used to be able to produce a reliable equation. Data was collected between My to October 2009. Finally, 124 managers were involved in the study. Five of them could not be included in the analysis due to incomplete answers. Twenty of them stated that their company did not adopt the ERP system, so they could not be included in the analysis for this study. Only 99 of the data can be further used for the analysis in this study.

### b. Multicollinearity

Multicollinearity refers to the relationship among the independent variables. According to Pallant (2005), multicollinearity exists when the independent variables are highly correlated (r=.9 and above). A frequent practice in examining bivariate correlation among independent variables is looking for coefficients of about .8 or larger, and if none is found, it is concluded that multicollinearity is not a problem (Lewis-Beck, 1980). On the other side, multicollinearity can be also checked by using Tolerance and Variance Inflation Factor (VIF). Tolerance is an indicator of how much of the variability of the specified independent is not explained by the other independent variables in the model and is calculated using the formula 1–R2 for each variable. If this value is very small (less than .10), it indicates that the multiple correlation with other variables is high, suggesting the possibility of multicollinearity. The other value used is the VIF, which is the inverse of the Tolerance value (1 divided by Tolerance). VIF values above 10 indicate no multicollinearity. According to Pallant (2005), commonly used cut-off points for determining the presence of multicollinearity are tolerance value of less than .10, or a VIF value of above 10.

### c. Normality

A normal distribution is a frequency distribution curve in which the mean, median and mode of a variable are equal to one and the distribution of scores is bell-shaped (Ritchey, 2008). Normal is used to describe a symmetrical, bell-shaped curve, which has the greatest frequency of scores in the middle, with smaller frequencies towards the extremes (Pallant, 2005). According to the author, normality can be assessed to some extent by obtaining skewness and kurtosis values or by using Kolmogorov-Smirnov formula. A skewed distribution is one in which the mean, median and mode of the variable are unequal and many of the subjects have extremely high or low scores. It can be positively skewed or negatively skewed. This assesses the normality of the distribution of scores. A non-significant result (Sig value of more than .05) indicates normality.

**d. Linearity**

In order to be able to conduct regression analysis, the residuals should have a straight-line or linear relationship with predicted dependent variable scores (Pallant, 2005). A linear pattern is one where coordinates of the scatterplot fall into a cigar-shaped pattern that approximates the shape of a straight line (Ritchey, 2008). The linear pattern can be obtained by drawing a scatterplot. A scatterplot is a two-dimensional grid of the coordinates of two interval/ratio variables, X and Y (Ritchey, 2008). The relationship showed in the scatterplot can be a positive correlation or a negative correlation. A positive correlation exists if an increase in X is related to an increase in Y. However, if the increase in X is related to a decrease in Y, it is considered as a negative correlation.



So, before conducting the regression analysis, prerequisite conditions such as sample size, multicollinearity, outliers, normality, linearity and heteroscedasticity were tested. For this study, the respondents needed will be at least 74 respondents should be used to be able to produce a reliable equation. Cut-off points for determining the presence of multicollinearity are tolerance value of less than .10, or a VIF value of above 10. Kolmogorov-Smirnov formula should have Sig value of more than .05 to indicate normality. A scatterplot was used to test linearity of data.

### 5.8.4. Data Analysis

The data collected were analyzed using descriptive statistics and inferential statistics. The data was processed and analyzed using SPSS version 16.0. The complete set of raw data of the study is attached in APPENDIX H. The followings explain the data analysis used in this research.

### 5.8.5. Descriptive Statistics

Descriptive statistics tell us how many observations were recorded and how frequently each score or category of observations occurred in the data (Ritchey, 2008). In addition, the author also mentioned that by using the statistical analysis, we can draw conclusions about the mathematical relationships among characteristics of a group of people or objects. Tabachnick and Fidel (2001) stated that descriptive statistics are used to summarize numerical descriptions of large bodies of data, most commonly stating the central tendencies and variability of given variables or the relationship between the said variables. In this study, the objective of using descriptive analysis was to describe and summarize the processed data in order that it is to be understood and interpreted easily. In this study, the descriptive analysis was used to:

a. explain the sample profile such as position level of the respondents, number of years worked for the company, education level and involvement in system developments. For the ERP system adoption, the profile refers to the number of years adopted, ERP system developer, vendor and adoption approach. The statistics that were used to explain this profile were frequency and percentage.
b. analyze the research question of the study. In analyzing the research question, the mean, median, mode, standard deviation, maximum and minimum values were calculated for each variable such as operational benefits, tactical benefits, strategic benefits, business performance, internal processes performance, customer service performance, financial performance and innovation and growth performance.



### 5.8.6. Inferential Statistics

Statistical inference entails drawing conclusions about a population on the basis of sample statistics (Ritchey, 2008). According to the author, the inferential statistics are computed to show cause-and-effect relationships and to test hypotheses and scientific theories. The inferential statistics used in the study was regression analysis. There are two types of hypotheses testing conducted in this study. First, hypotheses testing were conducted to find out whether a different effect exists among the three levels of ERP adoption for the three levels of management. Second, hypotheses testing were conducted to find out the effect of independent variables (operational, tactical and strategic level ERP adoption) on a company's business performance, internal processes, customer service, financial and innovation and growth performance. First hypothesis (H1) was analyzed by using MANOVA. Next hypotheses (H2 – H6) were analyzed by using regression analysis. Meanwhile, proposition for this study was analyzed based on in depth

interview. Table 5.2 shows hypotheses, corresponding variables and analysis method used in this study. The method of data analysis is discussed in the following sections.

Multivariate analysis of variance (MANOVA) is an extension of analysis of variance for use when we have more than one dependent variable (Pallant, 2005). These dependent variables should be related in some way, or there should be some conceptual reason for considering them together. MANOVA compares the groups and tells us whether the mean difference between the groups on the combination of dependent variables is likely to have occurred by chance. To do this MANOVA is to create a new summary dependent variable, which is a linear combination of each of the original dependent variables. It then performs an analysis of variance using this new combined dependent variable. MANOVA will show the researcher whether there is a significant difference between the groups on this composite dependent variable. It also provides the univariate results for each of the dependent variables separately.

**Table 5.2: Hypotheses, Corresponding Variables and Method of Analysis**

| Hypothesis | Independent Variable | Dependent Variable | Method of Analysis |
|---|---|---|---|
| H1 | • Operational Benefits<br>• Tactical Benefits<br>• Strategic Benefits | • Internal Processes Performance<br>• Customer Service Performance<br>• Financial Performance<br>• Innovation and Growth Performance | MANOVA |
| H2 | • Operational Benefits<br>• Tactical Benefits<br>• Strategic Benefits | Internal Processes Performance | Multiple Regression |
| H3 | • Operational Benefits<br>• Tactical Benefits<br>• Strategic Benefits | Customer Service Performance | Multiple Regression |
| H4 | • Operational Benefits<br>• Tactical Benefits<br>• Strategic Benefits | Financial Performance | Multiple Regression |
| H5 | • Operational Benefits<br>• Tactical Benefits<br>• Strategic Benefits | Innovation and Growth Performance | Multiple Regression |

| | | |
|---|---|---|
| Proposition | Integrating ERP system and BSC increases company's performance | Qualitative analysis |

The multivariate tests of significance will indicate whether there are statistically significant differences among the groups on a linear combination of the dependent variables. According to Pallant (2005), there are a number of statistics to choose from (Wilks' Lambda, Hotelling's Trace, Pillai's Trace). One of the most commonly reported statistics is Wilks' Lambda. Tabachnick and Fidell (2001) recommend Wilks' Lambda for general use; however, if the data have problems (small sample size, unequal N values, violation of assumptions), then Pillai's trace is more robust (Pallant, 2005). If the significance level for Wilks' Lambda is less than .05, then it can be concluded that there is a difference among the groups.

Regression analyses are set of statistical techniques that allow one to assess the relationship between one dependent variable and several independent variables (Tabachnick & Fidel, 2001). Multiple regressions is not just one technique but a family of techniques that can be used to explore the relationship between one continuous dependent variable and a number of independent variables or predictors (Pallant, 2005). Multiple regressions is based on correlation and allows a more sophisticated exploration of the interrelationship among a set of variables. This makes it ideal for the investigation of more complex real-life, rather than laboratory-based, research questions (Pallant, 2005).



Multiple regressions can be used to address a variety of research questions. It can tell how well a set of variables is able to predict a particular outcome. Multiple regressions will provide information about the model as a whole and the relative contribution of each of the variables that make up the model. Multiple regressions will allow researchers to test whether adding a variable contributes to the predictive ability of the model, over and above those variables already included in the model. Multiple regression can also be used to statistically control for an additional variable (or variables) when exploring the predictive ability of the model. According to Palllant (2005), some of the main types of research questions that multiple regression can be used to address are:

- how well a set of variables is able to predict a particular outcome;
- which variable in a set of variables is the best predictor of an outcome; and
- whether a particular predictor variable is still able to predict an outcome when the effects of another variable are controlled.

This study used standard multiple regression. In standard multiple regression, all the independent (or predictor) variables are entered into the equation simultaneously. Each independent variable is evaluated in terms of its predictive power, over and above that offered by all the other independent variables. If the Sig. value is less than .05, then the variable is making a significant unique contribution to the prediction of the dependent variable. If greater than .05, then it is concluded that that variable is not making a significant unique contribution to the prediction of the dependent variable. This study tested the effect of three independent variables namely operational level benefits, tactical level benefits and strategic benefits of ERP system adoption on business performance. It was tested whether the three independent variables has significant and positive effect on the business performance. In addition, the effects of these independent variables were also tested on internal and growth performance, customer service performance, financial performance and innovation and growth performance.

To find out the effect of ERP adoption benefits at the three levels of management, a multiple regression method was used. Multiple regressions are used to assess the relative influence of a number of independent (predicting) variables when they are used to predict a dependent variable (Foster et al., 2006). In addition, the multiple regressions can also predict the level of influence of an independent variable on the dependent variable. The important results of regression analysis according to Garson (2004) are as follows:

a. The regression coefficient, b, is the slope of the regression line: the larger the b, the steeper the slope, the more the dependent changes for each unit change in the independent. The "b" coefficient is the unstandardized simple regression coefficient for the case of one independent. When there are two or more independents, the b coefficient is a partial regression coefficient. In SPSS, it is common to call it "regression coefficient". The beta weights are the regression coefficient for standardized data. Only standardized b-coefficient can be compared to judge relative predictive power of independent variables. In this study, b-coefficient is used to compare level of contribution among operational, tactical and strategic on company's performance.
b. R-squared ($R^2$) is used to assess the goodness of fit of a multiple regression (Lewis-Back, 1980). This is called coefficient of multiple determinant. According to the author, the $R^2$ for a multiple regression equation indicates the proportion of variation in dependent variable explained by all independent variables.

For this study, SPSS 16.0 was used to conduct the descriptive analysis and multiple regressions. Output results of the descriptive analysis and multiple regression analysis can be found in the appendix.

## 5.9 Confirmatory Interview

In addition to the survey conducted for empirical study, a series of interviews was conducted to re-confirm the survey results. A letter for request of interview was sent to CEOs of Public Listed Manufacturing companies in Malaysia. The list of public-listed manufacturing companies was taken from the Federation of Malaysian Manufacturing Companies. Public Listed Manufacturing Companies were chosen because they are considered as large sized manufacturing companies. It is assumed that large sized companies will have more opportunities to adopt ERP due to the high cost of ERP implementation. 76 initial requests for interview were sent together with reply slips via post express to CEOs of the companies. The letter and the reply slip can be seen in APPENDIX C and the list of interviewee companies contacted can be seen in APENDIX D. After one week, telephone calls were made to ask whether the CEO's secretary received the letter. If they did not receive the letter, based on agreement, the letter together with the reply slip was faxed. Some of the companies that did not adopt ERP or the CEOs did not have time as mentioned in the letter, they declined to be interviewed. In addition to that, requests for interview were also sent to 15 ERP vendors in Malaysia. The list of ERP vendors in Malaysia was found through an internet search.



Finally, four ERP adopters and three ERP vendors agreed to be interviewed. Interviews were conducted with the CEO of Malaysian Mosaics Berhad, Pharmaniaga Berhad and UMW Holdings Berhad. Interviews were also conducted with the managing directors of Abas Solutions (M) Sdn Bhd, Oracle (M) Sdn Bhd and Synergistic Innovations Sdn. Bhd. for ERP vendors. The interviews were conducted between 4 to 6 November 2009 and 3 to 4 December 2009. A list of interviewees and the schedule for each interview conducted can be seen in APPENDIX E. Basically, the questions asked to the interviewees were similar to the questions asked in the questionnaire, covering information system adopted, ERP system adoption benefits generated at the operational level, tactical level and strategic level management. We also asked about how ERP adoption can influence a company's business performance and how the success of ERP adoption is measured. The list of questions asked and interview transcript can be seen in APPENDIX F.

## 5.10 Summary

This chapter has presented the methodological aspects employed by the current research. It has discussed the population and the samples of the current research. It has also overviewed the processes that will be carried out by current research prior to the actual data collection. In the final sub sections, the analysis that will be carried out has also presented.

# CHAPTER 6

# DATA ANALYSIS AND FINDINGS

## 6.1 Introduction

This chapter presents data analysis and the findings of the research. Description of the study's sample profile is first presented, followed by a report on the results of validity and reliability analysis of the research instrument. The result of factor analysis, reliability analysis, and descriptive statistics are also presented which are indicators of goodness measures. It is then followed by the results of correlation analysis and hypothesis testing through multiple regression analysis. This chapter ends with a summary of the current research findings.

## 6.2 Sample Profile of the Study

The descriptive statistics analysis of the sample was done and the results of the analyses are summarized in Table 6.1. As mentioned in chapter five, 99 managers were used as samples in the present study. The analysis indicated that 16.16% of respondents are at the strategic level, 63.64% at the tactical level and 20.20% of the respondents are holding operational level positions. In terms of length of service to the company, 36.36% of the respondents have worked for less than 5 years, 30.30% between five to ten years and 33.33% have worked for more than ten years. Most of the respondents hold a bachelor's degree or have had professional training (77.78%); master degree holders comprise 14.14% and SPM or STPM holders comprise 8.08%. None of the respondents hold PhD degrees. 46.46% of the manager respondents were involved in system development and 53.54% were not involved.

**Table 6.1: Summary of the Sample Profile of the Study**

| No | Profile | Frequency | Percentage |
|---|---|---|---|
| **1** | **Respondent Description** | | |
| 1.a | Level of position: | | |
| | • Strategic Level | 16 | 16.16% |
| | • Tactical Level | 63 | 63.64% |
| | • Operational Level | 20 | 20.20% |
| | | | |
| 1.b | Number of years worked for the company | | |
| | • Less than 5 years | 36 | 36.36% |
| | • 5 – 10 years | 30 | 30.30% |
| | • More than 10 years | 33 | 33.33% |
| | | | |
| 1.c | Educational Level: | | |
| | • Senior High School | 8 | 8.08% |
| | • Degree/Professional Training | 77 | 77.78% |
| | • Master Degree | 14 | 14.14% |
| | • PhD | 0 | 0.00% |
| | | | |
| 1.d | Involvement In ERP Development: | | |
| | • Involved | 46 | 46.46% |
| | • Not Involved | 53 | 53.54% |
| | | | |
| **2** | **ERP system Description** | | |
| 2.a | Number of years adopted | | |
| | • Less than 3 years | 20 | 20.20% |
| | • 3 – 8 years | 32 | 32.32% |
| | • More than 8 years | 47 | 47.47% |
| | | | |
| 2.b | ERP was developed by: | | |
| | • IT Staff | 3 | 3.03% |
| | • Outside Consultant | 32 | 32.32% |
| | • Combination of IT staff and consultant | 54 | 54.55% |
| | | | |
| 2.c | Vendor of Software: | | |
| | • SAP | 15 | 16.85% |
| | • Oracle | 16 | 17.98% |
| | • PeopleSoft | 4 | 4.49% |
| | • JD Edwards | 2 | 2.24% |
| | • BAAN | 0 | 0.00% |
| | • None of the above | 52 | 58.44% |
| | | | |
| 2.d | ERP Adoption Approach | | |
| | • All in One | 50 | 50.51% |
| | • Best of Breed | 49 | 49.49% |

Based on the information system adoption profile, 20.20% of managers responded that they had adopted the ERP for less than 3 years, 32.32% had adopted it for three to eight

years and 47.47% had adopted ERP for more than eight years. Based on the analysis results, 3.03% of the system was developed by the company's own IT staff, 32.32% was developed by outside consultants and 54.55% of the ERP adoptions were developed by a combination of IT staff and consultants. 41.66% of the software adopted by the respondents provided by the big five (SAP, Oracle, JD Edwards, PeopleSoft and Baan); 58.44% was provided by other firms. On ERP adoption approach, 50.51% of the ERP were implemented using all-in-one approach and 49.49% by using the best of breed approach.

## 6.3 Goodness of Measures

As mentioned in chapter five, it is important to make sure that the instrument developed is indeed accurately measuring the variable. In order to make sure the accuracy of measurements, assessing the goodness of the measures developed is required. According to Sekaran (2003), there are at least two important methods to assess the goodness of measure. They are factor analysis and reliability analysis. Both of the analysis was conducted in this research. The factor analysis was desirable because the contextual differences between this research and the variable's measurement was adopted, modified or constructed. In addition, reliability was evaluated by assessing the internal consistency of the items representing each construct using Cronbach's alpha that has been widely used in many studies (Hair et al., 2006). Results of the factor and reliability analysis are presented in the following section.



### 6.3.1 Factor Analysis

Factor analysis is a statistical techniques applied to a single set of variables when a researcher is interested in discovering which variables in the set form coherent subsets that are relatively independent one another (Tabachnick & Fidel, 2007). According to Hair (2006), factor analysis is used to achieve data reduction by (1) identifying representative items from a much larger set of items for use in subsequent multivariate analysis, or (2) creating an entirely new set of items, much smaller in number, to partially or completely replace the original set of items. Factor analysis was conducted in this research to retain the nature and character of the original items and reduce the number of items.

There are six assumptions were observed in conducting factor analysis suggested by Hair et al. (2006). First assumption, Kaise-Meyer-Olkin measure of sampling adequacy (KMO) values must exceed .50. Second assumption, Barlett's test of sphericity is at least significant at .05. The third assumption requires that anti-image correlation of measurement items should

be greater than .50. Fourth assumption, communalities of items must be greater than .50. Fifthly, the minimum requirement of factor loading (cutoff) .55 (n=99) based on .05 significant level. Cross factor loading exists if one items has more than one .55 of factor loading. The last assumption (sixth), for the factor analysis extraction only eigenvalues more than 1 is considered.

Factor analysis was conducted for benefits of ERP system at each of managerial level was apparently due to its debatable dimensions in the literature. It was highlighted in the preceding chapter that consensus on what level of manager should derive benefits from ERP system adoption. There are 62 items of benefits identified from previous research. Those benefits should be grouped into three managerial levels namely operational level benefits, tactical level benefits and strategic level benefits.

The first run of factor analysis on the 62 items of ERP system benefits elements yielded three factors, with KMO = .803, Barlett test of sphericity (p=.00), Anti-image correlation (>.50). However, there was one item crossed the loading in factor one and factor two. Both of them meet the loading threshold of .55 that were adopted in this research. The item was "improve customer satisfaction". It had loading threshold of .602 in the first loading and .552 in the second loading. This item was dropped in the second run of the factor analysis. The second run resulted KMO = .799, Barlett test of sphericity (p=.00), Anti-image correlation (>.50). In this data run, there were sixteen items that had loading threshold of less than .55. Those item should be excluded in the third run of factor analysis. The items are "reduce customer complaints", "reduce time to process employees administration", "increase market share", "improve production scheduling", "expand customer base to other regions" and "increase partnership with customers". In addition, "build new process chain", "build new market strategy", "customize product and services", "provide lean production". "enable worldwide expansion with global foreign currency capability" and "build cost leadership by increasing process efficiency" were excluded during the third run. The item "adapt to technology changes easily", "support business growth in capability" "support business growth with new products" and "support business growth with increasing numbers of employees" were should excluded due to low loading threshold of less than .55.

In summary, during the conceptual stage, ERP system benefits that were grouped into three managerial levels consisted of 62 items, however, after conducting factor analysis, only

42 items that are suitable for analyzing further due to low loading threshold of less than .55.

**Table 6.2: Rotated Component Matrix[a]**

The items were grouped into the three managerial levels where 17 items were grouped into operational level ERP system benefits, 14 items were grouped into tactical level and 11 items were grouped into strategic level ERP system benefits. The final result is presented in Table 6.2 and detail SPSS output provided in APPENDIX G.



With regard to Business performance, the need to run factor analysis for business performance for each of BSC dimensions was apparently due to its debatable dimensions in the literature. It was highlighted in the preceding chapter that consensus on what dimension of business performance should derive from ERP system adoption. There are 21 items of business performance identified from previous research. The performance should be grouped into four BSC perspectives namely internal processes, customer, financial and innovation and growth performance.

The first run of factor analysis on the 21 items of business performance yielded four factors, with KMO = .729, Barlett test of sphericity (p=.00), Anti-image correlation (>.50). However, three items were not meet the loading threshold of .55. the items are "production ratio" with loading threshold of .46, "on-time delivery" with loading threshold of .532 and "number of employee's training with

| | Component | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| **Operational Level Benefits** | | | |
| Increase user involvement in training | **.623** | .097 | .282 |
| Increase products produced per employee | **.623** | .053 | .341 |
| Increase customer served per employee | **.609** | .067 | .391 |
| Increase accessability of enterprise information | **.732** | .095 | .062 |
| Reduce administrative cost | **.596** | -.054 | .380 |
| Remove redundant processes | **.556** | .114 | .263 |
| Reduce inventory-carrying cost | **.645** | .075 | .485 |
| Lower labor cost | **.598** | .010 | .479 |
| Access customer data and customer inquiries easily | **.651** | .051 | .027 |
| Improve customer response time | **.665** | .074 | .308 |
| Reduce customer processing errors | **.728** | .014 | .305 |
| Ease customer order and service | **.693** | .054 | .255 |
| Reduce error in production processing. | **.702** | .093 | .024 |
| Reduce time to serve customer | **.658** | .146 | .392 |
| Improve data accuracy and reliability | **.689** | .230 | .168 |
| Improve work scheduling | **.650** | .067 | .159 |
| Improve the speed to information access. | **.625** | .255 | .045 |
| **Tactical Level Benefits** | | | |
| Increase decision making skills | -.091 | **.731** | .072 |
| Support worker ability for taking action quickly | .167 | **.672** | -.081 |
| Support management processes efficiency | .118 | **.697** | -.143 |
| Increase manager knowledge | .216 | **.670** | -.059 |
| Conduct better forecasting | .089 | **.632** | .015 |
| Improve profit and cost control | -.158 | **.734** | .185 |
| Increase financial control. | .156 | **.613** | .320 |
| Increase equity capitalization | .165 | **.655** | .211 |
| Increase customer product demands | .025 | **.555** | .345 |
| Improve decision quality | .130 | **.821** | -.051 |
| Improve the frequency of staff monitoring | .028 | **.701** | .258 |
| Improve asset management | -.083 | **.772** | .228 |
| Improve production management | .185 | **.722** | .036 |
| Improve workforce management | .216 | **.709** | .100 |
| **Strategic Level Benefits** | | | |
| Create new business lines | .327 | .052 | **.627** |
| Increase new markets | .204 | .141 | **.712** |
| Enable worldwide expansion with global resource management | .322 | .121 | **.745** |
| Enable worldwide expansion with global market penetration | .273 | .114 | **.641** |
| Enable worldwide expansion by deploying solution quickly | .330 | .043 | **.740** |
| Enable e-business through the web integration capability | .168 | .068 | **.842** |
| Support interactive customer services | .373 | -.008 | **.759** |
| Improve product design through customer direct feedback | .183 | .143 | **.753** |
| Expand to new e-market easily | .151 | .056 | **.875** |
| Build virtual corporation with virtual supply and demand consortium | .125 | .176 | **.821** |
| Build external linkages with related business parties easily. | .358 | .193 | **.658** |
| Variance Explained (%) Total = 55.998 | 19.767 | 19.287 | 16.944 |
| Eigenvalues | 14.202 | 5.974 | **3.342** |
| KMO .824 | | | |
| Barlett's Test Sig. .000 | | | |



loading threshold of .379. Those items were dropped in the second run of the factor analysis.

The second run resulted KMO = .712, Barlett test of sphericity (p=.00), Anti-image correlation (>.50). In this data run, all of the items have loading threshold of more than .55.

After the final factors, 18 items were maintained to make up the four factors. The four factors explained 60.76% of the construct. The final result is presented in Table 6.3 and detail SPSS output provided in APPENDIX G.

**Table 6.3: Rotated Component Matrix[a]**

| | Component | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| **Internal Process Perfromance** | | | | |
| Efficiency ratio | **.553** | .498 | .136 | -.004 |
| Number of complaints | **.791** | -.133 | .149 | .150 |
| Number of failures | **.921** | -.061 | .049 | -.019 |
| Cycle time reduction | **.679** | .392 | .023 | .087 |
| Employee turnover | **.562** | -.006 | .172 | .267 |
| **Customer Service Performance** | | | | |
| Quality of customer service | .040 | **.756** | .160 | -.010 |
| Quality of products | -.001 | **.636** | .411 | .057 |
| Ability to gain competitive Advantage | .048 | **.720** | .049 | .189 |
| Number of customer partnership | -.031 | **.576** | .029 | .225 |
| **Financial Performance** | | | | |
| Return on investment | .045 | .208 | **.834** | .037 |
| Return on assets | .042 | .174 | **.730** | .359 |
| Operating profits | .199 | .144 | **.749** | .093 |
| Sales growth rate | .141 | -.141 | **.737** | .229 |
| Cost reduction programs | .080 | .215 | **.651** | -.107 |
| Economic Value Added | .053 | .053 | **.747** | .078 |
| **Innovation and Growth Performance** | | | | |
| Employee empowerment | .060 | .181 | .101 | **.755** |
| Employee morale | .233 | .317 | -.035 | **.695** |
| Enhancement of workers' qualification | .126 | -.011 | .358 | **.708** |
| Variance Explained (%) Total = 60.758 | 20.701 | 15.053 | 14.141 | 10.864 |
| Eigenvalues | 5.280 | 2.276 | 1.986 | 1.148 |
| KMO .712 | | | | |
| Barlett's Test Sig. .000 | | | | |

### 6.3.2 Reliability Analysis

Reliability is a test that is needed to test how stable is the position of a given score in a distribution of scores when measured at different times or in different ways (Tabachnick and Fudel, 2007). According to Sekaran (2003), reliability of a measure is an indication of the stability and consistency with which the instrument measures the concept of the studied variables and helps to assess the goodness of a measure. A reliability coefficient that is commonly used to indicate how well the items in a set are positively correlated to one another is Cronbach's alpha. Cronbach's alpha score will be between 0 and 1. The closer Cronbach's alpha is to 1, the higher the internal consistency reliability. According to Sekaran (2003), when

Cronbach's alpha is less than .60 is generally considered as poor, .70 considered to be acceptable and those higher than .80 is good. The results of the reliability analysis for this study are summarized in Table 6.4.

**Table 6.4: Results of the Reliability Analysis**

| Variable | Number of items | Cronbach's alpha |
|---|---|---|
| Operational Level Benefits | 17 | .93 |
| Tactical Level Benefits | 14 | .92 |
| Strategic Level Benefits | 11 | .94 |
| Internal Processes Performance | 5 | .79 |
| Customer Performance | 4 | .72 |
| Financial Performance | 6 | .86 |
| Innovation and Growth Performance | 3 | .70 |

It can be seen that the Cronbach's alphas of all the dimensions are higher than the minimum threshold (Cronbach's alpha >.70). At the independent variables, operational level benefits that have 17 valid items have Cronbach's alpha of .93. Tactical level benefits that have 14 valid items have Cronbach's alpha of .92. Strategic level benefits that have 11 valid items have Cronbach's alpha of .92. Meanwhile at the dependent variable, internal processes performance that has 5 valid items have Cronbach's alpha of .79. Customer performance that has 4 valid items have Cronbach's alpha of .72. Financial performance that has 6 valid items have Cronbach's alpha of .86. Innovation and growth performance that has 6 valid items have Cronbach's alpha of .70. These indicate that the instrument is stable and consistent in measuring the concepts of the respective variables. The full SPSS output of reliability tests are attached in APPENDIX H.

## 6.4 Descriptive Statistics of Studied Variables

This section describes the responses of the respective variables of this research. Descriptive analyses were conducted for respective variables which include mean, median, mode and standard deviation. The mean, median and mode of a data set are collectively known as measures of central tendency as these three measures focus on where the data is centred or clustered. The mean (or average) of a set of data values or the sum of all of the data values divided by the number of data values. The median of a set of data values is the middle value of the data set when it has been arranged in ascending order. The mode of a set of data

values is the value(s) that occurs most often. Standard deviation is a widely used measurement of variability or diversity used in statistics and probability theory. It shows how much variation or dispersion there is from the average. A low standard deviation indicates that the data points tend to be very close to the mean, whereas high standard deviation indicates that the data are spread out over a large range of values. Table 6.5 displays the mean, median, mode value and standard deviation scores of variables used in this study. The full SPSS output of descriptive statistics are attached in APPENDIX I.

**Table 6.5: Mean, Median, Mode Values and Standard Deviation of Variables (n=99)**

| Variable | Mean | Median | Mode | Std. Deviation |
|---|---|---|---|---|
| Operational Level Benefits | 3.49 | 3.53 | 3.65 | .62 |
| Tactical Level Benefits | 3.50 | 3.50 | 3.21 | .62 |
| Strategic Level Benefits | 2.91 | 3.00 | 3.09 | .75 |
| Internal Processes Performance | 3.08 | 3.00 | 3.20 | .57 |
| Customer Performance | 3.56 | 3.50 | 4.00 | .44 |
| Financial Performance | 3.17 | 3.17 | 3.00 | .54 |
| Innovation and Growth Performance | 3.07 | 3.00 | 3.00 | .54 |

All items measuring the variables were using a five-point likert scale anchored by 1 (low) and 5 (high). Table 6.5 shows that operational level benefits variable has a mean value of 3.49. It indicates that the benefits of ERP system adoption experienced by managers at the operational level are high because the score is more than 3. The operational level benefits have 3.53 as a median score. It indicates that 3.53 is a set of data values is the middle value of the data set when it has been arranged in ascending order for operational level benefits. The variable has 3.65 as mode value. It means that for this variable, 3.65 is the value that occurs most often. Its standard deviation is .62 means that the data points tend to be very close to the mean. It indicates that most of the respondents have almost similar perception toward ERP system adoption benefits at the operational level.

At the tactical level benefits, mean value is 3.50. It indicates that the benefits of ERP system adoption experienced by managers at the tactical level are high because the score is more than 3. The tactical level benefits have 3.50 as a median score. It indicates that 3.50 is a set of data values is the middle value of the data set when it has been arranged in ascending order for tactical level benefits. The variable has 3.21 as mode value. It means that for this variable, 3.21 is the value that occurs most often. Its standard deviation is .62 means that the

data points tend to be very close to the mean. It indicates that most of the respondents have almost similar perception toward ERP system adoption benefits at the tactical level.

For strategic level benefits, the mean value is 2.91. It indicates that the benefits of ERP system adoption experienced by managers at the strategic level are low because the score is less than 3. The strategic level benefits have 3.00 as a median score. It indicates that 3.00 is a set of data values is the middle value of the data set when it has been arranged in ascending order for strategic level benefits. The variable has 3.09 as mode value. It means that for this variable, 3.09 is the value that occurs most often. Its standard deviation is .75 means that the data points tend to be very close to the mean. It indicates that most of the respondents have almost similar perception toward ERP system adoption benefits at the strategic level.

Mean value for internal processes performance is 3.08. It indicates that the managers at manufacturing companies perceive that after adopting ERP system, the internal processes of the company is high because the score is more than 3. Median score for internal processes performance is 3.00. It indicates that 3.00 is a set of data values is the middle value of the data set when it has been arranged in ascending order for strategic level benefits. The variable has 3.20 as mode value. It means that for this variable, 3.20 is the value that occurs most often. Its standard deviation is .57 means that the data points tend to be very close to the mean. It indicates that most of the respondents have almost similar perception toward internal processes performance after adopting ERP system.

Customer performance has mean value of 3.57. It indicates that the managers at manufacturing companies perceive that after adopting ERP system, the customer performance of the company is high because the score is more than 3. Median score for internal processes performance is 3.50. It indicates that 3.50 is a set of data values is the middle value of the data set when it has been arranged in ascending order for strategic level benefits. The variable has 4.00 as mode value. It means that for this variable, 4.00 is the value that occurs most often. Its standard deviation is .44 means that the data points tend to be very close to the mean. It indicates that most of the respondents have almost similar perception toward company's customer service performance after adopting ERP system.

Mean value for financial performance is 3.16. It indicates that the managers at manufacturing companies perceive that after adopting ERP system, the financial performance of the company is high because the score is more than 3. Median score for internal processes performance is 3.17. It indicates that 3.17 is a set of data values is the middle value of the data set when it has been arranged in ascending order for strategic level benefits. The variable has 3.00 as mode value. It means that for this variable, 3.00 is the value that occurs most often. Its standard deviation is .54 means that the data points tend to be very close to the mean. It indicates that most of the respondents have almost similar perception toward company's financial performance after adopting ERP system.

Innovation and growth performance has mean value of 3.07. It indicates that the managers at manufacturing companies perceive that after adopting ERP system, the innovation and growth performance of the company is high because the score is more than 3. Median score for internal processes performance is 3.00. It indicates that 3.00 is a set of data values is the middle value of the data set when it has been arranged in ascending order for strategic level benefits. The variable has 3.00 as mode value. It means that for this variable, 3.00 is the value that occurs most often. Its standard deviation is .54 means that the data points tend to be very close to the mean. It indicates that most of the respondents have almost similar perception toward company's innovation and growth performance after adopting ERP system.



## 6.5 Correlation Analysis

correlation is usually used to measure the association between variables. The Pearson product-moment correlation coefficient is the most frequently used measure of association and the basis of many multivariate calculations (Tabachnick & Fidel, 2007). Pearson correlation coefficients were computed in order to examine the strength and direction of the relationship between all variables in the study. The Pearson correlation coefficients value can range from -1.00 which representing a perfect negative correlation to +1.00 which representing a perfect positive correlation. A value of 0.00 indicates no linear relationship between the X and Y variable or between two variables (Tabchnick & Fidel, 2007). Cohen (1998) interpreted the correlation value as weak when the correlation value falls between .10 and .29 or -.10 and -.29. Medium/moderate relationship happens when correlation value is between .30 and .49 or -.30 and -.49. Large or/strong correlation happens when correlation

value is .50 and 1.00 or -.50 and -1.00. Table 6.6 shows the correlation result for this study. The full SPSS output of Pear correlation matrix of variables is attached in APPENDIX J.

From the result, it can be seen that operational benefits of ERP system adoption has a very strong correlation with business performance based on balanced scorecard in average with significant level of 10% with r=.578 and p=0.00. However, it has moderate correlation with internal processes performance with significant level of 10% with r=.432 and p=0.00. It also has moderate correlation with customer service performance with significant level of 10% with r=.376 and p=0.00. In regard with financial performance, it also has moderate correlation with financial performance with significant level of 10% with r=.395 and p=0.00. For innovation and growth performance, it also has moderate correlation with the innovation and growth performance with significant level of 10% with r=.367 and p=0.00.

Tactical level of ERP system benefits has a moderate correlation with business performance based on balanced scorecard in average with significant level of 10% with r=.451 and p=0.00. It has weak correlation with internal processes performance with significant level of 10%, r=.209 and p=0.00. It has moderate correlation with customer service performance with significant level of 10% with r=.334 and p=0.00. In regard with financial performance, it also has moderate correlation with financial performance with significant level of 10% with r=.349 and p=0.00. For innovation and growth performance, it also has moderate correlation with the innovation and growth performance with significant level of 10% with r=.392 and p=0.00.

At the strategic level of ERP system benefits, it has a strong correlation with business performance based on balanced scorecard in average with significant level of 10% with r=.572 and p=0.00. It has weak correlation with internal processes performance with significant level of 10%, r=.277 and p=0.00. It has strong correlation with customer service performance with significant level of 10% with r=.501 and p=0.00. In regard with financial performance, it also has moderate correlation with financial performance with significant level of 10% with r=.437 and p=0.00. For innovation and growth performance, it also has moderate correlation with the innovation and growth performance with significant level of 10% with r=.397 and p=0.00.

**Table 6.6: Pearson Correlations Matrix of Study Variables**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | 99 | 99 | 99 | 99 | | | | |
| CUST | Pearson Correlation | .376** | .334** | .501** | .213* | 1 | | | |
| | Sig. (2-tailed) | .000 | .001 | .000 | .034 | | | | |
| | N | 99 | 99 | 99 | 99 | 99 | | | |
| FIN | Pearson Correlation | .395** | .349** | .437** | .286** | .330** | 1 | | |
| | Sig. (2-tailed) | .000 | .000 | .000 | .004 | .001 | | | |
| | N | 99 | 99 | 99 | 99 | 99 | 99 | | |
| IG | Pearson Correlation | .367** | .392** | .397** | .328** | .321** | .364** | 1 | |
| | Sig. (2-tailed) | .000 | .000 | .000 | .001 | .001 | .000 | | |
| | N | 99 | 99 | 99 | 99 | 99 | 99 | 99 | |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | .000 | .000 | .000 | |
| | N | 99 | 99 | 99 | 99 | 99 | 99 | 99 | 99 |

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

## 6.6 Analysis of Assumptions for Multiple Regression

As mentioned in Chapter three, Pallant (2005) mentioned some prerequisite conditions that must be met prior to conducting the regression analysis. These prerequisite conditions and the results of the relevant assumption testing are detailed in the following sections.



### 6.6.1 Sample size

The issue about sample size is generaliability (Pallant, 2005). That is, with small samples we may obtain a result that does not generalise (cannot be repeated) with other samples. According to the author, if the results do not generalise to other samples, then they will have little scientific value. So how many cases or subjects do we need? Different authors tend to give different guidelines concerning the number of cases required for the multiple regressions. Tabachnick and Fidell (2001) propose a formula for calculating sample size requirements, taking into account the number of independent variables that we need to use: $N > 50 + 8m$ (where m = number of independent variables). If there are five independent variables, respondents needed are 90. For this study, the respondents needed will be $50 + 8(3) = 74$. So, at least 74 respondents should be used to be able to produce reliable equation. This study had 99 respondents. Hence, there was no violation in terms of sample size.

### 6.6.2 Multicollinearity

Based on the analysis, there was no multicollinearity in this study because from the correlation table, it was found that all correlation scores were between .252 to .730 and the ranges are below .8. In addition, based on the regression analysis, it was found that all tolerance scores were above .10 and the VIF score were below 10. This means that there was no multicollinearity between the variables. The data could be used to conduct regression analysis. Data correlation between the independent variables can be found in APPENDIX J and VIF score can be found in APPENDIX N.

### 6.6.3 Normality

In this study, data normality was assessed by obtaining a Kolmogorov-Smirnov statistic score ($KS_{score}$). A non-significant result (Sig value of more than .05) indicates normality. All of the variables in this study have sig value that were more than .05. Hence, all data for all variables are normal. The $KS_{score}$ and the significant value (sig.) for each variable can be seen in Table 6.7. The full SPSS output of One-Sample Kolmogorov-Smirnov Test are attached in APPENDIX K.

**Table 6.7: One-Sample Kolmogorov-Smirnov Test**

| No. | Variable | $KS_{score}$ | Sig. | conclusion |
|---|---|---|---|---|
| 1. | Operational Level Benefits | 0.543 | 0.929 | Normal |
| 2. | Tactical Level Benefits | 0.691 | 0.726 | Normal |
| 3. | Strategic Level Benefits | 1.002 | 0.268 | Normal |
| 4 | Business Performance | 1.125 | 0.159 | Normal |
| 5 | Internal Processes | 1.330 | 0.058 | Normal |
| 6 | Customer Performance | 1.344 | 0.054 | Normal |
| 7 | Financial Performance | 1.297 | 0.069 | Normal |
| 8 | Innovation And Growth | 1.141 | 0.148 | Normal |

### 6.6.4 Linearity

In order to be able to conduct regression analysis, the residuals should have a straight-line or linear relationship with predicted dependent variables scores (Pallant, 2005). A linear pattern is one where coordinates of the scatterplot fall into a cigar-shaped pattern that approximates the shape of a straight line (Ritchey, 2008). The linear pattern can be obtained by drawing a scatterplot. A scatterplot is a two-dimensional grid of the coordinates of two interval/ratio

variables, X and Y (Ritchey, 2008). The relationship showed in the scatterplot can be a positive correlation or a negative correlation. A positive correlation exists if an increase in X is related to an increase in Y. However, if the increase in X is related to a decrease in Y, it is considered as a negative correlation. In addition, the test can also be used to test linearity by finding the score of deviation from linearity in SPSS. To ensure no linearity problems, the significant score should be more than .05. Table 6.8 shows the analysis results of the test of linearity. The full SPSS output of linearity test is attached in APPENDIX L.

## 6.7 Multiple Regression Analysis

Multiple regressions were carried out to analyze the direct relationship between operational level ERPs system benefits and business performance, internal processes performance, customer service performance and innovation and growth performance. The analyses were carried out through regression analysis. Before conducting the multiple regression analysis, several main assumptions were considered and examined in order to ensure the multiple regression analysis is appropriate (Hair et al., 2006). All the assumptions have been tested and fulfil all the criteria. The following sections explain about regression analysis conducted for this study.

### 6.7.1 Managerial Levels and ERP System Adoption's Benefits

As mentioned in chapter four, different level of manager will have different responsibility, value and activities. Because of that differentiation, they also need different information to support their daily activity and responsibility. At the strategic management level, the information needs are more external and broader based compared to the first two levels. At tactical management, on the other hand, requires more aggregated and externally oriented information than the operational managers.

**Table 6.8: Test of Linearity**

| No. | Linearity of | F-test | Sign | Conclusion |
|---|---|---|---|---|
| 1. | Operational and BP | 1.153 | 0.307 | Linear |
| | Tactical and BP | 1.008 | 0.475 | Linear |
| | Strategic and BP | 1.086 | 0.380 | Linear |
| 2 | Operational and Internal Processes | 1.377 | 0.109 | Linear |
| | Tactical and Internal Processes | 1.127 | 0.335 | Linear |
| | Strategic and Internal Processes | 1.121 | 0.342 | Linear |
| 3 | Operational and Customer | 1.365 | 0.139 | Linear |
| | Tactical and Customer | 1.176 | 0.286 | Linear |
| | Strategic and Customer | 0.416 | 0.993 | Linear |
| 4 | Operational and Finacial | 0.940 | 0.574 | Linear |
| | Tactical and Finacial | 0.808 | 0.739 | Linear |
| | Strategic and Finacial | 0.955 | 0.537 | Linear |
| 5 | Operational and Innovation | 0.909 | 0.618 | Linear |
| | Tactical and Innovation | 0.944 | 0.558 | Linear |
| | Strategic and Innovation | 1.236 | 0.237 | Linear |



At the low or operational level, the nature of information is mostly internal, detailed and frequent. Since information requirements differ according to decision purposes, it is predicted that the benefits of ERP also differ according to managerial levels as stated in the first hypothesis. Hence, the effect of the ERP system adoption benefits differs according to managerial decision levels. There were six hypotheses and one proposition tested in this study. All of hypotheses in the present study were tested using regression analysis, except hypothesis 1 that was tested based on MANOVA analysis. The following is the result of MANOVA and regression analysis for the study.

In order to test hypothesis 1, Multivariate Analysis of Variance (MANOVA) was conducted. The multivariate tests of significance indicate whether there are statistically significant differences among the groups on a linear combination of the dependent variables. According to Pallant (2005), there are a number of statistics to choose from (Wilks' Lambda, Hotelling's Trace, Pillai's Trace). One of the most commonly reported statistics is Wilks' Lambda. Tabachnick and Fidell (2001) recommend Wilks' Lambda for general use. If the

significance level for Wilks' Lambda is less than .05, then it can be concluded that there is a difference among the groups.

Multivariate analysis of variance was performed on four dependent variables: internal processes performance, customer performance, financial performance and innovation and growth performance. Independent variables were operational level, tactical level and strategic level ERP system adoption benefits. MANOVA compares the effect the groups of operational level, tactical level and strategic level ERP system adoption benefits on business performance in term of internal processes performance, customer performance, financial performance and innovation and growth performance. MANOVA showed whether there is a significant difference between the groups on this composite dependent variable. It also provides the univariate results for each of the dependent variables separately. Results of evaluation of assumptions of normality, homogeneity of variance-covariance matrices, linearity and multicollinearity were satisfactory.

There was a statistically significant difference between operational level benefits on internal processes, customer, financial and innovation and growth performance, $F$ (4, 92) = 3.196, $P < .05$; Wilk's $\lambda = 0.878$, partial $\varepsilon^2 = .122$. For tactical level benefits, there was a statistically significant difference between tactical level benefits on internal processes, customer, financial and innovation and growth performance, $F$ (4, 92) = 4.078, $P < .005$; Wilk's $\lambda = 0.849$, partial $\varepsilon^2 = .151$. At the strategic level benefits, there was a statistically significant difference between strategic level benefits on internal processes, customer, financial and innovation and growth performance, $F$ (4, 92) = 4.598, $P < .005$; Wilk's $\lambda = 0.833$, partial $\varepsilon^2 = .167$. The results reflected that there is a different effect between operational, tactical and strategic level ERP system adoption benefits towards internal processes performance, customer performance, financial performance and innovation and growth performance. Table 6.9 shows multivariate tests result based on MANOVA. The full SPSS output of MANOVA is attached in APPENDIX M.

To investigate the effect of each independent variable toward dependent variables, tests between subjects were conducted. Table 6.10 shows the test of between-subject effects result from MANOVA analysis. We can see from the table that operational level benefits has a statistically significant effect on internal processes performance ($F$ (1, 95) = 11.914; $P < .005$; partial $\varepsilon^2 = .111$), but not on customer service, financial and innovation and growth

performance. For tactical level benefits, there is a statistically significant effect of tactical level benefits on customer service performance ($F$ (1, 95) = 4.805; $P$ < .05; partial $\varepsilon^2$ = .048), financial performance ($F$ (1, 95) = 5.922; $P$ < .05; partial $\varepsilon^2$ = .059) and on innovation and growth performance ($F$ (1, 95) = 9.519; $P$ < .005; partial $\varepsilon^2$ = .091) but not on internal processes performance. At the strategic level, there is a statistically significant effect of strategic level benefits on customer service performance ($F$ (1, 95) = 12.536; $P$ < .005; partial $\varepsilon^2$ = .117) and financial performance ($F$ (1, 95) = 5.328; $P$ < .05; partial $\varepsilon^2$ = .053), but not on internal processes and innovation and growth performance. Hence, there is a significant effect of operational level of ERP system adoption benefits toward internal processes performance, but not toward customer performance, financial performance and innovation and growth performance. At tactical level ERP system benefits, there is a significant effect of ERP system adoption benefits at this level toward customer service, financial and innovation and growth performance, but not toward internal processes performance. Strategic level ERP system adoption benefits have significant effect toward customer performance and financial performance, but not toward internal processes innovation and growth performance. The results support H1 where the benefits of adopting the ERP system differ according to managerial decision levels.

The following explanation will present findings about the effect of ERP adoption benefits on business performance, Internal Processes Performance, Customer Service Performance, Financial Performance and Innovation and Growth Performance.

**Table 6.9: Multivariate Tests**

| Effect | | Value | F | Hypothesis df | Error df | Sig. | Partial Eta Squared |
|---|---|---|---|---|---|---|---|
| Intercept | Pillai's Trace | .489 | 22.052(b) | 4.000 | 92.000 | .000 | .489 |
| | Wilks' Lambda | .511 | 22.052(b) | 4.000 | 92.000 | .000 | .489 |
| | Hotelling's Trace | .959 | 22.052(b) | 4.000 | 92.000 | .000 | .489 |
| | Roy's Largest Root | .959 | 22.052(b) | 4.000 | 92.000 | .000 | .489 |
| Operational | Pillai's Trace | .122 | 3.196(b) | 4.000 | 92.000 | .017 | .122 |
| | Wilks' Lambda | .878 | 3.196(b) | 4.000 | 92.000 | .017 | .122 |
| | Hotelling's Trace | .139 | 3.196(b) | 4.000 | 92.000 | .017 | .122 |
| | Roy's Largest Root | .139 | 3.196(b) | 4.000 | 92.000 | .017 | .122 |
| Tactical | Pillai's Trace | .151 | 4.078(b) | 4.000 | 92.000 | .004 | .151 |
| | Wilks' Lambda | .849 | 4.078(b) | 4.000 | 92.000 | .004 | .151 |
| | Hotelling's Trace | .177 | 4.078(b) | 4.000 | 92.000 | .004 | .151 |
| | Roy's Largest Root | .177 | 4.078(b) | 4.000 | 92.000 | .004 | .151 |
| Strategic | Pillai's Trace | .167 | 4.598(b) | 4.000 | 92.000 | .002 | .167 |
| | Wilks' Lambda | .833 | 4.598(b) | 4.000 | 92.000 | .002 | .167 |
| | Hotelling's Trace | .200 | 4.598(b) | 4.000 | 92.000 | .002 | .167 |
| | Roy's Largest Root | .200 | 4.598(b) | 4.000 | 92.000 | .002 | .167 |
| a. Exact statistic | | | | | | | |
| b. Design: Intercept+ Operational + Tactical + Strategic | | | | | | | |

**Table 6.10: Tests of Between-Subjects Effects**

| Source | Dependent Variable | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| Corrected Model | INTER | 6.227(b) | 3 | 2.076 | 7.705 | .000 |
| | CUST | 5.552(c) | 3 | 1.851 | 13.063 | .000 |
| | FIN | 7.489(d) | 3 | 2.496 | 11.097 | .000 |
| | INNOV | 7.256(e) | 3 | 2.419 | 10.782 | .000 |
| Intercept | INTER | 3.978 | 1 | 3.978 | 14.769 | .000 |
| | CUST | 9.253 | 1 | 9.253 | 65.312 | .000 |
| | FIN | 3.728 | 1 | 3.728 | 16.571 | .000 |
| | INNOV | 3.079 | 1 | 3.079 | 13.725 | .000 |
| OPERATIONAL | INTER | 3.209 | 1 | 3.209 | 11.914 | .001 |
| | CUST | .044 | 1 | .044 | .307 | .581 |
| | FIN | .430 | 1 | .430 | 1.910 | .170 |
| | INNOV | .362 | 1 | .362 | 1.612 | .207 |
| TACTICAL | INTER | .285 | 1 | .285 | 1.056 | .307 |
| | CUST | .681 | 1 | .681 | 4.805 | .031 |
| | FIN | 1.332 | 1 | 1.332 | 5.922 | .017 |
| | INNOV | 2.136 | 1 | 2.136 | 9.519 | .003 |
| STRATEGIC | INTER | .007 | 1 | .007 | .025 | .875 |
| | CUST | 1.776 | 1 | 1.776 | 12.536 | .001 |
| | FIN | 1.199 | 1 | 1.199 | 5.328 | .023 |
| | INNOV | .786 | 1 | .786 | 3.505 | .064 |
| Error | INTER | 25.590 | 95 | .269 | | |
| | CUST | 13.459 | 95 | .142 | | |
| | FIN | 21.372 | 95 | .225 | | |
| | INNOV | 21.311 | 95 | .224 | | |
| Total | INTER | 969.000 | 99 | | | |
| | CUST | 1274.125 | 99 | | | |
| | FIN | 1020.556 | 99 | | | |
| | INNOV | 964.111 | 99 | | | |
| Corrected Total | INTER | 31.817 | 98 | | | |
| | CUST | 19.011 | 98 | | | |
| | FIN | 28.861 | 98 | | | |
| | INNOV | 28.568 | 98 | | | |

a Computed using alpha = .05
b R Squared = .196 (Adjusted R Squared = .170)
c R Squared = .292 (Adjusted R Squared = .270)
d R Squared = .259 (Adjusted R Squared = .236)
e R Squared = .254 (Adjusted R Squared = .230)

### 6.7.2 ERP System Adoption Benefits and Internal Processes Performance

The next set of hypothesis examined whether there is a positive relationship between ERP system adoption benefits at the three managerial levels and internal process performance. Specifically, there were three sub-hypothesis posited to test the relationship between ERP system adoption benefits and internal processes performance. First sub-hypothesis is to test the relationship between operational level ERP system benefits and internal process performance. The second sub-hypothesis is to test the relationship between tactical level ERP system benefits and internal process performance. On the third sub-hypothesis, testing was conducted to test the relationship between strategic level ERP system benefits and internal process performance. Summary of the regression results related to the hypothesis are presented in Table 6.12. The full SPSS output of regression analysis is attached in APPENDIX N.

**Table 6.11: Regression Analysis of ERP System Adoption and Internal Processes Performance**

| Dependent Variable | Independent Variable | Std. Coefficient Beta |
|---|---|---|
| Internal Processes Performance | ERP System Adoption Benefits: | |
| | Operational Level Benefits | .417 |
| | Tactical Level Benefits | .100 |
| | Strategic Level Benefits | .019 |
| | $R^2$ | .196 |
| | Adjusted $R^2$ | .170 |
| | Sig. F Change | .000 |

Note: Significant levels: ***p<0.01, **p<0.05, *p<0.10

Table 16.12 presents the regression result of the relationship between ERP system adoption benefits at the three managerial levels and internal process performance (H3a – H3c). From the table, it can be seen that the relationship between the ERP system adoption benefits and internal process performance was significant. ERP system adoption benefits could explain 19.6% of the internal process performance ($R^2$ =.196, p>.01). However, not all of the three levels of ERP system adoption benefits have positive and significant relationship with internal process performance. Only operational level ERP system benefits have positive and significant relationship with internal process performance (β=.316 and p=.001). It means that the higher benefits generated by operational level managers, the higher company's internal process performance. Meanwhile, tactical level (p=.307) and strategic level (p=.875) managers do not have relationship with internal process performance. As a result, hypothesis H2a was supported, but not H2b and H2c.

### 6.7.3 ERP System Adoption Benefits and Customer Service Performance

The third set of hypothesis examined whether there is a positive relationship between ERP system adoption benefits at the three managerial levels and customer service performance. Specifically, there were three sub-hypothesis posited to test the relationship between ERP system adoption benefits and customer service performance. First sub-hypothesis is to test the relationship between operational level ERP system benefits and customer service performance. The second sub-hypothesis is to test the relationship between tactical level ERP system benefits and customer service performance. On the third sub-hypothesis, testing was conducted to test the relationship between strategic level ERP system benefits and customer service performance. Summary of the regression results related to the hypothesis are presented in Table 6.13. The full SPSS output of regression analysis is attached in APPENDIX N.

**Table 6.12: Regression Analysis of ERP System Adoption and Customer Service Performance**

| Dependent Variable | Independent Variable | Std. Coefficient Beta |
|---|---|---|
| Customer Service Performance | ERP System Adoption Benefits: | |
| | Operational Level Benefits | .063 |
| | Tactical Level Benefits | .199 |
| | Strategic Level Benefits | .403 |
| | $R^2$ | .292 |
| | Adjusted $R^2$ | .270 |
| | Sig. F Change | .000 |

Note: Significant levels: ***p<0.01, **p<0.05, *p<0.10

Table 6.13 presents the regression result of the relationship between ERP system adoption benefits at the three managerial levels and customer service performance (H4a – H4c). From the table, it can be seen that the relationship between the ERP system adoption benefits and customer service performance was significant. ERP system adoption benefits could explain 29.2% of the customer service performance ($R^2$ =.292, p>.01). However, not all of the three levels of ERP system adoption benefits have positive and significant relationship with customer service performance. Operational level benefits do not have significant relationship with customer service performance (p=.581). However, tactical level benefits (β=.199 and p=.031) and strategic level benefits (β=.403 and p=.001) have positive and significant relationship with customer service performance. It shows that the higher the benefits experienced by the tactical and strategic level managers, the higher company's

customer service performance. As a result, hypothesis H3a was not supported, but H3b and H3c were supported.

### 6.7.4 ERP System Adoption Benefits and Financial Performance

The third set of hypothesis examined whether there is a positive relationship between ERP system adoption benefits at the three managerial levels and financial performance. Specifically, there were three sub-hypothesis posited to test the relationship between ERP system adoption benefits and financial performance. First sub-hypothesis is to test the relationship between operational level ERP system benefits and financial performance. The second sub-hypothesis is to test the relationship between tactical level ERP system benefits and financial performance. On the third sub-hypothesis, testing was conducted to test the relationship between strategic level ERP system benefits and financial performance. Summary of the regression results related to the hypothesis are presented in Table 6.14. The full SPSS output of regression analysis is attached in APPENDIX N.

**Table 6.13: Regression Analysis of ERP System Adoption and Financial Performance**

| Dependent Variable | Independent Variable | Std. Coefficient Beta |
|---|---|---|
| Financial Performance | ERP System Adoption Benefits: | |
| | Operational Level Benefits | .160 |
| | Tactical Level Benefits | .226 |
| | Strategic Level Benefits | .269 |
| | $R^2$ | .259 |
| | Adjusted $R^2$ | .236 |
| | Sig. F Change | .000 |

Note: Significant levels: ***p<0.01, **p<0.05, *p<0.10

Table 6.14 presents the regression result of the relationship between ERP system adoption benefits at the three managerial levels and financial performance (H5a – H5c). From the table, it can be seen that the relationship between the ERP system adoption benefits and financial performance was significant. ERP system adoption benefits could explain 25.9% of the financial performance ($R^2$ =.259, p>.01). However, not all of the three levels of ERP system adoption benefits have positive and significant relationship with financial performance. Operational level benefits do not have significant relationship with financial performance (p=.170). However, tactical level benefits (β=.226 and p=.017) and strategic level benefits (β=.269 and p=.023) have positive and significant relationship with financial performance. It

shows that the higher the benefits experienced by the tactical and strategic level managers, the higher company's financial performance. As a result, hypothesis H4a was not supported, but H4b and H4c were supported.

### 6.7.5 ERP System Adoption Benefits and Innovation and Growth Performance

The final set of hypothesis examined whether there is a positive relationship between ERP system adoption benefits at the three managerial levels and innovation and growth performance. Specifically, there were three sub-hypothesis posited to test the relationship between ERP system adoption benefits and innovation and growth performance. First sub-hypothesis is to test the relationship between operational level ERP system benefits and innovation and growth performance. The second sub-hypothesis is to test the relationship between tactical level ERP system benefits and innovation and growth performance. On the third sub-hypothesis, testing was conducted to test the relationship between strategic level ERP system benefits and innovation and growth performance. Summary of the regression results related to the hypothesis are presented in Table 6.15. The full SPSS output of regression analysis is attached in APPENDIX N.

**Table 6.14: Regression Analysis of ERP System Adoption and Innovation and Growth Performance**

| Dependent Variable | Independent Variable | Std. Coefficient Beta |
|---|---|---|
| Innovation and Growth Performance | ERP System Adoption Benefits: | |
| | Operational Level Benefits | .148 |
| | Tactical Level Benefits | .288 |
| | Strategic Level Benefits | .219 |
| | $R^2$ | .254 |
| | Adjusted $R^2$ | .230 |
| | Sig. F Change | .000 |

Note: Significant levels: ***p<0.01, **p<0.05, *p<0.10

Table 6.15 presents the regression result of the relationship between ERP system adoption benefits at the three managerial levels and innovation and growth performance (H6a – H6c). From the table, it can be seen that the relationship between the ERP system adoption benefits and innovation and growth performance was significant. ERP system adoption benefits could explain 25.4% of the innovation and growth performance ($R^2$ =.254, p<.01). However, not all of the three levels of ERP system adoption benefits have positive and significant relationship with customer service performance. Operational (p=.207) and tactical

(p=.064) level benefits do not have significant relationship with innovation and growth performance. However, tactical level benefits (β=.288 and p=.003) have positive and significant relationship with innovation and growth performance. It shows that the higher the benefits experienced by the tactical level managers, the higher company's innovation and growth performance. As a result, hypothesis H5a and H5c were not supported, but H5b was supported.

## 6.8 Summary

This chapter has presented the results of the analyses carried out in this study. It was started with general overview of the studied population which spans from the response rate to test the response bias. Detail discussions on matter pertaining to goodness of measure and the diagnostic test were also put forth. Consequently, after fulfilling the basic assumptions, the result of the regression analysis were presented and interpreted. Finally, the results from the statistical analyses were

**Table 6.15: Summary of Research Findings**

| Hypothesis Number | Dependent Variable | Independent Variable | Analysis method | Sign. | Hypothesis Supported/ Not Supported |
|---|---|---|---|---|---|
| H1 | Business Performance | Operational | MANOVA | | H1 Supported |
| | | Tactical | | | |
| | | Startegic | | | |
| | | | | | |
| H2a | Internal Processess Performance | Operational | Multiple Regression | .001 | H3a supported |
| H2b | | Tactical | | .307 | H3b not supported |
| H2c | | Startegic | | .875 | H3c not supported |
| H2 | | ERP Adoption | | .000 | H3 was partially supported |
| | | | | | |
| H3a | Customer Service Performance | Operational | Multiple Regression | .581 | H4a not supported |
| H3b | | Tactical | | .031 | H4b supported |
| H3c | | Startegic | | .001 | H4c supported |
| H3 | | ERP Adoption | | .000 | H4 supported |
| | | | | | |
| H4a | Financial Performance | Operational | Multiple Regression | .170 | H5a not supported |
| H4b | | Tactical | | .017 | H5b supported |
| H4c | | Startegic | | .023 | H5c supported |
| H4 | | ERP Adoption | | .000 | H5 was partially supported |
| H5a | Innovation and Growth Performance | Operational | Multiple Regression | .207 | H6a not supported |
| H5b | | Tactical | | .003 | H6b supported |
| H5c | | Startegic | | .064 | H6c not supported |
| H5 | | ERP Adoption | | .000 | H6 was partially supported |

| | | | | | |
|---|---|---|---|---|---|
| Proposisition | | ERP-Scorecard Adoption | In Depth Interview | | Increase Company's Performance |

reflected trough the hypothesis testing. Further discussion on the findings of the research and its implication will be provided in the following chapter.

# CHAPTER 7

# DISCUSSION, CONCLUSION AND IMPLICATIONS

## 7.1 Introduction

This chapter presents discussion about level of ERP system benefits at the three managerial levels and effect of ERP system adoption benefits on business performance. It also discusses about the effect of ERP system adoption benefits on internal processes performance, customer performance, financial performance and innovation, growth performance and effect of integrating ERP system and BSC. The chapter ends with conclusion, research implication and strength, limitation and future research.

## 7.2 Discussion of the Findings

This section presents the detailed discussion of the research's findings by reflecting the research questions that were attempted to be addressed by the current research. Discussion of the findings is arranged according to the sequence of the research objectives. The following will discuss the level of ERP benefits at the three levels of ERP adoption, the effect of ERP adoption benefits on business performance and on each of the BSC perspectives, a comparison on the effect of different levels of ERP adoption benefits on the four BSC perspectives as performance measurement, and whether there is an increase in business performance when ERP system is integrated with BSC.

### 7.2.1 Levels of ERP System Benefits at the Three Levels of Management

The investigation on these issues aims at identifying levels of ERP system benefits at the three management levels after adopting ERP system in the Malaysian manufacturing environment. The research question needs to be answered is: what are the levels of ERP system adoption benefits at operational, tactical and strategic levels of managers in the Malaysian manufacturing environment?

Based on the analysis mentioned in the previous section, on average, not all the independent variables (operational, tactical and strategic levels of ERP adoption benefits) have a mean score above three. Only operational and tactical level have mean score above three. This means that the benefits generated by operational and tactical levels of managers were classified as high, but not at strategic level. This condition happens because by adopting ERP, the clerks that conduct operational activities can automate their job with the system. They do not have to send the data manually by using hard copy documents to other departments. In addition, they do not have to prepare reports manually for their subordinates manually. Preparing the report sometimes takes a lot of time in gathering of data and provision of report. For example, a purchase entered in the order module passes the order to a manufacturing application, which in turn sends a materials request to the supply-chain module, which gets the necessary parts from suppliers and uses a logistics module to get them to the factory. The traditional application systems, which organizations generally employ, treat each transaction separately. They are built around the strong boundaries of specific functions that a specific application is meant to cater for. ERP stops treating these transactions as stand alone activities and considers them to be a part of interlinked processes that make up the business (Gupta, 2000).



This finding supports Yen, Chou and Chang (2002) study. Their study found out that ERP provides the enterprise-wide solution to deliver many benefits such as low operating costs and improved customer service, thus enhancing their business operations in many areas. An ERP system can be used as a tool to help improve the performance level of a supply chain network by helping to reduce cycle times (Gardiner et al., 2002). ERP is comprised of a commercial software package that promises the seamless integration of all the information flowing throughout the company, including financial, accounting, human resources, supply chain and customer information. ERP systems are large computer systems that integrate application programs in accounting (i.e. accounts receivable), sales (i.e. order booking), manufacturing (i.e. product shipping) and the other functions in the firm.

The findings also support Shang and Seddon (2002) study. At the operational level, ES adoption will cause cost reduction, cycle time reduction, productivity improvement, quality improvement and customer service improvement. At the managerial level, ERP adoption will provide better resource management, improved decision making and planning and performance improvement. Eventhough it is not that high, at the strategic level, the adoption will support business growth, support business alliances, build business innovations, build cost leadership, generate product differentiation (including customization) and build external linkages (customers and suppliers).

However, benefits of the ERP adoption at tactical level were higher than at operational and strategic levels. The result shows that even though managers at all levels of the manufacturing company can obtain benefits from ERP system adoption, managers at the tactical level will obtain the most benefits. This implies that the core applications are used to conduct data procesing and the information will be sent to the higher level managers to conduct day to day operation. Middle level managers receive the most advantage from the ERP system adoption. Core applications or on-line transaction processing (OLTP) applications are those applications that operationally support the day to day activities of the business. They function as transaction processing systems. These applications support mission-critical tasks through simple queries of the operational database, which include sales and distribution, business planning, production planning, shop floor control and logistics modules. It can be concluded that all levels of managers in the manufacturing obtain benefits from ERP adoption, but the tactical level managers obtain the most benefits. This finding was supported by all Malaysian manufacturing CEOs that were interviewed to confirm the results of this study. One of the CEO interviewed mentioned that as a result of ERP system adoption, his company experienced a shortening of business processes by 72 hours in a month, increased efficiency by increasing delivery speed of life saving medicine to customers and the provision of service to the community with a higher profit. He also mentioned that after adopting the ERP system, inventory theft or loss was voided. According to the CEO, in 2006, with RM1billion of revenue and RM95

million of inventory, only RM400 (0.00%) of the inventory was untraceable.

### 7.2.2 The Effect of ERP System Adoption Benefits on Internal Processes Performance

This study found out that ERP adoption at the operational, tactical and strategic levels has a positive and significant influence on the company's internal processes performance. This means that at the operational level, the ERP system can reduce errors in production processing, reduce time to purchase from suppliers, reduce time to serve customers, reduce time to process employee administration, improve data accuracy and reliability, improve work scheduling and improve information access speed. At the tactical level, the system can improve decision quality, improve the frequency of staff monitoring, asset management, production management and workforce management. On the other hand, at the strategic level, the ERP system can build external linkages with related business parties easily, easily adapt to technology changes, support business growth in competition, support business growth in capability, support business growth with new products, support business growth with increasing numbers of employees, support business growth in new markets and enable worldwide expansion with centralized world operations.



The findings support studies by Davenport (1998) and Gupta and Kohli (2006) whereby ERP system implementation can standardize and accelerate the company's business processes. It also supports Rikhardson and Kraemmergaard (2006) study whereby organizational impacts of ERP system implementation include changes in IT function, increase in informational technology literacy, integration effects and better understanding of the business. Coordination of accounting processes, integration of business processes and better understanding of the business processes can be grouped as the ability of the manufacturing company to develop internal processes. Mabert et al. (2003) found that integration of business processes, availability of information and quality of information are the areas benefiting the most from ERP systems implementation. They also found that ERP implementation can improve inventory management and supplier

management/ procurement. This means that ERP implementation can affect the internal business processes of a company. ERP system implementation can support production capacity planning, provide more accurate market demand forecasts and improve manufacturing flexibility (Hsu and Chen, 2004).

Meanwhile, continued analysis on the individual effect of independent variables noted that the benefits of ERP adoption on internal processes are not significant at the tactical and strategic levels. However, for the operational level, the benefit is highly significant (at 1 percent). The result suggests that the ERP system is critical to support internal processes at the operational level. For example, ERP systems reduce error in production, purchasing lead time, customer service-time, processing of employee administration and improve information access speed. On the other hand, the tactical and strategic level managers do not report benefits related to internal processes because they are less likely to be involved in these functions. Their decision making processes require qualitative elements and critical thinking, such as planning for business growth and expansion.

These results were in line with interview results with CEOs of Malaysian manufacturing companies. According to them, ERP system adoption can streamline work flow, increase audit ability, give a better span of control, improve product costing, differentiate customer orders in a more detailed manner, can process difficult data quickly and easily, manage a variety of orders for different products and shorten the customer order processing time from 60 days to 3 days.

### 7.2.3 The Effect of ERP System Adoption Benefits on Customer Service Performance

ERP adoption at the operational, tactical and strategic levels has a positive and significant influence on company's customer service performance. This means that at the operational level, ERP system can access customer data and customer inquiries more easily, improve customer response time, reduce customer complaints, reduce customer processing errors, ease customer order and service and improve customer satisfaction. At the tactical level, ERP system can improve

production scheduling, increase customer product demands, improve the flexibility of customer services, expand customer base to other regions and increase partnership with customers. At the strategic level, the system can enable e-business through the web integration capability, support interactive customer services, improve product design through customer direct feedback, expand to new e-market easily and build virtual corporation with a virtual supply and demand consortium.

This findings support Davenport (1998) study where ERP system implementation can integrate customer order information. As a consequence of that integration, order processing can be increased, easier coordination and information sharing among departments is achieved and better customer services is provided. It also supports Hsu and Chen (2004) study that found that ERP implementation affects customer satisfaction. Based on their research, ERP implementation can control and improve product quality, reduce the cycle time of order fulfilments, increase response time to customer order and inquiries, improve service quality, improve customer satisfaction and loyalty and increase purchases from customers. McAfee (2002) provides evidence for improvements in throughput, customer response times and delivery speeds. Hsu and Chen (2004) report that customer satisfaction increases with ERP implementation through improved product quality, order cycle time, response time, service quality and customer loyalty.

On the other hand, continued analysis on the individual effect of independent variables noted that tactical and strategic level benefits significantly and positively affect the customer service performance. This means that the ERP system adopted and used by higher level managers can increase customer service performance, but this was not the case for operational managers. As expected, the highest benefit is achieved at the higher level. This finding provides evidence that today's companies are serious about satisfying customers' needs and the responsibility rests with the higher level. At the operational, the results show that the benefits of ERP are not significant since the operational level managers normally do not interact directly with the customers except for order processing

services. At the tactical and strategic level, the systems assist in long-term product design, innovation and expansion strategies. In addition, at the strategic level, the system can enable e-business through the web integration capability, support interactive customer services, improve product design through customer direct feedback, expand to new e-market easily and build virtual corporation with a virtual supply and demand consortium.The findings support the third hypothesis and are also in line with Hsu and Chen (2004) who reported that customer satisfaction increases with ERP implementation.

The findings were also supported by interview results with CEOs of Malaysian manufacturing companies. They experienced a higher customer service performance after adopting the ERP system. According to them, the ERP is a stepping stone towards activity based costing (ABC) and the manufacturing company will attain capability for on-line transaction processing and tracking (e.g. buy, sell, inventory control, hours accounting, manufacturing shop floor control). Through the ERP system usage, they can record and trace data by using real time accurately. In addition to that, time to serve customer is reduced because the manufacturing company can better serve the customer, hence this will increase customer satisfaction and community service.



### 7.2.4 The Effect of ERP System Adoption Benefits on Financial Performance

Based on the findings, ERP adoption benefits at the operational, tactical and strategic levels will have a positive and significant influence on financial performance. This implies that at the operational level, the ERP system can reduce administrative cost, remove redundant processes, reduce inventory-carrying cost and lower labor cost. At the tactical level, the system can conduct better forecasting, improve profit and cost control, increase market share, increase financial control and increase equity capitalization. At the strategic level, it can increase new markets, enable worldwide expansion with global resource management, enable worldwide expansion with foreign currency capability, enable worldwide expansion with global market penetration, enable worldwide expansion

by deploying solutions quickly and build cost leadership by increasing process efficiency.

The findings support Rikhardson and Krammergaard (2006) study. They found out that ERP system adoption can reduce inventory costs and therefore cause a related reduction in the cost of capital. The reasons for reduced inventory costs were attributed to better planning, better coordination with suppliers and customers, better integration between purchasing, productions and sales and shorter order cycle times. Companies could order smaller quantities at a time, thereby reducing inventory costs. The findings also support Hunton et al. (2003) and Hayes et al. (2001) studies. They found out that return on assets (ROA), return on investment (ROI) and asset turnover (ATO) were significantly better over a 3-year period for adopters, as compared to non-adopters. Mabert at al. (2003) found that the ERP system improves direct operating costs, inventory levels and cash management. Spathis and Ananiadis (2005) found that ERP system implementation can reduce information technology cost and decrease total operation costs. Shang and Seddon (2000) also found that ERP system implementation can reduce the operational cost of a company. ERP implementation can also decrease the inventory level and cost, which can increase profit (Hsu & Chen, 2004).

The research results were supported by the experiences of the CEOs of Malaysian manufacturers. One of the CEO interviewed mentioned that after implementing ERP, his company experienced some benefits in terms of financial performance. The benefits experienced were lower inventory control/holding cost, reduced operating cost due to improved efficiency, lower production cost and lower marketing cost. One of the CEO interviewed recounted that his company experienced a 12% increase in sales from 1999 to 2007 after adopting ERP. The company further experienced a 51% increase on sales from 2007 to 2008.

Unfortunately, the findings were not supported when the analysis was conducted individually. It is found that only ERP adoption at tactical and strategic

levels significantly and positively affects financial performance. ERP adoption at the operational level does not significantly affect the financial performance. It means that the ERP system adopted and used by tactical and strategic level managers can increase financial performance, but this was not the case for operational level managers. The benefits of adopting ERP systems are not statistically significant at the operational level even though the beta coefficient is positive. At the tactical level, the systems improve financial forecasting, profit planning, cost control and monitoring. At the strategic level, the systems assist the managers to strategically plan for sustainable profitability and market positioning.

### 7.2.5 The Effect of ERP System Adoption Benefits on Innovation and Growth Performance

The findings show that ERP adoption at the operational, tactical and strategic levels has a positive and significant influence on the company's innovation and growth performance. At the operational level, the ERP system can increase user involvement in training, increase products produced per employee, increase customer served per employee and increase accessibility of enterprise information. At the tactical level, the system can increase decision making skills, support worker ability for taking action quickly, support management processes efficiency and increase manager knowledge. At the strategic level, the system can build new process chains, build new market strategies, create new business lines, customize product or services and provide a lean production.

The findings support Wang et al. (2006) study where willingness to participate and commitment to learning that exist in ERP system adoption have significant effects on the outcome of group cohesion in implementing organizational innovations. It also supports Rikhardson and Kraemmergaard (2006) study. By adopting ERP, employees can increase informational technology literacy and the integration effect, both of which can be grouped as the ability of the manufacturing company to grow. ERP system implementation can increase knowledge sharing of a company (Jones et al., 2006). According to them, opportunities for knowledge sharing are present on the ERP team because the

knowledge that individuals must have for ERP implementation is more diverse than the knowledge required for traditional jobs. By increasing employee participation, the manufacturing company can develop the manufacturing company ability to grow. In addition, an ERP implementation team interacts with other organizational members to gather relevant information and keep them informed about changes when the ERP is implemented. The ERP system integrates business processes across functions and units, thereby creating a divergence in the required knowledge of organizational members (Baskerville et al., 2000; Jones et al., 2006).

The findings are supported by interview results with CEOs of Malaysian manufacturing companies. According to them by adopting the ERP system, the manufacturing company can grow and survive in business because it is linked to the creation of new products and services and to the adoption of novel ways of doing business whilst constantly improving the internal business processes, procedure, policies and business models. The ERP can increase IT function whereby the employees can obtain data from the data mart at their own desk. The ERP can also increase employees' self confidence in performing their jobs.



On the other hand, continued analysis on the individual effect of independent variables, noted that only ERP adoption at tactical levels significantly and positively affects the innovation and growth performance. On the other hand, operational and strategic level does not significantly affect the business performance. This finding implies that the operational and strategic managers are not heavily involved in innovation and growth activities. The tactical level managers reported experiencing greater benefits from the ERP systems in handling this area of their responsibilities.

### 7.2.6 The Effect of ERP System Adoption Benefits on Business Performance

Based on previous analysis, it shown that ERP adoption benefits at the operational, tactical and strategic levels has a positive and significant influence on company's business performance. The benefits adopted at operational, tactical and strategic

level influence the business performance in different way. This means that the ERP system adopted and used by the three levels of managers in manufacturing companies can increase the companies' business performance positively and significantly. By implementing the ERP, the manufacturing company can automate business process to cut costs and avoid delays processing. Processes expedited process until product or service delivery to customer. Finally, if the customer order process can be conducted in a shorter time, this will increase satisfaction. Satisfy customers will be back to order more products and this will increase retention rate. Retention rate will increase revenue and finally, increase profits.

Another reason why ERP can increase performance is that the system can increase the quality of customer service, quality of products, gain competitive advantage through increase of customer services, increase on-time delivery and increase customer partnership. In addition, the system can also increase efficiency ratios, and reduce complaints amount, cycle time, failure amount and cycle time. Training amount, better employee morale, development of workers' qualification, return on investment, return on assets, operating profits, sales growth rate, cost reduction and Economic Value Added can be better managed through the ERP system.



The findings support the study conducted by Hunton et al. (2002). The author experimentally tested the relationship between ERP and performance by presenting 63 certified financial analysts at a financial services firm with a hypothetical case of a company and comparing these analysts' initial earning forecasts with their forecasts after they were told that the hypothetical firm had committed to invest in an ERP system. The results of the experiment indicated that the revisions in earnings is positive, thereby providing support for the hypothesis that implementation of ERP systems have a positive effect on business performance. The findings also supported Shang and Seddon (2002) study because by adopting ERP, the companies can support organizational changes, facilitate business learning and increase managerial empowerment and the ability to built common visions.

The findings also support Hsu and Chen (2004) study. Based on their study, ERP adoption can create tangible and tangible benefits. Tangible benefits can increase business performance because the adoption can support capacity planning, provide more accurate market demand forecast, facilitate mass customization and improve manufacturing flexibility, increase inventory turnover rate, decrease inventory level and cost, control and improve product quality, speed up new product development cycle and time-to-market, reduce the cycle time of order fulfillment and achieve operational excellence. Indirectly, intangible benefits can also contribute to increasing business performance, in the following ways: allocate enterprise resources better, increase communications among departments, integrate information across the enterprise, increase the ability of critical operational and decision support information to provide visibility of enterprise planning activities, provide access to real-time business intelligence, improve information flow among departments, increase response time to customer order and inquiries, improve service quality, improve customer satisfaction and loyalty and increase purchase from customers.

The findings are also in line with the opinions of CEOs of Malaysian manufacturing companies on ERP adoption. One of the CEO interviewed has an opinion that ERP can increase business performance through better internal processes, customer services and innovation and growth. The benefits from ERP adoption arose out of management's ability to have up-to-the-minute access to information for decision making and managerial control, integration across functional areas within the business unit, and online transaction processing in order to stay ahead of the competition. One of the CEO interviewed mentioned that ERP is a minimum requirement nowadays; it is a must for manufacturing companies because it automates all data processing, ensures data accuracy to support ISO, prevents data redundancy, eases the management of personnel. On another occasion, the other CEO mentioned that 70% of the data needed to calculate key performance indicator is generated from the ERP. The ERP can also shorten the business processes from 60 days with the manual system to 72 hours with the ERP. In addition, the ERP can help the manufacturing company to provide good services to

community and earn a profit as well as increased responsiveness due to up to one day service delivery for life saving drugs. That is why the CEO mentioned that ERP is a minimum requirement nowadays.

### 7.2.7 Effect of Integrating ERP System and Balanced Scorecards

Based on interviews with Malaysian manufacturing CEOs, it is concluded that integrating ERP system with BSC can further improve the company's business performance. By using the ERP system, data that has been gathered and integrated at the operational level can be used to produce any information needed by any other manager in the company. As mentioned by Hall (2007), besides online transaction processing (OLTP), the ERP system has a business analysis applications function that is called on-line analytical processing (OLAP). The application includes decision support, modelling, information retrieval, ad hoc reporting/analysis and what-if analysis. The applications supply management with "real time" information and permit timely decisions to improve performance and achieve competitive advantage. They also support management-critical tasks through analytical investigation of complex data associations captured in data warehouses with consolidation, drill down and slicing and dicing capabilities.



The research results also support Chand et al. (2005) and Marnewick and Labuschagne (2005) in that generic module of the ERP system includes finance, human resource, supplier relationship management (SRM) and Business Intelligence (BI). According to the author, BI applications are decision support tools that enable real-time and interactive access to and analysis and manipulation of mission-critical corporate information. These tools prevent the potential loss of knowledge within the enterprise that results from massive information accumulation.

## 7.3 Conclusion

One of the greatest benefits of the ERP system is the integration of processes, data and organisational elements. This integration unites all major business processes from order processing to product distribution within a single family of software

modules. In today's knowledge economy, ERP systems, along with other technological advances such as e-commerce play a significant role to ensure that a business is sustainable. The systems assist companies in aligning managerial performance with the strategic plan. Intense global competition, reduced duration of product life cycles and constant changes in the business landscape require companies to demand integrated information systems for decision making. Based on the data analysis and discussion in the previous chapters, this research concludes that:

1. The perceived benefits of ERP system adoption are measurable, and are high for each of the three managerial levels based on balanced scorecard perspectives. This means that managers at operational, tactical and strategic levels in Malaysian manufacturing companies experienced better job performance through automation and better integration of data and information in using the ERP system. However, the benefits of adopting the ERP system differ according to managerial decision levels. Operational managers experienced the highest benefits from the ERP adoption. The results show that through data automation and integration, ERP system adoption directly aid the operational level managers in conducting their jobs more efficiently and effectively. Data and information provided by the ERP system are suitable with the data characteristics needed by the managers at this level which include up-to-date, instant, highly accurate, very detailed, easily accessed and having a fixed structure and image.

2. ERP system adoption at the three managerial levels is positively and significantly related to a company's business performance. This implies that by adopting ERP systems in manufacturing companies, managers at all levels use the integrated system to collectively improve company's business performance. This happens because by using the ERP system, managers are able to access and produce information to support decision making on a real time basis and to communicate with each other. Based on interview with Malaysian manufacturing CEOS, the findings show that by adopting an ERP system, operational managers can better supervise the operations of the organisation as compared to without the ERP system. Tactical level managers can easily translate the general goals and plans

developed by strategic managers into more specific objectives and activities. Meanwhile, the strategic level managers can focus on long term issues and emphasise the survival, growth and overall effectiveness of the organisation by taking advantage of the real time information.

3. When the performance is categorised according to the four balanced scorecard perspectives, the results show differences in benefits. Even though managers experience benefits from ERP implementation, the level of significance varies according to different BSC perspectives. ERP system adoption is partially positively and significantly related to the performance of internal processes. Only ERP system adoption at the operational level is positively and significantly related to the performance of internal processes. Meanwhile, ERP system adoptions at tactical and strategic levels are not positively related to the performance of internal processes. This means that ERP adoption at the operational level has a direct impact on a company's business performance through the improvement in efficiency ratio, a reduced complaints and failures, improvement in production ratio, and reduction in cycle time and employee turnover.

4. ERP system adoption at the three managerial levels is partially positively and significantly related to the performance of customer service. ERP system adoptions at operational are not positively related to the performance of customer service. Only ERP system adoption at the tactical and strategic level is positively and significantly related to the performance of customer service. This implies that the ERP system adopted and used by higher level managers can increase customer service performance, but this is not the case for operational managers. ERP system adoption at the tactical and strategic level increases the performance because the manufacturing company is able to improve the quality of customer service and of its products, gain competitive advantage, increase on-time delivery and increase the number of customer partnerships.

5. ERP system adoption at the three managerial levels is partially positively and significantly related to the company's financial performance. ERP system adoption at the operational level is not positively related to the company's

financial performance. Meanwhile, ERP system adoptions at tactical and strategic levels are positively and significantly related to the company's financial performance. This is in line with the role of tactical level managers where they provide the support and coordination to bring about a large financial advantage from the independent frontline units. Meanwhile, strategic managers create and embed a sense of direction, commitment and challenge to people throughout the organisation to achieve the company's financial targets. ERP system adoption at tactical and strategic levels improves return on investment, return on assets, operating profits, sales growth rate, cost reduction programs and Economic Value Added.

6. ERP system adoption at the three managerial levels is partially positively and significantly related to a company's innovation and growth performance. ERP system adoption at the operational and strategic level is not positively related to company's innovation and growth performance, but adoptions at tactical levels are positively related to company's innovation and growth performance. This implies that through ERP system adoption at tactical level managers improve a company's business performance by improving the company's innovation and growth performance. The ERP system adoption at those levels may cause an improvement in the amount of employee training, employee empowerment, employee morale and an enhancement of worker qualifications.

7. The benefits of adopting the ERP system increases when the system is integrated with the Balanced Scorecard. This empirical research also contributes to the study of the usefulness of BSC as an additional tool for managers in performance monitoring and evaluation. In the ERP scorecard, the benefits of ERP adoption are evaluated not only in financial terms but also in terms of process level performance, customer value and organisation learning value. The combination of financial and non financial values offers a deeper analysis of the sources of benefits of ERP systems and the future impact on the bottom line. The findings suggest that the ERP scorecard offers a systematic perspective on the analysis of the ERP effect on business performance as well as its ability to enhance business performance. Thus, integrating the BSC with the ERP system

provides an additional competitive edge for these companies by increasing the effectiveness and efficiency of information provided.

## 7.4 Research Implications

### 7.4.1 Practical Implications

#### a. Practical Implications for Manufacturing Companies

As noted in the results, managers at the three managerial levels have experienced benefits from ERP system adoption and the adoption can improve the company's business performance. This implies that all managers contribute towards achieving a company's objectives, goals, missions and vision. Hence, all of them should be actively involved in developing the manufacturing company information system that provides data and information suitable for their own needs. Successful information system development should not be the responsibility of Chief Information Officers only. All managers should work hand in hand to create an information system that produces high quality information that is accurate, free from error, relevant, complete and aggregated. In addition, an integrated ERP system and Balanced Scorecard maximises benefits; hence a manufacturing company should simultaneously develop its information system and performance measurement system. Integrating information system with multiple performance measurements or the BSC can assist sustaining the company's competitive advantage.

#### b. Practical Implications for Operational Level Managers

Operational level managers achieve the highest benefits from ERP adoption among the three managerial levels. Operational managers use the core application of ERP system in their work. Core applications that operationally support the day-to-day business activities enable the managers' jobs to be done more accurately and easily. Based on the research findings, ERP adoption at the operational level increases the company's business performance through internal processes performance. Hence, the managers should ensure that these applications work

well without interruption to provide common data for all units and departments in a company. If these applications fail, so does the business.

At this level, managers should make sure that they can easily access customer data and inquiry, improve response time, reduce customer complaints and processing errors and improve customer satisfaction. They should also able to reduce error in production processing, reduce time to purchase from suppliers, reduce time to serve customers, reduce time to process employee administration, improve data accuracy and reliability and improve work scheduling and information access speed. They are also required to increase user involvement in training, increase products produced per employee, increase customers served per employee, increase accessibility of enterprise information to reduce administrative cost, remove redundant processes and reduce inventory carrying cost.

### c. Practical Implications for Tactical Level Managers

ERP adoption at the tactical level affects a company's business performance by increasing financial and innovation and growth performances. Real time information that is supplied by core applications at the operational level permits managers at the tactical level to make timely decisions to improve performance and achieve competitive advantage. The managers at this level should use decision support modules, modelling, ad hoc reporting and analysis and 'what if' analysis to set company's goals in the short term basis so as to increase short term financial and innovation performances.

At this level, managers should be able to improve production scheduling, increase customer product demands, improve flexibility of customer services, expand customer base to other regions, and increase partnership with customers. They also need to improve decision quality, improve the frequency of staff monitoring, improve asset management, improve production management, and improve workforce management. By using the ERP system, they should also be able to increase decision making skills, support worker ability for taking action quickly, support management process efficiency, increase managers' knowledge to conduct better forecasting, improve profit and cost control, increase market share, increase financial control and increase equity capitalisation.



### d. Practical Implications for Strategic Level Managers

ERP adoption at the strategic level affects a company's business performance by improving customer service, financial and innovation and growth performance. Real time information that is supplied by core applications of the operational and application modules at the tactical level permits managers at the strategic level to make timely decisions to improve business performance and achieve sustainable competitive advantage. The managers at this level should use decision support modules, modelling, ad hoc reporting and analysis and 'what if' analysis to set company's goals in the long term basis to increase long term business performances.

In addition, ERP system adopted and used by strategic level managers can increase customer service performance, but not at the operational and tactical levels. The results highlight the fact that satisfying customers now become the strategic agenda for most manufacturing companies. In previous practices, the role of servicing the customers was left to the retailers where actual interactions take place. In today's competitive world market, the customer perspective becomes a priority area in strategic decision making and the ERP system is utilised to serve this need. Managers at this level should put customer service on the agenda to be strategically planned for to achieve long term objectives.

To achieve the objectives, the strategic level managers should use the ERP system to enable e-business through the web integration capability, support interactive customer services, improve product design through customers' direct feedback, expand to new e-markets easily and build virtual co-operation with the virtual supply and demand consortium. The managers will also able to build external linkages with related business parties easily, adapt to technology changes easily, support business growth in competition, capability, new products, increasing numbers of employees, new markets and enable worldwide expansion with a centralised global operation. Through the ERP system they are able to build new process chains, new market strategies, new business lines, customise product or services and provide lean production to increase new markets, enable worldwide expansion with global resource management, enable worldwide expansion with foreign currency capability, enable worldwide expansion with global market penetration, enable worldwide expansion by deploying solutions quickly and build cost leadership by increasing processes efficiency.

### 7.4.2 Theoretical Implications

Theoretical implications of the study are as follows:

1. The competency of managers at all levels contributes to a company's performance. The findings support the contingency theory which states that decision quality is expected to be higher if information flows smoothly between subordinates and superiors or among the subordinates and superior

themselves. The ERP system provides real time information for managers' timely decision making. In order to support real time information generation, all managers are required to have IT capability in different ways. Lower level managers need On-Line Transaction Processing (OLTP) to provide real time data and information. Meanwhile, upper levels need On-Line Analytical Processing (OLAP) that is integrated with OLTP to provide analytical tools that support decision making. The research findings support the contingency theory in that every manager in a manufacturing company utilises his own creativity in order to successfully lead the organisation. However, the design of an organisation's information system must fit with the environment and also its subsystems as the needs of an organisation are better satisfied when the information system is properly designed based on the needs.

2. The findings also support the complementarities theory whereby the manufacturing company can maximise business benefits when IS innovation occurs parallel with management system innovation. The manufacturing company can enhance its performance and sustain its competitive advantage if it can simultaneously design the IS and performance management systems. CEOs of ERP adopters in Malaysia experienced an additional advantage when they implemented both the ERP system and BSC, whereby they could access real time data and information to measure their own performance as well as that of their subordinates on a real time basis. Data from the ERP system also directly provide information to managers to measure performance in real time.

3. The findings support the RBV-theory whereby the ERP system consists of technology, relationships and humans that can be used to achieve competitive advantage. The ERP system is an IT asset that can enhance business performance and sustainable competitive advantage. Through core and analytical applications, the ERP system provides data and information to managers. The resulting strong working partnership between business managers will lead to the achievement of business value from the IT investment. This indicates that managers who are able to work with IT to obtain information can support their decision making and can, as a result,

improve the company's performance.

## 7.5 Strengths and Limitations of the Study

### 7.5.1 Strengths of this study

The results of this study provide guidelines for the three managerial levels at manufacturing companies to measure their performance after adopting ERP by using balanced scorecard perspectives. By using the ERP-Scorecard measurements, they are able to evaluate their performance not only in terms of financial performance but also for non-financial performance. It was also noted that the mixed research methodology was used to strengthen the findings of this study. The findings identified through surveys were reconfirmed through interviews with ERP system adopters and ERP vendors in Malaysia. Hence, the knowledge that was gained from ERP adopters as well as ERP vendors through this study enriched the study results. This study also contributes to the knowledge of Management Accounting System and Information System, performance management and research theory.



### 7.5.2 Limitations of this study

The study is limited only to large manufacturing companies in Malaysia that have an export market. Manufacturing companies have more functional departments compared to that of merchandising and service companies and thus experience more benefits by adopting ERP system through automation. In addition, the multiple currencies allowed for by the ERP system ease the transactions with business partners outside of Malaysia. However, based on the ERP vendors' estimation, only 10% of Malaysian manufacturing companies have adopted ERP systems by the 2009; most of them are large manufacturers. According to an ERP system vendor, the cost of ERP system adoption and implementation is nearly 10% of a company's annual revenue and because of that, only large manufacturing companies can afford to adopt. Even though some respondents are from Sabah (7%) and Sarawak (11%), most of the respondents are from Peninsular Malaysia (82%) as most of the large manufacturing companies are located there.

## 7.6 Future Research

Since this study focuses on large manufacturing companies in Malaysia, future research in this area may be undertaken to study the ERP system implementation trend in small and medium enterprise manufacturers. Small and medium manufacturers have different characteristics compared to large manufacturers; hence the way they manage ERP systems to increase their business performance may be different. A study about the impact of ERP system adoption on service sectors, and how the companies generate benefits there from, will also increase knowledge about ERP system adoption and may be valuable to service companies in Malaysia. A study about the impact of ERP system adoption in higher learning institutions would be valuable to the Ministry of Higher Education. Such a study might be focused on how an Institution of Higher Learning can save costs in servicing students by implementing an ERP system. Similarly, a study may be conducted to examine the factors which contribute to the business performance of ERP adopters. In general, companies are not proactive in committing large amounts of capital expenditure to information systems even though the benefits may be substantial. In addition, a comparison of ERP implementation across industries will also contribute to the general study of ERP systems. In this study, respondents were not classified based on industry; hence future research which compares the benefits generated by Malaysian manufacturing companies across different industries would enrich the research on ERP system adoption in Malaysia.

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