PROCESS THEORY APPROACHES IN SME ORGANIZATIONS TO ENTERPRISE RESOURCE PLANNING SYSTEMS (ERP) IMPLEMENTATION LIFECYCLES

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Abstract

Enterprise Resource Planning Systems (ERP) have become the defacto IS system for major organizations during the past 15 years. The Small and Medium Sized (SME) marketplace is the focus market segment for software developers, consultants and researchers. The implementation of ERP systems have seen perilous times as organizations encountered numerous problems, financial strains, organizational difficulties, organizational cultural challenges, resulting in successful implementations but also failures to the extent of bankruptcy filings.

This paper will examine the various process theory methodologies available to ERP implementation project teams, Champions, consultants and software vendors as alternative approaches for a successful implementation. Selection of an ERP and a guiding process methodology is more crucial to the SME organizations that typically face more organizational, financial, cultural, and technical constraints than large-scale organizations. These process theory methodologies have their genesis in classic MIS SDLC, yet the different models have diverse beginning and end phases, and inclusions.

Introduction

In the current global economy environment, "SMEs' performance is essential for the development of any country's economy" and provide the foundation for future economic growth and prosperity with their growth into large enterprises (Abouzeedan and Busler, 2004). Statistics indicate that historically most new businesses do not survive the first five years of operations (Castrogiovanni, 1996; Monk, 2000).

There would be a very positive impact on the global economy if a higher proportion of these fledging enterprises survived and grew into global economy competitors (Monk, 2000). Part of this ability to compete and survive is based on the ability of the enterprise to create, analyze and ultimately utilize business information systems about its operations to provide quality leadership in products, improve business processes, enhance its supply chain, and create better customer relationships (Schubert & Leimstoll, 2007).

From an enterprise research perspective, small and medium sized enterprises (SMEs) are the leading segment of organizations that provide a wide variety of researchable theories and experiences. Not only are these organizations crucial to industrial economies, but also demonstrate operational qualities that promote cause and effect relationships that are proving to be enormously interesting to researchers (Katz, Aldrich, Welbourne and Williams, 2000).

The majority of ERP systems were implemented in large-scale organizations in the mid to late 1990's to the current day and generally were done to: 1) overcome the millennium date problem (often known as the Y2K initiative), 2) resolve issues of disparate systems within the organization, 3) resolve poor quality/visibility of information, 4) resolve lack of business processes and/or systems not integrated, 5) replace obsolete systems, 6) assist in integrating acquisitions, and 7) resolve issues of lack of support for organizational growth (Deloitte, 1999; Plant & Wilcocks, 2007).

Without due diligence, many organizations will find the ERP software system dictating the operational

aspects of the business (Bajwa, Garcia & Mooney, 2004). Consequently, the challenge for the adopting organization is to properly choose how various processes will be implemented within the programmatic (configuration) options. Furthermore, it is critical how these options are selected to maximize the efficiencies and effectiveness of the organization (Shanks, Parr, Hu, et. al., 2000). Given these factors, issues related to user satisfaction and perceived usefulness in the ERP implementation must be considered (Zviran, Pliskin, & Levin, 2005). Even considering the highly configurable nature of ERP systems (Bancroft, Seip & Spregel, 1998), the inherent data structures, programming code, and existent assumptions about business processes can impose a behavior on organizations that many management teams will find difficult to adopt (Piszczalski, M., 1997; Al-Mashari, Al-Mudimigh & Zairi, 2003).

A significant number of organizations, for existing legitimate managerial reasons: financial, personnel, infrastructure resource limitations, etc. have not considered adoption of a new or upgraded system (Adam and O'Doherty, 2000). It is important to note that simply having an accounting information system (AIS) is not the equivalent of implementing a true ERP for the enterprise. AIS are typically a component, module, or subsystem of a complete ERP system.

Some level of SME organizations were compelled, or were in a position to be strongly influenced by a vendor/client relationship in their value chain to adopt a particular system, even though it may not be the most appropriate fit. Some SME organizations may be legal units of some larger organization and may be essentially forced to adopt a particular enterprise solution to remain within the strategic goals of the parent organization. It has been suggested by other researchers (Sistach et. al. 1999; Sistach and Pastor, 2000) that this phenomenon may also occur in Supply Chain Management (SCM) situations and other modules.

There are numerous factors affecting successful implementation of ERP programs into any organization. These have not been fully identified and described for the SME market, although many studies have addressed these factors for the larger scale market. A recent research effort (Argyropoulou, Ioannou, & Prastacos, 2007) specifically addressing SME implementations, reported that these organizations were much more likely not to use a structured methodology for implementation. Further the study reported that SMEs were either not familiar or unsophisticated with techniques such as business process reengineering (BPR) and change management.

The Data Envelopment Analysis (DEA) model was developed in 2004 to help mid-size organizations select ERP systems to best assess costs with capabilities/services to evaluate relative performance. Most SME firms lack the technical and financial resources to make the appropriate selection of ERP software. Historically SME IS professionals often used software selection guides or surveys to choose an organizational software package (Fisher, et. al., 2004).

Small and Medium Enterprises (SME)

Many organizations are aware of limiting factors, subsequently cautious and hesitant to implement new ERP solutions due to well publicized problems and failures, and the financial and technical resources necessary. However, SME organizations are in a unique position to leverage this risk and financial commitment with a significant opportunity to gain a considerable competitive advantage and exploit future system evolutions by adopting ERP "best practice" systems (Wang, Ragsdale, & Schuler, 2006).

SME organizations – marketplace definition

The market segments for software products, particularly ERP solutions, are differentiated into several strata including: large organizations, SME organizations, and SMB markets. There are no generally accepted definition parameters of SMEs in the United States, including the federal government (Ou, 2006).

The following distinctions in market profiles are adopted for this paper and were sourced from the *Journal of Accountancy* (Johnston, 2003). *Large organizations* typically implement full ERP software applications and have annualized sales in excess of $500 million, and have more than 500 employees. *Small to medium enterprises* (SME) have sales up to $500 million, and have no more than 500 employees. This stratum represents more than 84,000 U.S. companies. *Small to medium businesses* (SMB) have sales up to $100 million, and have no more than 100 employees. This represents more than 516,000 companies in the U.S. SME organizations that have < 500 employees and <$500 million in annualized sales is the focus and definition adopted within this research.

SME organizations – ERP perspectives and challenges

In a report released in March 2006, *Thinking big: Midsize companies in the United States and the challenges of growth*, the Economist Intelligence Unit interviewed 240 U.S. senior executives from a total 3,722 global midsize company business executives using similar SME segment parameters. These firms indicate an aggressive expansion of their customer base using a strategy of product and service diversification to secure new geographic (global) markets. The keys to successfully infusing this strategy are: improved operating efficiency, excellent work force, and *critically efficient information technology infrastructure* (Ramaswani, Holloway & Kenny, 2006). The executives identified growth priorities substantially influenced by a strong IS environment and information systems. The executives indicate IS are critical to enabling growth (76%), and a deficiency of talented staff (36%) to manage the growth and constraints such as resistance to change and lack of technical skills, are major impediments to IS investment (Ramaswani, Holloway & Kenny, 2006).

The Aberdeen Group (2006) provided their *ERP in the Mid-Market* benchmark report. Their definition of SMEs was much larger but findings were similar in most regards, but did focus more on the larger companies that tended to be financially and organizationally related to larger Fortune 1000 and S & P 500 type organizations. There were noteworthy analytical points, such as the correlation between ERP functionality utilized and company size. Their analysis demonstrated that functionality rose steadily and peaked at the $100-$250 million size organization (the typical definition of an SME), and then dropped. They concluded these companies did not have unlimited resources like their larger competitors, but have sufficient resources to maximize their implementations value and have learned to leverage these investments, with a greater incentive for productivity and efficiency (Aberdeen Group, 2006).

ERP implementation

Historical perspective

In a classic MIS article, Kydd (1989) suggests that" failure to address the uncertainty and equivocality that exist during the development and implementation of a new management information system is a major reason why projects fail". *Implementation* as a process has different definitions and connotations, spanning from the fully encompassing process of selection and ultimate upgrades years hence, vs. a very narrowly defined step in one project phase. This paper will adopt the broader, fully encompassing process approach definition that includes a complete process theory ERP lifecycle.

Supporting research indicates a sound IT strategy is linked to a full understanding of any organization's business strategy. "IT strategy is the alignment of the information technology infrastructure and investment with the business' strategic direction" (Norris, Wright, et. al., 1998). ERP popularity can be traced to greater global organizational activity, mergers and acquisitions, short product life cycles, and system disaster fears from older legacy systems (Bingi, Sharma, & Godla, 1999).

There are a number of primary reasons to implement an ERP system (Nadkarni & Nah, 2003). ERP can integrate disparate domestic and global systems

under one enterprise operation, resulting in one consolidated database and the elimination of "islands of automation" (Kerr, 1988) that so politically and operationally plagued IS systems in the 1975-2000 time frame. Secondly, the "Y2K" date bug was effectively eliminated, and the organization/enterprise was expected to benefit with greater functionality and improved business processes; although fueling the original efforts, this not no longer exists as a major implementation factor.

Too often ERP solutions were viewed by a majority of enterprises as a panacea for their organizational ills. Many of these implementations were failures (at one point in the late 1990's the failure rate was approaching 70% by some professional estimates) for any number of reasons, while some implementations were limited successes. There were many implications to managements of these organizations and they also had a profound effect on the accounting functions and financial and managerial reporting efforts. The literature reports have identified countless successes and failures. Some have been such monumental failures that lawsuits were filed and some organizations have been forced into bankruptcy proceedings (e.g. FoxMeyer Drugs driven into bankruptcy, 1998) from the subsequent business difficulties. Several implementations like Hershey's have seen copious financial losses while others encountered extensive costs when the realization that the software would not fit the organization's needs, similar to Dell's circumstances (Bingi, Sharma, & Godla, 1999; Esteves, & Pastor, 1999; Shang, & Seddon, 2000; Umble, & Umble, 2002).

ERP systems have taken a more dramatic role than originally envisioned in the early 1990s. Organizations are rapidly being tested and asked to respond with qualified and well-trained professionals utilizing complex information systems (ERP) to meet not only the daily informational and operational needs, but also an ever-expanding governmental compliance initiative, e.g. SOX 404 compliance. Consequently, managements are facing an increasingly dedicated technological environment with significant challenges. In the last 18 years (1990 – present), information technology provided a methodology for contemporary organizations to integrate supply, production, and delivery processes. Prior competitive advantage in these organizations was persistently maintained with the previous deployment of technology into physical assets and excellent balance sheet management, but this could no longer be the champion of growth and management (Kaplan & Norton, 1996; Swanson & Ramiller, 2004).

A fully integrated ERP effectively defines the tasks and objectives of an organization. "The information age organization operates with integrated business processes that cut across traditional business functions. It combines the specialization benefits from functional expertise with the speed, efficiency, and quality of integrated business processes" (Champy & Hammer, 1993). Additionally "all employees must contribute value … by the information they can provide. Investing in, managing, and exploiting the knowledge … has become critical to the success of information age companies" (Kaplan & Norton, 1996; Jacobs & Whybark, 2000). In contrast to ERP, *legacy systems* are long-tenured, non-ERP, dedicated mainframe systems where each organizational subdivision may have its own dedicated computer system, often not integrated with other systems. Historically these have also been referred to as "islands of information" or "islands of automation" (Kerr, 1988).

ERP has been historically touted as cheaper to purchase and install/maintain than to classically construct legacy systems that are replaced, thus appearing to be a panacea to large and complex organizations (Nah & Delgado, 2006). ERP are perceived to be highly flexible and adaptable. History has proven ERP can generate organizational behavior restrictions, and behaviors that organizations did not expect. The discipline of the programming code, the DBMS complex data structure, the intricate integration of applications, and built-in assumptions of normal business processes, can and have taxed and frustrated many organizations.

"First/Second/Third Waves"

The "First Wave" of ERP implementation presented a fundamental transformation of any organization. Adoption and implementation of ERP systems experienced the "First Wave" as a far-reaching scope of business processes impact, and generates a paradigm change to businesses/organizations simply due to the magnitude of the changes. The efforts were predominately focused on the technical aspects of the implementation, i.e. software, infrastructure, basic training initiatives. However the business process changes envisioned and deemed necessary usually generated low priority. Hence, business process changes and operational enhancements were fundamentally deferred and became the major factors of the "Second Wave".

Marketers, researchers, practitioners, and software vendors coined the "Second Wave" and "Third Wave" of ERP implementations during the past 8 years. These characterize the time frame in the system implementation and operation, after the base system has been installed, and the "go live" point has occurred, and refer to major updates and enhancements to the software. These normally include business processes such as the implementations of Customer Relationship Management (CRM) and Supply Chain Management (SCM) modules. These efforts all provide *value-added* contributions to the ERP system and take the organization to the point of leveraging the system for overall operational and financial gains, i.e. ROI opportunities and value chain optimization (Hawking, McCarthy & Stein, 2004; Stein, Hawking, & Foster, 2004, 2003; Smith, & Fingar, 2003; Deloitte Consulting, 1999).

In summary, companies were seeking *efficiency* benefits, higher-order *effectiveness* benefits, and ultimately *transformation*. Transformation is the ability of an organization/strategic business unit to fundamentally change how they conduct their business and associated processes (Deloitte Consulting, 1999).

Success and failure parameters

The ERP implementation efforts suggest an essential issue: "the key questions about enterprise systems from the perspective of an adopting organization's executive leadership are questions about success" (Markus & Tanis, 2000). These questions are also posed by others (Davenport, 2000a, 2000b; Deloitte Consulting, 1998; Markus & Tanis, 2000; Ross & Vitale, 2000) all noting the multidimensional accrued benefits of these systems, running the spectrum of operational improvements to enhanced decision support systems for strategic goals.

Deloitte Consulting (1998) published a study that was based on in-depth interviews of 62 Fortune 500 companies, and although not an academic composition, it is accepted in the ERP industry, academics and professionals serving the industry as a benchmark publication in ERP implementation efforts. The study concludes: "Until now, conventional wisdom saw going live as the end. In sharp contrast to this view, our study uncovers at least two distinct waves of ERP enabled enterprise transformations. The First Wave refers to the changes to an organization that include and accompany going live with ERP. The Second Wave, on the other hand, refers to the actions that are taken after going live that help organizations achieve the full capabilities and benefits of ERP enabled processes" (Deloitte Consulting, 1998).

Success in information systems (IS) implementations has long been a focus of academic research efforts (Lyytinen & Hirschheim, 1987; DeLone & McLean, 1992, 2003; Ballantine et. al., 1996). Others research efforts focused on the measurement of success, antecedents and explanations of success or failure (Markus, Axline, Petrie & Tanis, 2000; Koh, Soh, & Markus, 2000). The exigency affiliated with success or failure in ERP systems results from the inherent risks and colossal costs, sometimes rivaling the expected benefits of these systems. In many cases, failures have led to losses and bankruptcies (Bulkeley, 1996; Davenport, 1998; Bingi, Sharma, & Godla, 1999; Esteves, & Pastor, 1999; Markus & Tanis, 2000; Ross & Vitale, 2000; Shang, & Seddon, 2000; Davenport, 2001; Umble, & Umble, 2002).

There are different dimensions, e.g. technical, financial, economic, operational or strategic that can

be assessed to measure success in ERP implementations (Markus, et. al., 2000). Success can and should be measured at different time points (Larsen & Myers, 1999) to assess value, with evidence pointing to changing levels, e.g. early failure but later success. Paradoxally, research indicates performance slides after initial implementation with moderate to severe business disruptions (Ross & Vitale, 2000).

ERP implementation – lifecycle models

The literature on ERP lifecycle models is somewhat dispersed with the resulting absence of a generally accepted enterprise lifecycle model (Rosemann, 2003). This is curious considering the extensive research conducted on systems analysis and design and software development without a significant effort towards the management of enterprise systems (Gable et. al., 1997; Klaus, Rosemann, & Gable, 2000). Currently, there are a number of software development models, (e.g. waterfall model, spiral model), but no standardized ERP lifecycle model. There is a concentration on implementation issues and critical success factors both in the literature and the trade press (Bingi, Sharma, & Godla, 1999; Holland, Light & Gibson, 1999; Stefanou, 1999; Sumner, 1999; Nah, Lau & Kuang, 2001; Umble, Haft, & Umble, 2003). Process theory in a case study (Koh, Soh & Markus, 2000) was contrasted with variance theory utilizing a ERP process model. Several authors (Shanks et. al., 2000; Markus & Tanis, 2000; Nah & Delgado, 2006; Plant & Willcocks, 2007) stress the point that an ERP implementation project is best conceptualized as a business project and not simply the installation or update of an innovative technology.

Cooper and Zmud (1990) developed one of the first ERP related models that includes the following six lifecycle stages in an ERP implementation: 1) *initiation phase* – establishing the business case and identifying the problems and opportunities, 2) *adoption phase* – gain organizational support for the implementation effort, 3) *adaptation phase* – acquire the system, installation, maintenance, 4) *acceptance phase* – system has complete functionality and user training completed, 5) *routinization phase* – normal operations in daily activity, and 6) *infusion phase* – incremental organizational effectiveness.. These stages have similarities to other researcher-developed models and as they are examined, these lifecycle models tend to have between three and six phases. Each of these phases' success can be gauged and evaluated by a series of defined metrics including factors of human and organizational learning.

There are numerous highly referenced alternative ERP lifecycle models emanate from, Bancroft, (1997); Bancroft, Seip and Sprengel, (1998); Gable, Scott and Davenport, (1998); Esteves and Pastor, (1999); Holland and Light (1999); Holland, Light and Gibson, (1999); Parr, Shanks and Darke, (1999); Markus and Tanis (2000); Parr and Shanks, (2000); Ross and Vitale, (2000); Sandoe, Corbitt, and Boykin (2001); and Ahituv, Neumann and Zviran (2002). Essentially, all of the above models distinguish similar, but not entirely identical phases; additionally, they group and name these phases differently.

Bancroft (1997) proposed a lifecycle model with an emphasis on the initiating phases starting with focus to the actual implementation. Gable, Scott and Davenport (1998) created a different approach with an initial focus on the consulting effort, through implementation to phases of training and knowledge transfer. Esteves and Pastor (1999) have six phases also, but they included a final phase, *retirement* dealing with the next evolution of the ERP software. Markus and Tanis (2000) compressed the lifecycle model down to four phases of *chartering, project, shakedown, and onward and upward*. Finally, Ahituv, Neumann, and Zviran (2002) developed a four-phase model, including *selection, definition, implementation, and operation* that closely resembles the actual implementation phases expected in SMEs.

Structured lifecycle models – process theory basis

The implementation of an ERP system is the result of many phases of organizational, professional and consulting firm review and analysis. Often this is a structured format similar to the MIS concept of SDLC. Some of these phases become nebulous and overlap during the actual implementation projects.

Implementation is often confusingly referred to as the entire adoption, installation, and operational process of bringing an ERP system online, yet alternately can refer to the single phase within the overall project where the software system becomes operational.

Cooper and Zmud's (1990) phases of *adaptation, acceptance and routinization* are discussed by many researchers and practitioners as the "Second" and "Third Waves" of ERP implementation and post-implementation activity. Alternative ERP lifecycle models create a full spectrum of grounded theory: Esteves and Pastor (1999), Markus and Tanis (2000) and Ahituv, Neumann and Zviran (2002). Substantively, all four models address near identical phases, although grouped and titled differently.

Process Theory Approach – ERP Lifecycle Models

There are a number of ERP lifecycle models identified in the literature. Included in this detail review are a representative group that are chosen because of their multiple references in other literature or their inclusion of different phases of the lifecycle model: 1) Cooper and Zmud (1990) advocate a six phase model, similar to SDLC, but with different and more descriptive names for the phases and some differences as to where various sub-phases should be included, 2) Esteves and Pastor (1999) advocate a six phase model very similar to classic SDLC models, 3) Ahituv, Neumann and Zviran (2002) developed a four phase model, including selection, definition, implementation, and operation, and 4) Markus and Tanis (2000) developed a simpler four phase system, that essentially merged most of the above phases.

ERP lifecycle model – Cooper and Zmud

The Cooper and Zmud (1990) model identifies six phases: initiation, adoption, adaptation, acceptance, routinization, and infusion. This approach looks upon IS implementation from a general perspective and is somewhat similar to Esteves and Pastor, but with different nomenclature.

The lifecycle model includes six phases of ERP implementation during its life in an organization (see Figure 1).

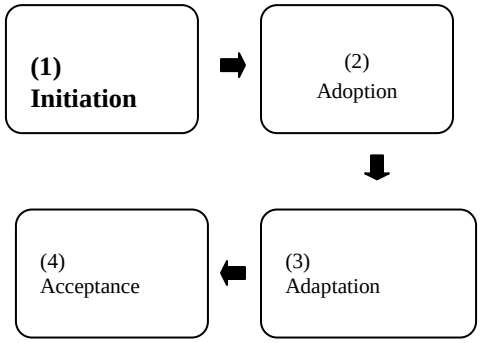


Figure 1. ERP Lifecycle model – Cooper & Zmud

The *initiation phase* is characterized by identifying the organizational problems and opportunities for IS solutions. Likewise, these are seen as "push" "pull" alternatives. "Push" as a result of new technological innovation and "pull" as a result of an organizational need. The *adoption phase* has various activities and negotiations occurring to acquire and solidify organizational support for the implementation effort of the IS solution. The *adaptation phase* has the actual system developed or acquired, installed and maintained. This is the main core of the implementation process and requires great managerial, financial and human resources support. The *acceptance phase* sees the system operated as a live system with complete feature functionality, including user and system training. Acceptance however does not assume full operational functioning, just acceptance that the system meets all operational compliance factors. The *routinization* assumes that the IS system, in this instance the implemented ERP system is now operated in daily activity. The *infusion phase* assumed incremental organization effectiveness as a result of normal system operation. The system is used to its fullest potential.

ERP lifecycle model – Esteves and Pastor

Esteves and Pastor (EP) (1999) suggested an ERP lifecycle model, representing the various phases that an ERP system would chronologically implement in an organization. The lifecycle is structured in phases going through the whole ERP project and functional life: adoption decision, acquisition, implementation, use and maintenance, evolution, and retirement.

The lifecycle model includes six phases of ERP implementation during its life in an organization (see Figure 2).

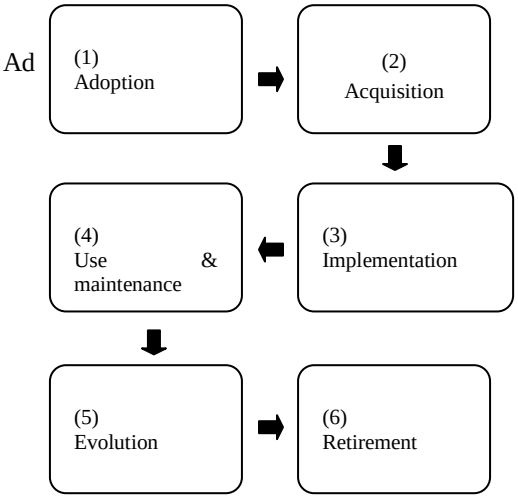


Figure 2. ERP Lifecycle model – Esteves & Pastor

The *adoption decision* represents the time when management determines that a new ERP system is necessary for any number of reasons. The phase includes systems requirements definition, the desired goals and benefits, and the impact of the ERP system adoption. The *acquisition* relates to the decision of system choice as a result of the systems requirements definition in the adoption phase. This also considers the system that needs the least amount of customization. The *implementation* deals with the actual adoption of the system into the computer infrastructure and any customization necessary to make the system functional. This phase is also characterized by the greatest degree of training. The *use and maintenance* deals with the functionality, usability and adequacy of the system to the organization. Post implementation issues include required maintenance, updates, correction of malfunctions both programmatic and option selection, systems operational optimization and overall general improvements. The *evolution* represents the period when additional capabilities are integrated into the ERP system for additional benefits. The evolution phase has benefits both "upwards" and "outwards". The *retirement phase* deals with the period when an ERP solution no longer meets organizational goals and objectives and needs to be replaced (Esteves & Pastor, 1999).

ERP lifecycle model – Ahituv, Neumann, and Zviran

This model developed by Ahituv, Neumann, and Zviran (2002) is a blended model of traditional SDLC, Prototyping and Application Software Package purchase approaches. This model is comprised of four phases: selection phase, definition phase, implementation phase, and operation phase. There are many overlays and consistencies with the previous three models, and is probably most closely related to the Esteves and Pastor ERP lifecycle model, with some phases combined.

The Ahituv et. al. model is similar to the others, but has various detailed activities identified in each of the phases. It is a blended approach of three traditional system development models the authors defined, Information System Life Cycle (The Waterfall Model) and very much like classic SDLC, Prototyping Model that is the antithesis of SDLC and creates a prototype system for further development, and Application Software Package Model that is related to the purchase of a preexisting system.

The authors also identified a series of characteristics that would influence the selection of an ERP lifecycle model for development methodology: system complexity, system strategic importance, system flexibility, application scope, technological infrastructure, organizational process changes, intensity of relationship with vendor, employment of external consultants, and users' involvement.

The lifecycle model includes four phases of ERP implementation during its life in an organization (see Figure 3).

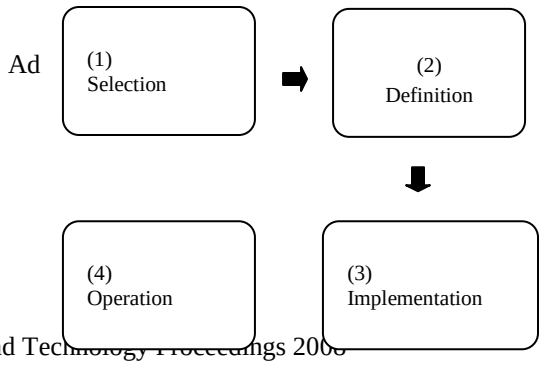




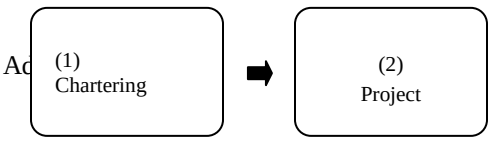
Figure 3. ERP Lifecycle model – Ahituv, Neumann, & Zviran

The first or *selection phase* identifies the most appropriate ERP package and includes the definition of project objectives, collection of vital information about systems, vendors, and consulting firms, needs analysis, feasibility study, contract negotiation and signing. The second or *definition phase* is the shortest in duration and includes all preparatory activities for the following implementation phase. The third or *implementation phase* is the predominant phase of the ERP lifecycle and is designed to provide maximum organizational efficiency and effectiveness plus financial rewards upon movement into the operation phase. The phase is characterized by the iterative implementation of various system modules passing through activities to either add processes or organizational layers to the accomplished project objectives. The fourth and final phase is the *operations phase*. Here the system is brought to normal operations and is the longest of the phases, potentially lasting multiple years.

ERP lifecycle model – Markus and Tanis

The Markus and Tanis (2000) lifecycle model created a unique phasing approach unlike the other models. Their proposed ERP lifecycle model reflects a more streamlined and simplified approach. Their life cycle consists of four phases: chartering, project, shakedown, and onward and upward. These phases have more commonality with the Cooper and Zmud lifecycle model than with Esteves and Pastor's approach. They obviously combine some elements into broader categories, and thoroughly ignore any retirement and replacement issues.

The lifecycle model includes four phases of ERP implementation during its life in an organization (see Figure 4).



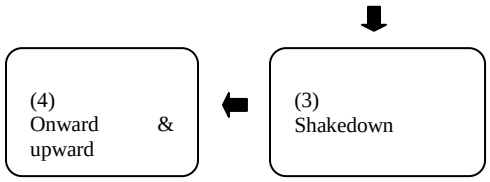


Figure 4. ERP Lifecycle model – Markus & Tanis

The *chartering phase* is the first in the process and includes all elements related to the original vision to adopt or upgrade an ERP system. This includes the feasibility studies, initial system design and selection process of the overall implementation process. The scheduling and planning for the system implementation is completed and all project leaders, champions and consultants are selected. This effectively is the combination of at least the first two phases in the other lifecycle models.

The second or *project phase* includes all installation and most implementation issues. The system is rolled out to the users, all training occurs for users and systems personnel, all data conversion activity occurs along with required acceptance testing and any integration with existing legacy systems. This includes parts of a number of other phases in each model.

The third *shakedown phase* has a definite time line delineated by the point of normal operations commencement by all users, though the point of when normal daily routine activity begins. Essentially this extends through all bug fixes and performance fine-tuning resulting in a stabilized functional system.

The fourth *onward and upward phase* assumes that the system has reached normalcy, i.e. routine and efficient operational status. This phase includes all time from this initiation point until the system is replaced or upgraded. When these events occur, it is assumed that the process restarts at the beginning of the lifecycle similar to Cooper and Zmud. Keys elements of this phase include assessing the actual and perceived benefits as a result of the implementation process, advancing the training and

skill sets of the users and upgrading the software plus instituting all business process improvements.

The interesting element of the Markus and Tanis model is that all implementation and upgrade operations can use each of the four stages of the model. Any upgrades will begin again with the chartering phase and stage through all phases until completion.

The Markus and Tanis model is generally accepted as the simplest to understand and reference. It provides a well-delineated set of phases and also includes the contingency for upgrading of the system and replacement with a new evolution of IS systems. The Ahituv model could be the closest to what the real world has migrated into over the past ten years and has the most detailed structure and would also be an effective choice. This option would probably be more appropriate in large scale ERP implementation efforts since these enterprises are characterized as more complex and have more resources, both human and financial, to utilize in the implementation. Attempting to utilize this approach in the SME marketplace could burden the enterprise and the implementation team to a greater degree than is appropriate for the SME scale.

Summary

SME certainly have different constraints than the large-scale organizations that led the ERP marketplace for many years. SME do not have the same financial resources, in-house technical competencies, and often have unique organizational cultures, all generating greater risk for any attempted ERP implementation. There are countless studies of critical success factors to promote a positive result in these efforts. Choosing a process theory approach combined with vendor tools, an exceptional ERP implementation team, a strong project Champion, and most importantly management commitment promote a successful project.

The process theory approach should help the project team and executive management understand and plan for the various stages the implementation will progress through. Some SMEs will be forced to take steps such as the "big bang approach" rather than a "phase-in" approach because of some of the constraints. But in all cases, this is a significant undertaking for any organization, and without a good structured plan based on one of the process theory models, organizations will do little to promote risk aversion in their implementation efforts.

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