CHAPTER II

LITERATURE REVIEW

2.1 Introduction

This chapter introduced theories and techniques that were applied to this research. The chapter starts off with the definition and introduction to the ERP system. Next in line discussion were on the failures and mistakes regarding the implementation process of ERP systems in the past. It would then followed by suggested methodologies and theories in effort to avoid those pitfalls and obstacles before, during and after the system implementation.

The methodologies were Business Process Reengineering (BPR), Change Management (CM), and Total Cost of Ownership (TCO) analysis. Theories and literatures were taken from many resources such as academic/economic papers, comments, textbook and website references written by the experts and gurus within the ERP and related fields.

2.2 Introduction to ERP system

The definitions of ERP could be intriguing and widely argued, its meaning were interpreted differently from one organization to the other, or even from department to department within the same company. An information system vendor might say it was an expansion of "Material Requirement Planning" also known as the MRP. A production supervisor/manager might define it as software helping with planning of machine sequences and raw material usage. Whereas an accountant might define it as an automated accounting software which help she/he with the general ledger, costing and reports which she/he must present to her/his superior, or a sale manager might understood it as a system that help she/he track down the sale volume on day to day basis.

The following are a few definitions provided by the scholars and experts in the field which will be the guideline definition used in this research.

"ERP stands for enterprise resource planning, a software system that aims to serve as a backbone for your whole business. It integrates key business and management processes to provide a sky-level view of much of what's going on in your organization.

Source: Derek Slater., 1999, "What is ERP?" www.cnn.com/TECH/computing/9905/28/erpent.idx/

"Enterprise Resource Planning or ERP is an industry term for integrated, multi-module application software packages that are designed to serve and support multiple business functions. An ERP system can include software for manufacturing, order entry, accounts receivable and payable, general ledger, purchasing, warehousing, transportation and human resources.

Source: Anonymous., 2002, "ERP Overview" http://erp.ittoolbox.com/pub/erp_overview.html#r1

"An Enterprise Resource Planning system (ERP) is a collection of modules/components integrated together while utilizing one database typically used primarily by medium to large manufacturing organizations with multiple sites located worldwide.

Source: Matthew L. Dawson, 2002, "What is an ERP system?" erpevolution.html

The above quotes are various definitions of the ERP system. In all definition it was clear that an ERP system is not just software but it is a system that integrates all departments and functions within the company into one unity. It is an ultimate database computer system which could serve needs or provide necessary information to different departments within the organization simultaneously.

2.3 Benefits of ERP system

The benefits of the ERP system are widely debated. Dawson (2002) suggested the following benefits.

- *Improved work processes i.e. ERP system incorporates many new and improved "best of practice" business processes*
- *Increase in access to data for business decision making by the help of real time report and business intelligent modules*
- *Increased control of work processes by staff i.e. Staff members become more in control of their work processes without the reliance of computer support personnel. The increased control results in an increased level of productivity*
- *Reduced paper documents i.e. Paper documents are reduced, as there are online formats for data entering and retrieving*
- *Information is recei... ... ...*

- *Greater accuracy of information with detailed content i.e. Data is entered once, which eliminates the human error effect in a multiple system environment.*
- *Improved cost control*
- *Increase in customer response time*
- *Efficient cash collection i.e. timely recorded data results in a reduction of cash collections by customers. Invoices are processed as inventory is shipped resulting in the customer receiving their bill timely*
- *Improved monitoring and quicker resolution of queries*
- *Quick response to business operations and market conditions*
- *Improved supply-demand link with Locations and branches*
- *Unified customer database i.e. this allows all sites to utilize the same customer information. Redundant record keeping is reduced or eliminated*
- *Improved information access and management throughout the Organization*
- *Single-Vendor Approach.*

The following quote deems a scenario when ERP system proved a plus.

"Typically, when a customer places an order, that order begins a mostly paper-based journey from in-basket to in-basket around the company, often being keyed and reentered into different departments' computer systems along the way. All that lounging around in in-baskets causes delays and lost orders, and all the keying into different computer systems invites errors. Meanwhile, no one in the company truly knows what the status of the order is at any given point because there is no way for the finance department, for example, to get into the warehouse's computer system to see whether the item has been shipped. "You'll have to call the warehouse" is the familiar refrain heard by frustrated customers. "

Source: Christopher Koch., 2002, "The ABC's of ERP" http://www.cio.com/research/erp/edit/erpbasics.html#erp_costs

With the ERP system the front office or the sale coordinator can know how many units of a particular product were coming through the production line given a time interval so that they can respond to the sale personnel or customer needs within a few clicks, or they can inform the customer when the delivery would be made, by who and at what cost or delays. This is the benefit, real information on hand at the right time.

Another example, high flexibility in today turbulence market and information technology world is one of the most important attribute that a company must attain. As all the finance data are input into one single database, the management can see the cost of good sold for each batch of production at real production cost and at real time, or call up financial status to know the financial well-being of the company at any

point in time. This information could assist the management in setting medium and long term plans for the company or come up with a short term plan to counter off competition.

In conclusion ERP system spanned out and share important information to those who needed it at the right moment and at the correct value. It gives authorized person a whole picture of the processes being run in the company. Orders can be process through each department at electronic speed. This makes responsibilities easier to handle, lesser paper work, lesser telephone calls to another department for answer on a customer order and happier management, employees, and customers and hopefully a rise in sale volume.

Of course the benefits mentioned were on every company's wanted list; however as the saying goes "no pain no gain" stand true in many ERP implementation cases. There were many paper and journal written widely to account for failures in ERP implementation. This was elaborated in the section 2.4.

2.4 Failures and Mistakes of ERP System Implementation

The ERP system can be a huge system as it integrates what once separated databases which belong to different departments into one mega database. As mentioned if implemented properly ERP system promised a long list of benefits and competitive advantages but many companies in the past found that was not the case. It often happens that there are many obstacles which make implementation fail or does not live up to its expectation.

In this section the research will go through failures relating to ERP system implementation. Rockford Consulting group (2004) suggested 12 major reasons why companies fail in implementing ERP system.

- *"Lack of Top Management Commitment*
- *Inadequate Requirements Definition*
- *Poor ERP Package Selection*
- *Inadequate Resources*

- *Resistance to Change/Lack of Buy-in*
- *Miscalculation of Time and Effort*
- *Misfit of Application Software with Business Processes*
- *Unrealistic Expectation of Benefits*
- *Inadequate Training and Education*
- *Poor Project Design and Management*
- *Poor Communications.*
- *Ill-advised Cost Cutting"*

In the section 2.4.1, the research went through these mistakes and finds articles which attempts to solve or avoid the mentioned problems.

2.4.1   Inadequate Resources

Donovan (2003) suggested five reasons for poor results after implementing ERP system, one of the culprits is cost, *"The cost to implement was much greater than anticipated"*. Rockford Consulting Group, Ltd (2004) had commented that one of the ERP implementation failures was the unrealistic expectation of benefits and Return on Investment (ROI). "Another significant cause for ERP implementation failure was the unrealistic expectation of benefits and ROI. Another was not preparing enough funds to support the implementation process through and through i.e. cost is often underestimated."

Software vendors are unpopular for overstating the benefits in terms of ROI and the benefits of the system. The common mistakes were those implementation teams often left out of the total costs are costs of planning, consulting fees, training, testing, data conversions, documentation, replacement staffing, and the learning curve performance drop.

The ROI became an unrealistic goal when this happen. Problems will follow some of the common problems seen are blaming each other for the failure, lack of system buy-in, management lost confidence and back off their supports etc.

This shows the underestimation of cost and over expectation of the benefits anticipated by the implementation team and the management. The META Group, Inc. had investigated the Total Cost of Ownership (TCO) of the ERP system.

The TCO that the group suggested included the software installation cost plus two years of the system maintenance cost, any upgrading cost during the period, and optimization to fine tune it into the organization.

Similarly an on-line article from Koch (2003), had suggested 10 hidden cost of ERP system. Some of them were training, integration and testing, customization, data conversion, data analysis, consultants fee, replacing and reorganizing the current IT team, cost of implementation team, cost of drop in performance due to 'Post-ERP depression'.

Therefore it was important for company not to overlook any cost and TCO must be identifies and money must be budgeted for them in the early stage of decision making.

This research attempt to avoid these mistakes, Gartner, Inc. had suggested Distributed Computing Chart of Accounts method. The method divided costs into two main categories being direct and indirect costs. The main aim of this methodology was to single out every cost involved, measure it, track it down and try to control or even reduce it. Interestingly the method also includes 'Downtime' cost, cost that were often overlooked. The method would be discussed next.

"The Gartner TCO Model Distributed Computing Chart of Accounts provides a method in which costs are divided into defined categories such that costs between different companies, organizations and groups can be simulated and analyzed in a consistent, reliable and detailed fashion."

Source: Gartner., 2003:1, "Chart of Accounts E-Rev.n" http://www.gartner.com/4_decision_tools/modeling_tools/costcat.pdf

Direct and indirect costs were defined by Gartner as followed.

"Direct (budgeted) costs are the capital, fees, and labor costs spent by the corporate IS department, and business unit IS groups in delivering Information Technology services and solutions to the organization and users. Indirect (unbudgeted) costs measure the efficiency of IS in delivering expected services to end users."

Source: Gartner., 2003:2, "Chart of Accounts E-Rev.n" http://www.gartner.com/4_decision_tools/modeling_tools/costcat.pdf
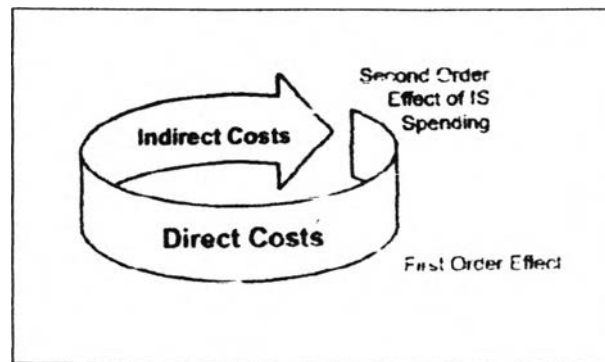
Figure 2-1: Direct Cost: Showing relationship of the cost with others incurred

It should be noted that the method tallies costs for an annual analysis period. The method further divided direct cost into three sub categories. The next diagram shall be utilized as a map as this research goes through definitions of each cost of the ERP system proposed by Gartner one by one.

2.4.1.1 Direct Cost

Gartner Inc (2003:2) defined direct cost as a cost "measures the direct expenditures on IS by an organization (capital, IS labor, and fees). According to the above diagram direct cost can be further divided into three sub categories as followed.
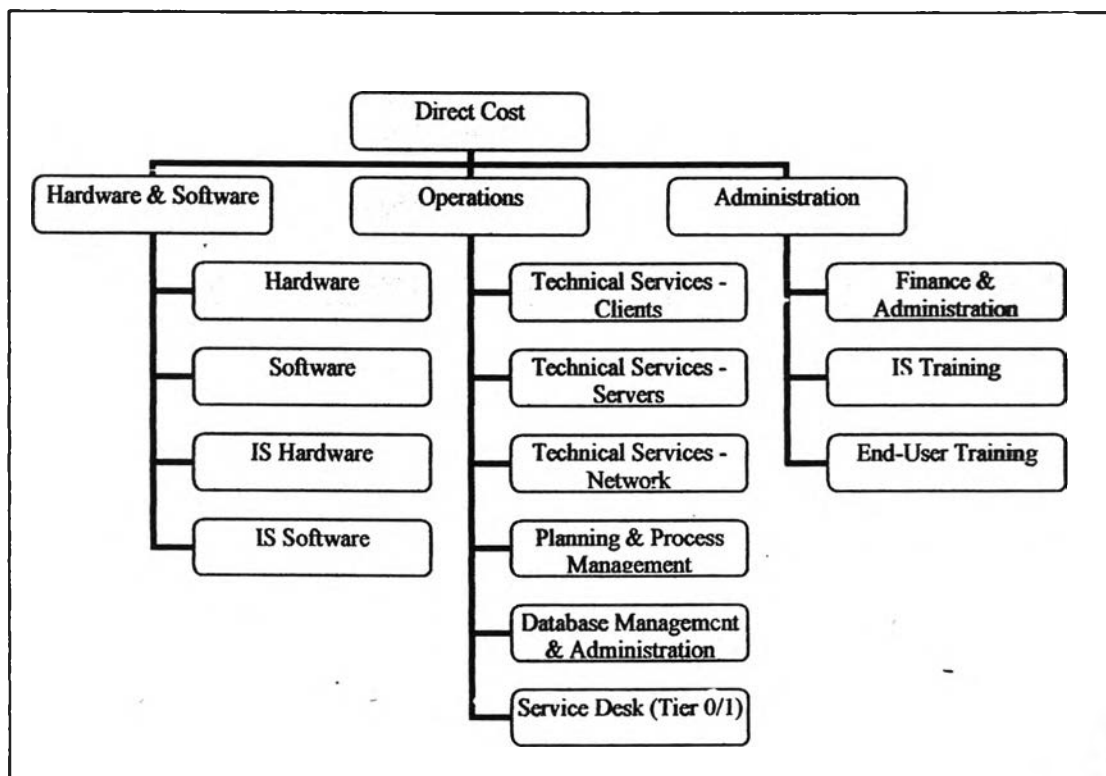

Figure 2-2: Overview of the direct cost category (1)

2.4.1.1.1 Hardware and Software cost

The hardware and software cost category was defined by Gartner Inc. as followed.

"Hardware and Software costs are the annual capital expenditures associated with the purchase of distributed computing hardware and software assets. The capital fees accounted for in this category cover the initial acquisition as well as upgrades. The cost account for the annual expenses on all client computers (both desktops and mobile), server peripherals and networks. The hardware and software category divides these expenses into accounts for production assets, those used by end users to perform business functions, and IS assets, those used by IS to perform IS function such as network management and development."

Source: Gartner., 2003:5, "Chart of Accounts E-Rev.n"
http://www.gartner.com/4_decision_tools/modeling_tools/costcat.pdf

The ERP system that the company implemented consisted of both production asset and IS assets. The following figure gave an overview of the hardware and software costs category.
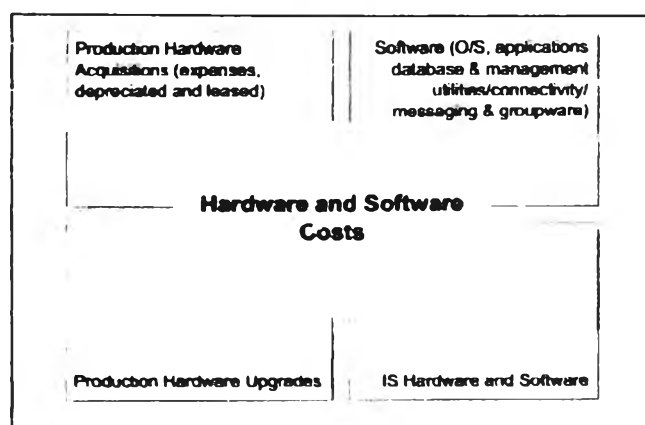

Figure 2-3: Overview of the direct cost category (2)

Source: Gartner., 2003:5, "Chart of Accounts E-Rev.n" http://www.gartner.com/4_decision_tools/modeling_tools/costcat.pdf

The Gartner Inc.'s method recommended that both hardware and software cost could be found from the implementing network diagrams, inventory and asset management logs, depreciation records, lease records, purchase contract, purchase orders, supplier logs and agreements and budgets.

According to figure 2-3, the hardware and software cost are further divided into four main sub categories as followed.

i.Hardware Costs

- **Expensed/Depreciated/Lease:** This cost (calculated annually) should cover, servers, clients, peripheral and network hardware (service fee e.g. installation fee is excluded here but will be included in the appropriate operations labor category).

- **Upgrades:** These accounts for the total annualized cost for the mentioned hardware upgrade e.g. upgrade made to production clients, servers, peripherals, and network assets. It also included hard drives, processors, memory, network connectivity, removable media, and power supplies. Gartner's (2003:6) further stressed that such upgrades were not included in the original purchased bundle or were purchased or installed after the original installation and are included within this category. For the first year the upgrades were unnecessary as all the production assets were new and were already equipped with the necessary hardware ready for use.

- **Spares:** Gartner's (2003:6) defined this as the total annualized expenses for spare which were distributed computing production assets which components such as server, client, peripheral, or network replacements. This should exclude device which were use as standby servers or disk drives that sending heartbeat to the system incase the other one fail (these devices should be included in the expense, depreciation and lease category). As all production hardware comes with minimal 3 years guarantee and onsite service (vendors providing substitute machine if one fail with another within 4 hours of calling time) there shall be no spares required.

- **Supplies:** This accounted for the total annual expenses for consumable information system supplies such as diskettes, CD-ROMs, DAT and back up tapes, removable media, printer toner cartridges and any other computer supplies for clients, servers, peripherals, and network assets (does not include printing paper).

ii.Information System Hardware Costs

- **Expensed/Depreciated/Lease:** This cost (calculated annually) should cover server, client, peripheral and network hardware (service

fee e.g. service, installation fee is excluded here but will be included in the appropriate operations labor category).

- **Upgrades:** These accounts for the total annualized cost for the mentioned hardware upgrade e.g. upgrade made to IS (Information System) clients, servers, peripherals, and network assets. It also includes hard drives, processors, memory, network connectivity, removable media, and power supplies. Gartner's (2003:6) further stressed that such upgrades are not included in the original purchased bundle or are purchased or installed after the original installation and are included within this category.

- **Spares:** Gartner's (2003:6) defined this as the total annualized expenses for spare which are distributed computing IS assets which components such as server, client, peripheral, or network replacements. This should exclude device which are use as standby servers or disk drives that sending heartbeat to the system incase the other one fail (these devices should be included in the expense, depreciation and lease category)

- **Supplies:** This accounts for the total annual expenses for consumable information system supplies such as diskettes, CD-ROMs, DAT and back up tapes, removable media, printer toner cartridges and any other computer supplies for clients, servers, peripherals, and network assets (does not include printing paper).

iii. Information System Software Costs

"The software category within Hardware and Software accounts for all of the capital expenditures on new and upgraded IS software that is used exclusively by the IS department including software such as network, systems, storage and asset management, call center management, training and CBT, and others."

Source: Gartner., 2003:8, "Chart of Accounts E-Rev.n"
http://www.gartner.com/4_decision_tools/modeling_tools/costcat.pdf

- **Network, systems, storage and asset management:** This is the cost for all software used by Operations staff in order to control the distributed computing environment and assets. This category of cost

includes network, systems, storage, asset management software tools that are purchased rather than developed.

- **Service desk management:** Similarly this is the cost for software used by operation staff to provide Service Desk/ Help Desk support to end users. It should also cover cost for call tracking, trouble ticketing, dispatch, remote control, problem database, knowledge database, knowledge management, and statistical reporting software tools that are purchased rather than developed.

- **Training Software and Computer Base Training (CBT) software:** This is the cost for all software tools and CBT used for IS and end-user training purposes. This category of cost includes training development software tools, CBT software and other training center software that are purchased rather than developed.

- **Test/Other:** This are the cost for things that are not included in the network, systems, storage and asset management, service desk management, and training and CBT sections.

2.4.1.1.2 Operation Cost

The second major category in the Gartner's direct cost is 'operational cost' or was previously referred as "management cost" in the previous version of the Gartner TCO Model.

"Operations accounts for the technical staff resources including both in-house staff, contractors, and outsourced management and support contracts, tallied in this accounting are cost by Operations' subcategory (technical Services, Planning and Process Management, Database Management and Administration, and Service Desk) and, for actual data collection ,expense responsibility (Corporate IS, Business Unit IS).

Source: Gartner., 2003:9, "Chart of Accounts E-Rev.n" http://www.gartner.com/4_decision_tools/modeling_tools/costcat.pdf
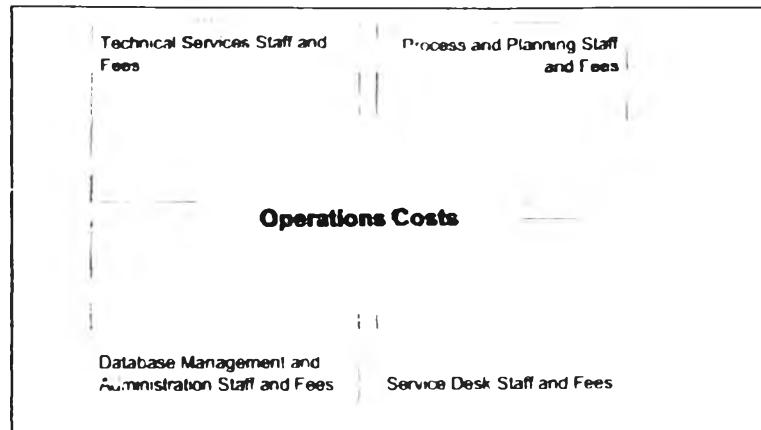
Figure 2-4: Overview of the direct cost category (3)

iv.Technical Services Costs – on clients, server and network

This is the category for cost of Operations staff and management contracts in any of the following Technical Services activities for client and peripherals, server assets and network assets.

- **Tier II problem resolution:** This is the cost for labor and contract costs for dispatched support on issues with systems, networks, and applications that could not be resolved by service desk Tier I staff (but the support needs tier III support)

- **Tier III problem resolution:** This is the cost for labor and contract costs for technicians and administrators labor spent identifying and resolving advanced support issues which includes failures, faults, and accessibility problems with the network, computers, printers, network communication equipment, OS and application.

- **Traffic management and planning:** This is the cost for labor and contracts for proactively monitoring, interpreting, planning and balancing the load place on the network infrastructure.

- **Performance tuning:** This is the cost for proactive monitoring, interpreting, planning and balancing the performance of servers, networked systems and application to maximum utilization.

- **User administration (logical addition and changes):** this is the cost for controlling user accessibility to network and application resources e.g. adding new users and resources, password and authorization management.

- **Operation system support:** This is the cost for time spent managing OS e.g. settings, upgrades, service pack installation, driver updates etc.

- **Maintenance labor:** This is the cost for routine job e.g., performing scheduled back up or maintain the availability and performance of severs, clients, printers and network devices e.g. cleaning of the server's clean room (this cost do not include file and disk maintenance).

- **Software deployment:** This is the cost accounting for deploying new or upgrading existing custom made or purchase software e.g. utilities applications and messaging software but this category does not include the management of OS.

- **Application management:** This is the costs for the on-going management of software applications including configuration control, access management, launch, monitoring usage, and the metering of the licenses, including business application but excluding the deployment of applications or OS.

- **Hardware configuration/reconfiguration:** This is the cost for labor and contract for reconfiguration of existing solution within the LAN e.g. adding hardware subcomponents, upgrades, physical move, and change configuration. Items includes system upgrades performance enhancement, topology changes, switched/ hub networks changes, and other hardware settings.

- **Hardware deployment:** Cost for installing and deploying new hardware including servers, clients, peripherals, network communication devices and networks.

- **Disk and file management:** This category account for costs fro optimizing local server online storage and file systems e.g. directory trees, disk defragmentation.

- **Storage capacity planning:** This is the cost for monitoring, managing and optimizing online and off-line storage capacity to ensue that enough disk capacity is available e.g. obsolete file deletion, purging where this category does not include database management and administration.

- **Backup and archiving:** This is the cost for backing up network and desktop data, restoring lost or damaged files, archiving and file retrieval.

- **Repository management:** This is the cost for managing central disk or tape repository including tape library management and off-site storage monitoring and management.

v.Planning and Process Management

"Accounts for the costs of Operations staff and outsourced contracts for performing any of the following Planning and Process Management activities: account management, system, research, planning and product management, evaluation and purchase, security and virus protection, business recovery."

Source: Gartner.,   2003:16,   "Chart   of   Accounts   E-Rev.n"
http://www.gartner.com/4_decision_tools/modeling_tools/costcat.pdf

- **Account Management:** This is the cost for labor and contracts for working with and managing the relationship between IS and the business unit. Typical tasks including business unit alignment, application and infrastructure requirements, business case development, and project management.

- **System research, planning and product management:** This is the cost identifying infrastructure needs, reviewing configurations, setting standards, research options and documenting the changed plan. Documentation of the existing architectures, configuration, infrastructure, simulation and modeling of new systems, total cost ownership (TCO), life cycle management, and standards development by IS personnel are tasks and cost that considered here.

- **Evaluation for purchase:** This category accounts for labor and contracts costs for evaluation and certification of servers, clients, networks, applications, and systems prior to procurement and rollout, and the direct IS labor associated in supporting the purchasing work which also includes the support of legal (issuing contracts) and purchasing department.

- **Security and virus protection:** This accounts for cost of proactively detecting or preventing security violation, security

restriction, access management, or virus infection and the recovery processes should any of the mentioned circumstances occurs e.g. anti-virus, spam, hacker, abuse and firewall activities. It should be noted that password administration, asset management, and tier II and tier III reactive support are not included in this category of cost.

- **Business recovery:** This is the cost for creating business recovery or disaster recover plan and management plans which includes backup, restore procedures, tape management, hot-site and cold-site planning, record keeping, and business recovery team management and organization.

vi. Database Management and Administration

"Include the cost of Operations staff performing Database Management and Administration. Administrative tasks include index management, replication, log administration, data recovery, optimization, and other maintenance tasks. Excluded in this category are design-and development-related activities."

Source: Gartner., 2003:17, "Chart of Accounts E-Rev.n" http://www.gartner.com/4_decision_tools/modeling_tools/costcat.pdf

vii. Service Desk (Tier 0/1)

"Accounts for the costs of Operations staff performing Service Desk activities, particularly tier 0 and tier 1 resources. Tier 0 refers to call taking and logging without providing problem assistance or resolution. Tier 1 refers to fist and second level non-dispatche dproblem assistance or resoulution delivered via phone, e-mail or on-line communication. Tier II and Tier III support is allocated to technical Services in the Operation category"

Source: Gartner., 2003:18, "Chart of Accounts E-Rev.n" http://www.gartner.com/4_decision_tools/modeling_tools/costcat.pdf

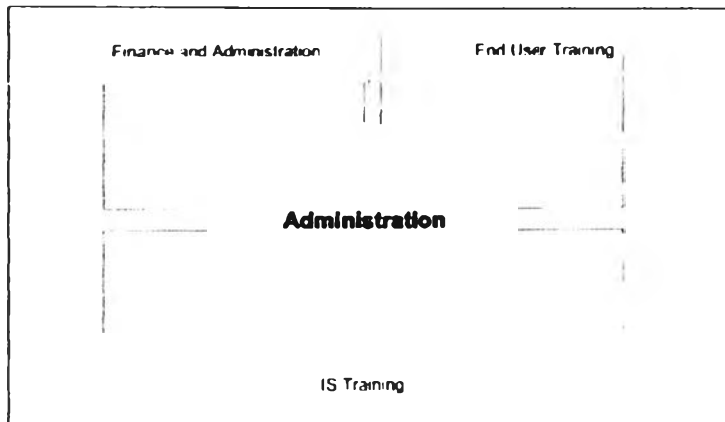### 2.4.1.1.3 Administration Cost

This is the cost for overhead labor and fees, and training. In the previous version of the Gartner TCO Model, administration cost was referred as support cost. The original definition of the cost can be found in the next quote.

"Administration costs are the direct labor expenses and fees associated with providing administration services to the IS organization and infrastructure. Administration activities include finance and administration, IS training, and end-user training.

Figure 2-5: Overview of the direct cost category (4)

viii.Finance and Administration

"Accounts for Finance and Administration labor and fees, including costs for supervisory management, IS administrative assistance, asset management, budgeting and chargeback, auditing, purchasing, procurement and contract management, and vendor management personnel."

- **Supervisory management:** accounts for cost related with resources and services primarily responsible for exclusive supervisory efforts, particularly middle and executive management, as well as general department administrative support personnel.

- **IS administrative assistance:** accounts for labor and contract costs for administrative support personnel, particularly direct assistants to middle and executive management, as well as general department administrative support personnel.

- **Asset management:** It is the cost (labor and contract) for managing depreciation records and lease contracts, and performing asset inventories (physical or automatic management), asset identification and tracking, asset database management, change recording, and reconciliation.

- **Budgeting and chargeback:** This account for labor and contract costs for budgeting and chargeback tasks e.g. the management of central IS and business unit IS capital and operational budgets, and the assignment and accounting of the chargeback systems.

- **Auditing:** This is the cost for auditing tasks e.g. the review of IS contracts, relationship, asset records, the processes and compliance to the written policies.

- **Purchasing, procurement and contract management:** This category accounts for labor and costs for procurement of end-user and IS hardware and software, services, and training, and legal personnel and services that draft and negotiate purchasing agreements, site licenses, and other procurement involve contracts.

- **Vendor management:** This account for labor and contract costs for working with and managing hardware, software, application, and service vendors, including IS labor time spent in vendor meeting, writing terms of agreement, contracts, RFPs, reviewing proposals, dealing with vendor related matters, and other vendor management related tasks outside of the product research and evaluation tasks listed under 'Operation' category.

ix. IS Training

"IS training accounts for staff and outsourced contracts for performing IS training course development, coordination, and instruction."

Source: Gartner., 2003:20, "Chart of Accounts E-Rev.n" http://www.gartner.com/4_decision_tools/modeling_tools/costcat.pdf

- **IS course development:** cost for developing of IS training courseware and CBT including IS training tasks not related to instruction time e.g. coordination

- **IS training (delivery):** This account for cost for instructional delivery of IS courses.

x. End-User Training

"End-user Training accounts for the IS staff and contracts for performing end-user training course development, coordination, and instruction. Note: The time/cost of end user attending training is not included here but in the End-user Operation category."

Source: Gartner.,   2003:21,   "Chart   of   Accounts   E-Rev.n"
http://www.gartner.com/4_decision_tools/modeling_tools/costcat.pdf

- **End-user course development:** expenditure for development of end-user training courseware and CBT. Including other end-user training tasks not related to instruction time e.g. coordination
- **End-user training:** This is the cost for instructional delivery of end-user courses.

2.4.1.2   Indirect Cost

"Indirect costs are an expense that <u>are not budgeted</u> and often go unaccounted for in most IS organization. Indirect Costs include End-user Operations and Downtime, measuring and productivity losses that result form IS and the distributed computing environment."

Source: Gartner.,   2003:20,   "Chart   of   Accounts   E-Rev.n"
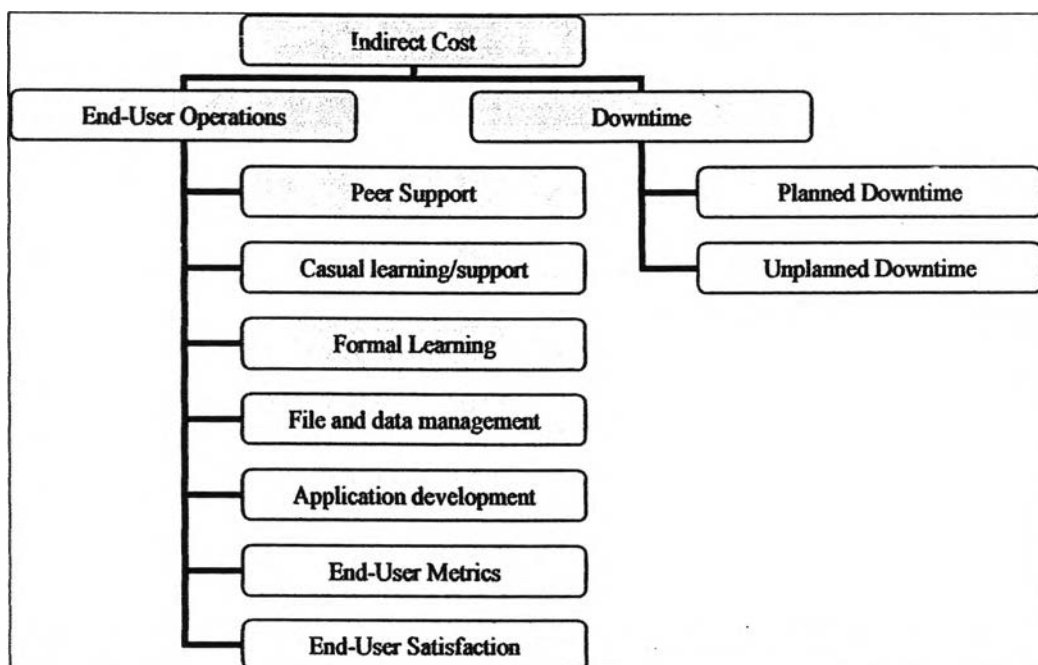http://www.gartner.com/4_decision_tools/modeling_tools/costcat.pdf

Figure 2-6: Overview of the indirect cost category (1)

The above quote further emphasize the importance of identifying all cost, these hidden expenses are often hidden and if not measured properly. The

true TCO is underestimated and this is one of the pitfalls to an organization in the system implementation process (see section 2.4.1). The next categories 'End-User Operation' and 'Down Time' is therefore designed to get all the cost that might occur during the ERP implementation. According to Gartner's 2003 Chart of Account method, figure 2-6 sum up the overall picture of the indirect cost category.

i. End-User Operation Cost

"End-user operations costs consist of peer support, causal learning, application development, and file and data management."

Source: Gartner., 2003:22, "Chart of Accounts E-Rev.n"
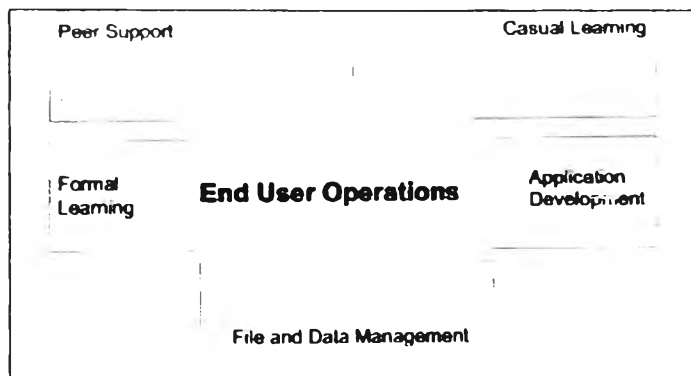http://www.gartner.com/4_decision_tools/modeling_tools/costcat.pdf

Figure 2-7: Overview of the indirect cost category (2)

Source: Gartner., 2003:5, "Chart of Accounts E-Rev.n" http://www.gartner.com/4_decision_tools/modeling_tools/costcat.pdf

- **Peer support:** This is the annual labor expenses for end users supporting each other when not getting the technical support straight from the IS personnel. This action includes troubleshooting, repair, support, maintenance, installation, training, and back up management. Gartner's (2003:24) further added that "Peer support often involves assistance of one or more peers to resolve key issues, increasing per incident costs further."

- **Causal learning/support:** This is the labor expenses of end user training and supporting themselves in lieu of formal training and support programs. This are the time which are used for reading manuals, using online help, trial and error, and other self-learning

methodology. Gartner's (2003:24) comments that this type of learning and support have higher cost than 'formal learning', while the lower level the formal learning usually results in high casual learning expense.

- **Formal learning:** This account for the annual labor expenses for all the course time spent by the end-user on computer system and all application training.

- **File and data management:** This is the cost that occurs when the end-users spend time managing files and data which also includes end-user-performed file system, maintenance, organization, optimization, backup and recovery of the data or information.

- **Application development:** This is the annual labor expenses of end-users performing development and customization of non-business/mission critical e.g. infrastructure software.

ii. Downtime Cost

"Downtime expenses are the annual losses in productivity due to the unavailability of the desktop computer, servers, network, printers, and applications. Cost is measured as lost wages (productivity)."

Source: Gartner., 2003:25, "Chart of Accounts E-Rev.n" http://www.gartner.com/4_decision_tools/modeling_tools/costcat.pdf

The downtime cost can be calculated as followed.

Annual downtime hours * % productivity impact to users when downtime occurs*end-user burdened salary
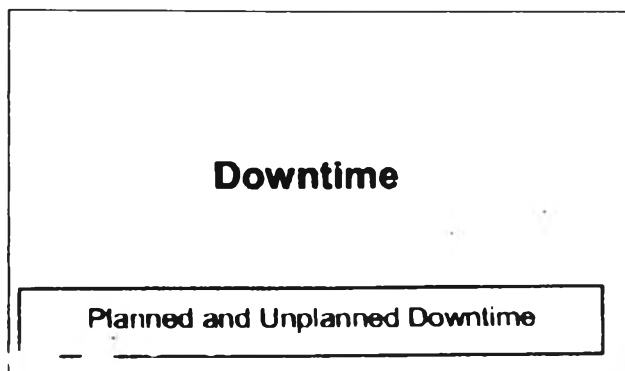

Downtime

Planned and Unplanned Downtime

Figure 2-8: Overview of downtime

Source: Gartner., 2003:5, "Chart of Accounts E-Rev.n" http://www.gartner.com/4_decision_tools/modeling_tools/costcat.pdf

Although the model suggested by Gartner and TCO consideration seemed to be the solution to avoid under budgeting, another article by the META Group, Inc. 'Deriving value from 21st Century ERP Applications' issued important warnings. 'TOC metrics can be misleading when they are based on industry-wide averages and not segregated by factors of project size and complexity.' In another word, different company is in different situation, being different in size, industries, operation environment (structure and culture) and objective of implementing the ERP system. Therefore the paper suggested a variable so called 'relative TCO' which expressed the TCO as a percentage of the company's revenue. This will help company not to over look the post-implementation cost.

In every investment cost is important in determining the ROI. Calculating ROI from ERP system is another field attracting debates from various experts and scholars. In another article from Donovan (2003), suggested that ROI is to be expected from the improvement business process that ERP software brings with it but not from the ERP software itself, *"Unarguably, ROI comes from process improvements ERP supports, not from new ERP software." "ERP software alone, no matter how good it is, makes little impact on improving business performance. If you continue to follow the same pre-ERP business processes after implementation, you can expect the same or possibly worse performance."*

Therefore it was important for the implementation team not to just concentrate on the cost (money term) alone, but to emphasize on reorganizing or change the business processes and also not to overlook the people involve if full ROI which is improve business process from the ERP is to be achieved. This was a bridge linking up to section 2.4.2.

2.4.2   Lack of Top Management Commitment, Resistance to Change

2.4.2.1   Individual Resistance to Change

According to Robins (2001:545-547), individual resistance came from five sources, while Warwick Manufacturing Group suggested a sixth category of 'Status'.
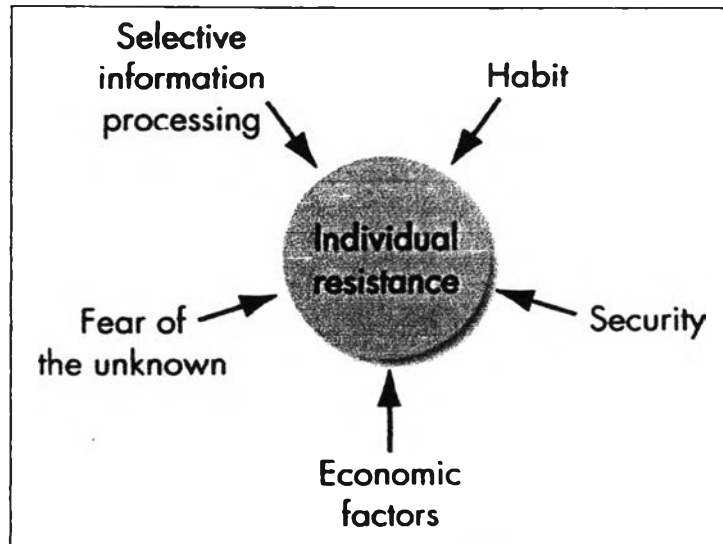

Figure 2-9: Sources of Individual Resistance to Change

Source: Stephen P. Robbins, 2001:545, "Organizational Behavior: Organizational Change and Stress Management", Prentice-Hall, Inc., New Jersey

- **Selective Information Processing:** Robbins (2001:546) commented that people tends to shape their "world" or her/his environment through their perceptions. Individual tend to select what they want to hear in order to keep their perception about things intact (see it in the way they see).

- **Fear of the unknown:** Robbins (2001:546) "Changes substitute ambiguity and uncertainty for the known", this is about insecurity and fear of what will happen after change. More communication and training (which believe to improve the operation/management skill level of the personnel through training and educational development) will help improve the situation and drive changes forward.

- **Economic factors:**

  "Another source of individual resistance is concern that changes will lower one's income."

Change in position or business processes might result in change in position and income. People will resist change if they are threatened of this form of security.

- **Security**:

"People with high need for security are likely to resist change because it threatens their feelings of safety"

Source: Stephen P. Robbins, 2001:546, "Organizational Behavior: Organizational Change and Stress Management". Prentice-Hall, Inc., New Jersey

"Security" here does not mean physical contact safety only, but it also implies as 'job security' or the stability of one's future/job/carrier/position. Again changes in position or business processes can result in lost of job or position i.e. security, which can result in resistance to change.

- **Habits**:

"Life is complex enough; we don't need to consider the full range of options for the hundred of decisions we have to make everyday. To cope with this complexity, we all rely on habits or programmed responses. But when confronted with change, this tendency to respond in our accustomed ways becomes a source of resistance."

Source: Stephen P. Robbins, 2001:545-546, "Organizational Behavior: Organizational Change and Stress Management". Prentice-Hall, Inc., New Jersey

Above quotes demonstrate that changes might take time or are difficult due to personal habits. This depends a on the company's culture and structure. This linked us up to section 2.4.2.1.

2.4.2.2 Organizational Resistance to Change

Figure 2-10: Sources of Organizational Resistance to Change

Source: Stephen P. Robbins, 2001:545, "Organizational Behavior: Organizational Change and Stress Management". Prentice-Hall, Inc., New Jersey

- **Threat to Established Resource Allocation:**

    "Those groups in the organization that control sizable resources often see change as a threat. They tend to be content with the way things are. Will the change, for instance, mean a reduction in their budgets or a cut in their staff size? ..."

    Source: B. M. Bass, 1990, "Bass & Stogdill's Handbook of Leadership". New York: Free Press

- **Threat to Established Power Relationships:**

    "Power refers to a capacity that 'A' has to influence the behavior of 'B', so that B acts in accordance with 'A''s wishes"

    Source: Stephen P. Robbins, 2001:545-546, "Organizational Behavior: Organizational Change and Stress Management". Prentice- Hall, Inc., New Jersey

    "Power is the potential or actual ability to influence others in a desired direction."

    Source: Gordon, J. R, 1993:392, "A Diagnostic Approach to Organizational Behavior". Needham heights, MA, Allyn & Bacon

    "Power is defined as the potential ability to influence behavior, to change the course of events, to overcome resistance, and to get people to do things that they would otherwise not do"

    Source: Pfeffer, J, 1993:204-205, "Understanding Power in Organization". in mabey, C. and Mayon-White, B. (eds), Managing Change, London, PCP

Personnel within the organization that had the most advantage from the current resource (capital, money, manpower etc) allocation will feel

threatened by the changes that might alter any future decisions regarding resources allocation. Changes might also result change in the organization structure and hierarchy, this might result in redistribution or change of decision making authority, those who were affected might resist change.

As for an example, all the information is integrated together when ERP system is implemented therefore the management would know the financial status of the company real time, which mean if there were any issues such as a sudden rise in raw material prices, the management will call for budget reduction or staff layout to maintain financial stability within the company.

Those established person within the organization who had established source of funds and personnel and are aware of this function of the system might not be very happy and might resist change towards what the new system can provide.

- **Threat to Expertise:** Robbins (2001:548) commented that "Changes in organizational patterns may threaten the expertise of specialized groups." ERP system implementation may result in reorganization of some department e.g. the IT department might not have the in-sight knowledge so the company must use outsourcing strategy which might result in threatening the current group of IT position, resistance of change arise.
- **Group Inertia:** If the majority won't change it is highly likely that individual to follow the same action, even though one might think differently from the group. When applying change the implementation team must overcome the group inertia to help the change progress.

"Even if individual s want to change their behavior, group norms may act as a constraint"

Source: Stephen P. Robbins, 2001:548, "Organizational Behavior: Organizational Change and Stress Management". Prentice-Hall, Inc., New Jersey

- **Limited Focus of Change:** Organization are made up of smaller sub system, these systems are related one way or another. Robbins (2001:547) commented that changing the structure might be needed for change to be accepted.

- **Structural Inertia:**

    "Organizations have built-in mechanisms to produce stability....When an organization is confronted with change, this structural inertia acts as a counter balance to sustain stability"

    Source: Stephen P. Robbins, 2001:547, "Organizational Behavior: Organizational Change and Stress Management". Prentice-Hall, Inc., New Jersey

From the brief explanation of the resistance forces towards changes it is quite clear that in order for the ERP system to be implemented properly things like reorganization, restructuring, reprocesses together with proper change management. The research shall next investigate these theories in order to avoid the pitfalls and mistakes mentioned.

2.4.3   Business Reprocess Reengineering (BPR)

"Business Process Reengineering is a pre-requisite for going ahead with a powerful planning tool, ERP. An in depth BPR study has to be done before taking up ERP. Business Process Reengineering brings out deficiencies of the existing system and attempts to maximize productivity through restructuring and re-organizing the human resources as well as divisions and departments in the organization."

Source: Anonymous., www.webpro.com

From the reason above it was therefore reasonable to investigate into BPR, a few definition of the BPR can be viewed in the following quotes.

"Business Process Engineering is "the analysis and design of workflows and processes within and between organizations" (Davenport & Short 1990). Teng et al. (1994) defines Business Process Engineering as "the critical analysis and radical redesign of existing business processes to achieve breakthrough improvements in performance measures."

Source: Anonymous., http://www.aitconsulting.com

"A systematic, disciplined improvement approach that critically examines, rethinks, and redesigns, and implements the redesigned mission-delivery processes to achieve dramatic improvements in performance in areas important to customers and other stakeholders.

Source: Anonymous., www.library.auckland.ac.nz/ subjects/bus/topicguides/bpr.htm

"Business Process Reengineering means not only change – but dramatic change. What constitutes dramatic change is the overhaul of organizational structures, management systems, employee responsibilities and performance measurements, incentive systems, skills development, and the use of information technology."

Source: Covert, 1997, "Successfully Performing BPR"., http://members.ozemail.com.au/~visible/papers/Introduction

From the definitions, BPR was a big change, a change which affects every cell within the organization. It commonly started with the study of the current flow and of work and redesigns it for more efficient and dynamic performance needed by today's competitive business world.

Covert (1997) further adds "The promise of BPR is not empty -- it can actually produce revolutionary improvements for business operations. Reengineering can help an aggressive company to stay on top, or transform an organization on the verge of bankruptcy into an effective competitor."

From the previous few sections the articles have shown that without efficient BPR, the chance for a successful ERP system implementation is diminished. This implies that BPR was an important step before implementing ERP system. The research would next investigates steps involves in BPR before plunging the company into one.

2.4.3.1 Steps to BPR

BPR can involve many people, which mean it might cause confusion and the complexity of resistance of change. Covert (1997) reinforce this perspective, "Business Process Reengineering, (BPR) can potentially impact every aspect of how we conduct business today. Change on this scale can cause results ranging from enviable success to complete failure." Therefore before BPR a proper planning was required. The author shall next investigate into different ideas presenting steps for effective BPR. The people at the WEBPRO International Inc. have suggested 7 steps to BPR.

- *Study the current system*
- *Design and develop new systems*
- *Define Process, organization structure and procedure*

- *Develop and customize the software*
- *Train people*
- *Implement new systems*
- *Monitor and reevaluate*

Source: Anonymous., www.webpro.com

Covert (1997), divided BPR implementation into 7 phases

- *Phase 1: Begin Organizational Change*
- *Phase 2: Build the Reengineering Organization*
- *Phase 3: Identify BPR Opportunities*
- *Phase 4: Understand the Existing Process*
- *Phase 5: Reengineer the Process*
- *Phase 6: Blueprint the New Business System*
- *Phase 7: Perform the Transformation*

Boyce (2001) suggested fewer steps which could be summarized in the next figure. The research concluded that a proper BPR planning was to involve the analysis of the current work flow and work management processes, prepare a "team of change", identify opportunities, the actual reengineering process, change management, trainings, implementation and evaluation. The evaluation part helps to identify the weakness all over again and may lead to the next BPR.
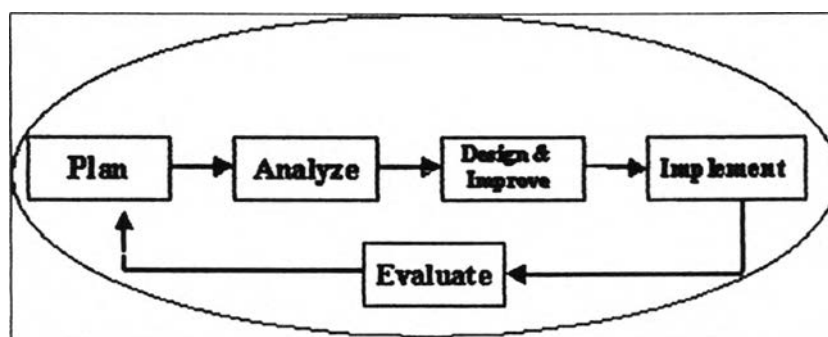

Figure 2-11: BPR implementation steps

Source: Chuck Boyce., (2001), http://www.prosci.com/mod1.htm

2.4.3.2 Change Management (CM)

It could be understood from the last section that ERP implementation requires efficient business process and hence the proper BPR which required proper CM. Change was a general term from moving from one place to another. BPR could result in change in organization structure, culture and work processes. In this section of literature reviews the research would investigates various CM techniques, type and processes.

Grundy's (1993) has proposed three natures of changes they were:

- *smooth incremental change: is a change which evolves slowly in a systematic and predictable way;*
- *bumpy incremental: is characterized by periods of relative tranquility punctuated by acceleration in the pace of change;*
- *discontinuous change: defines as change which is marked by rapid shifts in either strategy, structure or culture or in all three.*

Source: Adapted from Barbara Senior, (2002:38-39), "Organizational Change: The Nature of Organizational Change". Ashford Color Press Ltd., Gosport

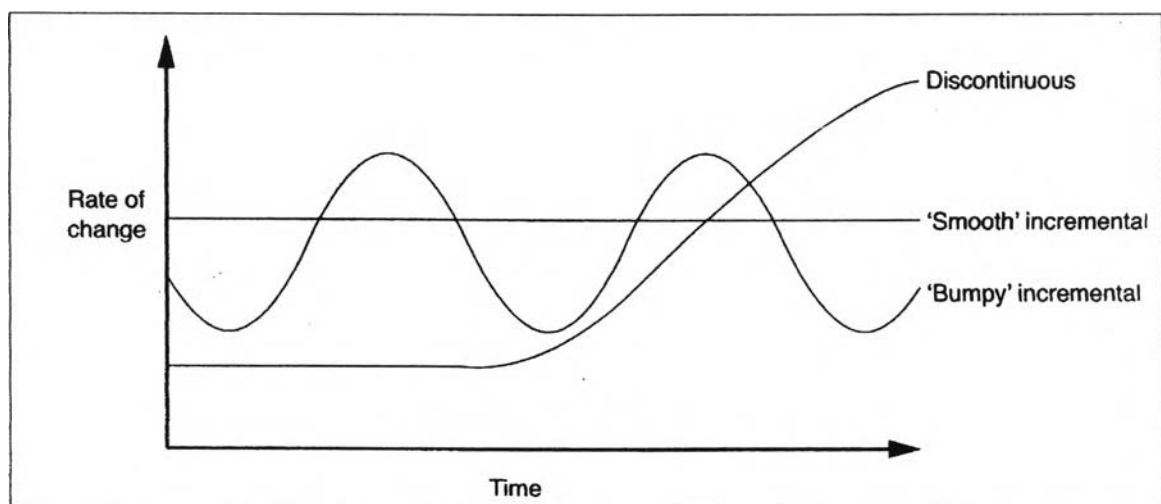Type of changes mentioned can be demonstrated by the next figure.

Figure 2-12: Major type of Organizational Change

Source: Barbara Senior, (2002:38), "Organizational Change: The Nature of Organizational Change". Ashford Color Press Ltd., Gosport

Robbins (2001) had proposed "Lewin's Three-Step Change Model"

stages of change could be seen and elaborated in the next figure and next set of quotes.
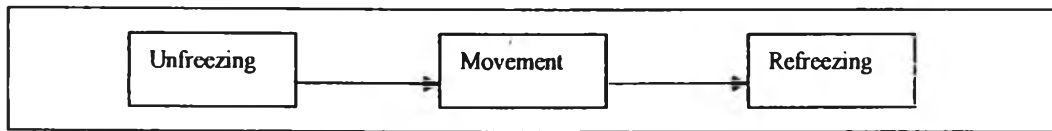

Figure 2-13: Lewin's Three-Step Change Model

"Unfreezing: Change efforts to overcome the pressures of both individual resistance and group.

Refreezing: Stabilizing a change intervention by balancing driving and restraining forces.

Driving forces: Forces that direct behavior away from the status quo (equilibrium state)."

Restraining forces: Forces that hinder movement away from the status quo.

Source: Adapted from Stephen P. Robbins, 2001:551, "Organizational Behavior: Organizational Change and Stress Management". Prentice-Hall, Inc., New Jersey

As mentioned change could also results in re-organization or restructuring of the original organization hierarchy. Robbins had proposed two main types of organization structures, being mechanistic and organic. The pictorial elaboration could be found in the next figure.
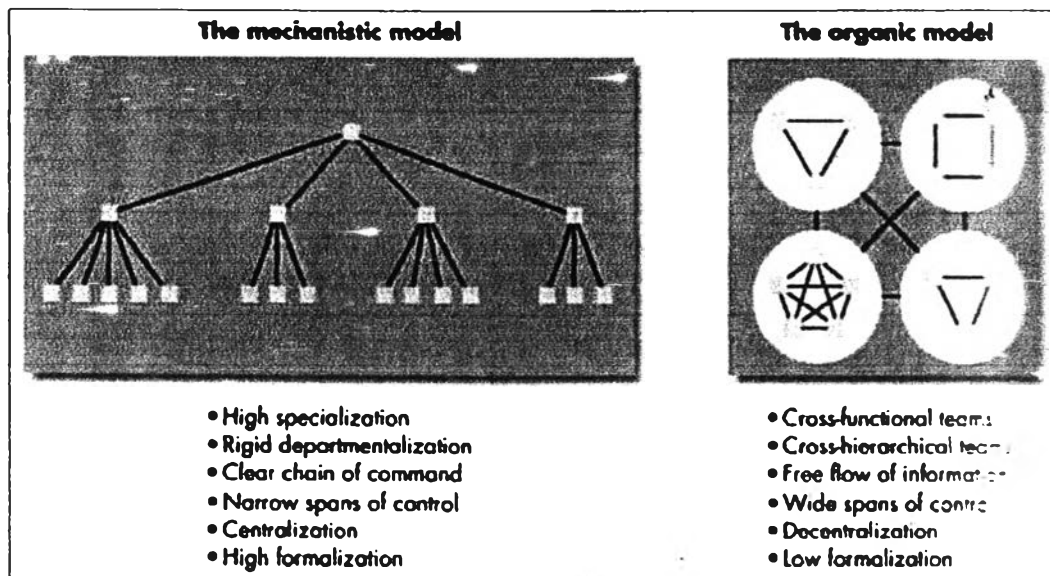

Figure 2-14: Mechanistic versus Organic model

Source: Stephen P. Robbins, 2001:430, "Organizational Behavior: Foundation of Organization Structure". Prentice-Hall, Inc., New Jersey

Robbins (2001:429), a mechanistic model or structure was characterized by extensive departmentalization with high formalization a limited information network and centralization which mean little participation by lower rank employees in decision making process.

On another hand the organic structure is flatter and spread out, uses cross-hierarchical and multi ability cross functional teams. It also characterized by low formalization, possesses a comprehensive information network, and relies on participative decision making. Robbins (2001:430), "An organization's was a mean to help management achieve its objectives. Since objectives were derived from the organization's overall strategy, it was only logical that strategy and structure should be closely link." Therefore during a BRP process in order to get to successful ERP implementation, this was one factor that the management must be very crucial and clinical about choosing organization structure. A suitable organization structure would play a part in successful CM.

Another factor that the management must be aware of during CM was the organization culture. To prepare and set the people within the company to have the right frame of mind and the right corporate culture is vital. Without the shared sprit of cooperation and 'system ownership' or 'corporate ownership' the project was viewed to be doom. 'Corporate Culture' was a combination of two main things. One was 'people' who were being employed by the company. Issues were their personal values, skills and habits etc. People management and employees are the one who dictate and perpetuate the culture. Secondly was the way the organization works, these were things such as decision making process, staff's attitude, stability, etc. More definitions can be found in the following quotes.

- "*culture is not a characteristic of individuals, but a collection of individuals who share common values, beliefs, ideas etc. These collections may include family, occupational regional or national groups;*

- *culture is learned. People learn the culture of a group when they become a member;*

- *culture has a historical dimension. A particular nation's culture develops over time and is partly the product of that nation's history, its demographic and economic development, it geography and its ecological environment.*

- *Culture has different layers. Hofstede (1991) distinguishes four different layers of culture i.e. symbols, heroes, ritual and values"*

Source: www.ejisdc.org

"...organizational culture refers to a system of shared meaning held by members that distinguishes the organization from other organizations. This system of shared meaning is, on closer examination, a set of key characteristics that the organization values."

Source: Stephen P. Robbins, 2001:430, "Organizational Behavior: Foundation of Organization Structure". Prentice-Hall, Inc., New Jersey
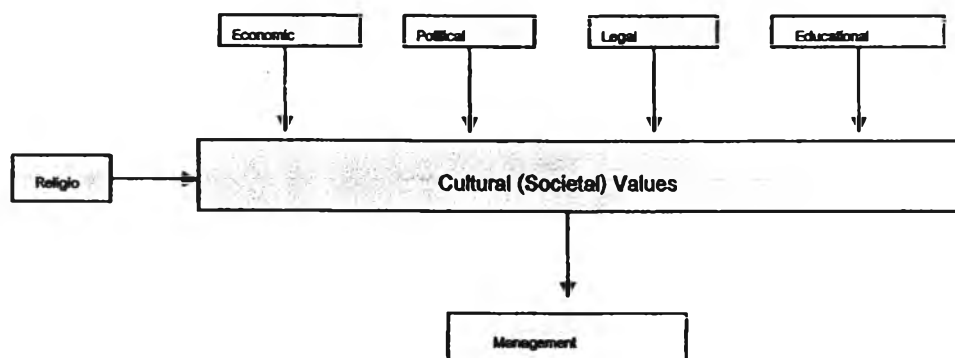

Figure 2-16: Influences on Cultural and Societal Values

Source: M. Zafar Iqbol, 2002:121 International Accounting. South Western Copy

According to M.Zafar Iqbor (2002:121), there were five major environmental external influences that contribute and formulate the cultural or societal values. According to the research done by Hofstede, with 116,000 responses from workers in 40 different countries, the cultural difference can be grouped in to four dimensions.

"Individual behavior varies across cultures"

Greet H. Hofstede. Culture's Consequences 1980: International Differences in Work-Related Values. Bevery Hills, Calif: Sage Publicaiton

- *Power Distance*
- *Uncertainty avoidance*
- *Individualism versus collectivism*

- *Masculinity versus femininity*

"Power distance reflects the tolerance of inequality between superiors and subordinates."
Source: M. Zafar Iqbol, 2002:129 International Accounting. South Western Copy

In the large power distance environment the employees at the operation end tends to follow the decision by their superiors with no question asked e.g. Japan's culture or where seniority was the main culture.

In contrast the working environment where the gap was smaller the employees would follow the decision only after it had been approved acceptable by the majority or when they feel threatened.

The uncertainty avoidance can be defined as

"...the extent to which uncertainty is avoided in a culture"
Source: M. Zafar Iqbol, 2002:131 International Accounting. South Western Copy

This usually determined how a company dealt with crisis or problems. Cultures with high uncertainty avoidance rate the importance of employment stability higher than the level of stress. On the another hand the culture with low uncertainty avoidance was characterized by accepting the risk as a part of daily life routine and feeling comfortable with it.

Individualism: "The trait in which the employee attaches higher importance to personal and family interests than to the organization."
Collectivism: "...the cultural characteristic in which interests of the organization should have top priority."
Source: M. Zafar Iqbol, 2002:130 International Accounting. South Western Copy

"Masculinity is the relative importance of the qualities such as assertiveness and materialism. Femininity is characterized by quality of life, nurturing, and relationship."
Source: M. Zafar Iqbol, 2002:131 International Accounting. South Western Copy

"The long-term orientation emphasizes the adaptation of traditions to meet current needs. It values perseverance, efficiency and economy in using resource and willingness to make a

sacrifice to achieve objectives. The short-term orientation values respect for tradition, personal stability, quick results form the efforts made, and concern with appearances. "

Source: G. Hofstede and M. Bond. 1998 The Confucius Connection: From Cultural Roots to Economic Growth." Organizational Dynamics

Robbins (2001:510) also presents seven primary characteristics that in general represent the essence of an organization's culture.

- *"Innovation and risk taking: The degree to which employees are encouraged to be innovative and take risks.*

- *Attention to detail: The degree to which employees are expected to exhibit precision, analysis, and attention to detail.*

- *Outcome orientation: The degree to which management focuses on results or outcomes rather than on the techniques and processes used to achieve these outcomes*

- *People orientation: The degree to which management decisions take into consideration the effect of outcomes on people within the organization.*

- *Team orientation: The degree to which activities are organized around teams rather than individuals.*

- *Aggressiveness: The degree to which people are aggressive and competitive rather than easygoing.*

- *Stability: The degree tow which organizational activities emphasize maintaining the status quo in contrast to growth. "*

Source: Stephen P. Robbins, 2001:510, "Organizational Behavior: Organization Culture". Prentice-Hall, Inc., New Jersey

2.5 System Development Framework and Strategy

From the section 2.2 of this chapter, it was clear that the ERP system was an Information System (IS) which integrates all the business function into one mega database, so that information can be across departments given the authority, for faster information on hand, faster decision making, and providing the company with the competitive edge over its competitors.

There were many methods available in various implementation frameworks in developing computer-based information systems such as CRM, ERP etc, the research would focused on the later system. However there would be no single perfect system development strategy or framework Shelly et al (2003:20). This was mainly because each case has its own variation e.g. various company's infrastructure. Therefore the

research should first analyze variation of system development strategy before going on with any of the chosen strategy.

2.5.1   Structured Analysis Strategy

This is one of the most traditional technique exist, *"Structured analysis is a traditional systems development technique that is time-tested and easy to understand."* Shelly et al (2003:20). The methodology utilizes a series of phases known as the System Development Life Cycle (SDLC) to help completing the system implementation. Structured analysis also known as process-center technique because the method focuses on processes which transform raw hard data into compact useful information and reports. This was called process modeling where it would identifies the data transition into a process, the business culture, structure and regulation that transform the data and give output as output data flow.

2.5.2   Object-Oriented Analysis Strategy (O-O)

This method was different from the structure analysis strategy because it combines raw data and the processes that act on to the data into 'objects', whereas the previous method treat processes and data as separate items. The O-O method is use by the systems analyst to model a real business processes and operations resulting in a set of software objects that represent nearly everything in the company, e.g. people, things, transactions and events. This O-O method had an advantage and had been practice widely because of its flexibility, efficiency and simplicity in converting to O-O programming languages (Visual Basic, Java, and C++).

2.5.3   Joint Application Development and Rapid Application Development Strategy

This strategy was done in order to take the end-user and the system user to take part in the designing and developing phase of an IS. This was done to make sure of end-user system's buy-in and has more sense of ownership of the IS being implemented. This reduces risk and make change management which often come with the IS overhaul an easier task. There are two main methodologies in this

strategy being, Joint Application Development (JAD) and Rapid Application Development (RAD). According to Shelly et al (2003:22), the main differences was "*JAD focuses on team based fact-finding, which is only one phase of the development process, while RAD is more like a compressed version of the entire process.*"

2.5.4 Microsoft Solution Framework (MSF) Strategy

This method designs a series of models which includes a risk management model, a team model and a process model. This method integrates both SDLC phase-oriented approach and O-O method. The method integrates the SDLC phase-oriented approach in terms of planning, fact-finding questions, design and implementation issues and tackle the same problems. The MSF methods also utilize O-O method in design concepts yet covering the broader business and organizational contexts evolving around the development of an IS.

As mention there would be no single best methodology. Therefore the implementation team must do was to understand each of the system development strategy then implement any modification according to the company's business infrastructure and constraints. The implementation team had opted for Structure Analysis as their system development strategy backbone.

According to Koch (2002, "The ABCs of ERP"), there were three main ways for implementing ERP system. They are the Big Bang, Franchising Strategy and Slam Dunk.

- **Big-Bang:** this could be the most difficult and ambitious approach comparing to the next two. This approach companies cast off all their legacy systems at once and install a ERP system company wide. This call for big and dramatic change. This strategy was not very popular due to many failure stories in the past relating with this type of change strategy.

- **Franchising:** this strategy was more widely used which suitable to larger companies which do not share common processes across

business units. ERP system would be installed separately in different units while linking common processes.

- **Slam dunk:** this strategy was more popular in smaller company where the implementation focuses on key processes. Koch (2002) "The goal here was to get ERP up and running quickly and to ditch the fancy reengineering in favor of the ERP system's "canned" processes."

From this research point of view, the later three strategies can be viewed as a subset of the main framework mentioned in section 2.5.1, 2.5.2, 2.5.3, and 2.5.4. For long term strategic success of company or for the mission of ERP implementation and proper CM and BPR the management must access their company's structure and culture, and then choose the options that are suitable to the strategy. These are done in the following chapters of this research.

2.6 Conclusion

This chapter discussed the theories and review literatures that are related to the research. Then chapter first discuss the definition of the ERP system that will be use for the entire research. The chapter next discusses the benefits as well as the failure stories regarding the ERP system implementation. The chapter then touches on the TCO, which guides the implementation team on the total cost for the system implementation and to avoid the pitfall in under estimating the budget. Change management was then discussed. Within CM there are issues such as resistance to change and its sources. The CM then led to discussion of Business Reprocess Reengineering which according to many scholars and experts is another tool compulsory for successful ERP system implementation. Each tool are carefully implemented and discussed in Chapter 4, 5 and 6 of this research in an attempt to solve the problems of the company. The background of the company and its problem can be found in Chapter 3.