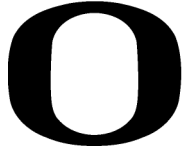


Presented to the Interdisciplinary Studies Program:



UNIVERSITY OF OREGON
APPLIED INFORMATION MANAGEMENT

Applied Information
Management and the
Graduate School of the
University of Oregon in
partial fulfillment of the
requirement for the degree
of Master of Science

Implementing Vanilla ERP Systems: Factors to Consider in Strategy, Business Alignment, and Customization

CAPSTONE REPORT

**Janice Yick
Field Manager
BC Hydro**

University of Oregon
Applied Information
Management
Program

July 2011

Continuing Education
1277 University of Oregon
Eugene, OR 97403-1277
(800) 824-2714

Approved by

Dr. Linda F. Ettinger
Senior Academic Director, AIM Program

Implementing Vanilla ERP Systems:
Factors to Consider in Strategy, Business Alignment, and Customization

Janice Yick

BC Hydro

Abstract

This annotated bibliography examines 31 references to identify factors to consider when implementing a vanilla enterprise resource planning (ERP) system. Literature published since 1998 reveals that there is a high cost in maintaining customized ERP systems, thus companies are deliberately implementing vanilla ERP software. Factors include the need to address strategic and cost implications, organizational adaptation to ERP functionality, deploying strategies to minimize customizations, change management, cross-functional implementation teams, coordination mechanisms, and clear performance measurements.

Keywords: vanilla implementation, process alignment, ERP, customization, best practice, adaptation, integration

Table of Contents

Abstract..... 3

Table of Contents..... 5

List of Figures..... 7

Introduction to the Annotated Bibliography..... 9

 Problem..... 9

 Significance..... 11

 Purpose..... 12

 Audience..... 13

 Delimitations..... 14

 Reading and Organization Plan Preview..... 16

Definitions..... 17

Research Parameters..... 21

 Search Report..... 21

 Literature Collection..... 23

 Documentation Approach..... 25

 Literature Evaluation Criteria..... 26

 Reading and Organization Plan..... 27

Annotated Bibliography..... 30

 Factors for Consideration Related to Vanilla ERP Implementation Strategy..... 31

Factors for Consideration Related to Business Process Alignment..... 60

Factors for Consideration Related to ERP Customization..... 82

Conclusion 96

References..... 107

List of Figures

Figure 1. Factors for consideration related to vanilla ERP implementation strategy99

Figure 2. Factors for consideration related to business process alignment.....103

Figure 3. Factors for consideration related to ERP customization.....105

Introduction to the Annotated Bibliography

Problem

Enterprise Resource Planning (ERP) “is based on the concept of identifying and implementing the set of *best practice* [processes], procedures, and tools that different functions of a firm can employ to achieve total organizational excellence through integration” (Mabert et al., 2000, p. 52). Best practice processes are viewed to yield positive organizational impacts because they standardize processes across the organization (Gattiker & Goodhue, 2002, p. 4799, p. 4807). ERP systems have the ability to (a) automate and integrate business processes; (b) share data and practices across the organization; and (c) produce and access real-time information (Nah et al., 2001, p. 285). “A successful ERP can be the backbone of business intelligence for an organization, giving management a unified view of its processes” (Motwani et al., 2005, p. 530).

The promise of greatly improved operational efficiency and enhanced organizational performance (Liang et al., 2007, p. 60) drove up the popularity of ERP systems, which soared in 1994 (Chen, 2001, p. 376). By late 1990s, the ERP market was forecasted to exceed \$50 billion by 2002 (Chen, 2001, p. 376). However, by 1999, studies show that 40% of ERP installations only achieved partial implementation and 20% were total failures (Trunick, 1999). ERP failures included companies such as Dell, Boeing, Dow Chemical, Mobil Europe, Applied Materials, Hershey, and Kellogg’s (Chen, 2001, p. 374).

Despite the potential difficulties in maintaining ERP software, especially when ERP customizations are involved (Mabert et al., 2001, p. 69), ERP systems have become the dominant software for many organizations (Mabert et al., 2000, p. 52). There are several reasons for its popularity. First, there is “a trend to move away from ‘home grown’ software systems toward

packaged systems that are not primarily developed or customized” (Gattiker & Goodhue, 2002, p. 4799). Second, if ERP is successfully implemented, it should link all functionalities within the company into one tightly integrated system with shared data and visibility (Chen, 2001, p. 374). Third, ERP systems should provide consistency across business functions (Al-Mashari, 2003, p. 40). Lastly, ERP systems should result in potential benefits such as declines in inventory, reduction in working capital and abundant information on customer needs (Chen, 2001, p. 374). The problem is, they often don’t! One of the key reasons is that upgrading customized ERP systems is laborious and costly because customizations must be re-coded every time ERP systems are upgraded (Haines, 2009, p. 182).

According to Ng et al. (2003), an upgrade cost can amount to 25% to 33% of the initial ERP implementation (p. 1). Due to mounting costs of maintaining customized ERP systems, many companies are implementing ERP systems with minimal customizations (Parr & Shanks, 2000a), purportedly for the reason noted by Gattiker and Goodhue (2002) that companies realize that best practice business processes are incorporated into the ERP software (p. 4799, p. 4803). Therefore, companies are accepting the default features embodied within the ERP (Kitto & Higgins, 2010, p. 38).

These minimally customized systems are known as *vanilla* implementations (Parr & Shanks, 2000a, p. 293); in other words, companies must conform to the ERP processes (Parr & Shanks, 2000b, p. 6). Unfortunately, the vanilla solution does not always meet the information processing requirements of a given specific organization (Soh et al., 2000, p. 27). It often requires significant modifications to organizational processes (Luo & Strong, 2004, p. 322) as there are potential difficulties in aligning the embedded ERP business processes with the existing organizational processes (Gattiker & Goodhue, 2002, p. 4801; Liang et al., 2007, p. 60). In fact,

processes for fragmented (localized), functional-based organizational structures may have to be redesigned to conform to the integrated ERP systems (Al-Mashari, 2001, p. 177-178). As a result, organizations would have to adapt to new functionality, live with the shortfall of processes, or institute workarounds (Soh et al., 2000, p. 47). And, although ERP systems provide companies the ability to make changes to ERP configuration tables to customize the processing of transactions in order to keep them vanilla, this centralized approach does not provide suitable functions for all businesses (Scapens et al., 1998). For example, a British subsidiary of an U.S. multinational company found it difficult to use ERP for its operations because the software was configured for U.S. operations (Scapens et al., 1998).

Significance

In 2003, Ng et al. note that “ERP maintenance and upgrade activities are attracting increasing attention in ERP-using organizations” (p. 1). By 2009, Haines comments that many companies are seeing that “ERP customizations can have substantial long-term cost implications” (p. 183). Thus, prompting companies to deliberately implement ERP software in its vanilla form, which requires organizations to change their existing business processes to fit the ERP delivered processes (Parr & Shanks, 2000b, p. 5, p. 6). As stated by Karimi et al. (2007), “a business process is essentially composed of discrete and detailed activities performed on, or in response to, incoming information” (p. 107). For example, manufacturers may have unique business processes to handle customized orders whereas service companies may have two different business processes - one for dealing with large customers and another for small customers. As these processes are critical to the survival of organizations, the issue of “[changing] business processes to fit the ‘technological imperatives’ of a computer system...[has] received a great deal of attention” (Gattiker & Goodhue, 2002, p. 4799).

Purpose

The purpose of this study is to develop a scholarly annotated bibliography that summarizes literature that addresses factors for consideration related to implementation of a vanilla ERP system. The goal is to explore: (a) vanilla ERP implementation strategies to manage competition and mitigate risks; (b) impacts of aligning business processes with ERP embedded processes; and (c) impacts of customizations and how they should be minimized.

This study is designed to give organizations a better understanding of the implications of implementing vanilla ERP systems as they are very costly investments. Research goals include the presentation of cases that report steps to mitigate and manage impacts when an organization decides to implement a vanilla ERP system. The study is organized and framed based on these research questions:

Grand question. What are the factors to consider when implementing a vanilla ERP system?

Sub-questions.

- a. How can organizations manage competition and risk during the implementation of a vanilla ERP system (Al-Mashari, 2003; Bingi et al., 1999; Chen, 2001; Gattiker & Goodhue, 2005; Hong & Kim, 2002; Kumar et al., 2002; Mabert et al., 2000; Mabert et al., 2001; Motwani et al., 2005; Nah et al., 2001; Parr & Shanks, 2000a; Parr & Shanks, 2000b; Tchokogue et al., 2005; Wright & Wright, 2002)?
- b. What are the reported and potential impacts of aligning existing business processes with ERP embedded processes (Al-Mashari, 2001; Al-Mashari & Al-Mudimigh, 2003; Daneva, 2004; Daneva & Weiringa, 2006; Davenport, 1998; Gattiker & Goodhue, 2002; Gattiker & Goodhue, 2004; Karimi et al., 2007; Soh

- et al., 2000)? What causes misalignments (Al-Mashari, & Al-Mudimigh, 2003; Daneva, 2004; Daneva & Weiringa, 2006; Davenport, 1998; Gattiker & Goodhue, 2002; Gattiker & Goodhue, 2004; Soh et al., 2000)? What are the alignment strategies (Al-Mashari, 2001; Al-Mashari, & Al-Mudimigh, 2003; Chou & Chang, 2008; Daneva, 2004; Daneva & Weiringa, 2006; Davenport, 1998; Gattiker & Goodhue, 2002; Gattiker & Goodhue, 2004; Karimi et al., 2007; Soh et al., 2000)?
- c. What are the impacts of customization (Dittrich et al., 2009; Haines, 2009; Ioannou & Papadoyiannis, 2004; Light, 2001; Luo & Strong, 2004; Rothenberger & Srite, 2009; Scott & Kaindl, 2000)? How should customizations be minimized (Haines, 2009; Light, 2001; Rothenberger & Srite, 2009)?

Audience

The audience for this scholarly annotated bibliography is the group of professionals who are planning to implement a vanilla ERP system or have already implemented a customized ERP system but are considering implementing vanilla ERP systems in the future. This group includes information technology (IT) management executives, managers of organizations and IT consultants. ERP software is modularized by core business functions like financial, manufacturing, distribution, logistics, quality control and human resources (Al-Mashari & Al-Mudimigh, 2003). Therefore, organizations from any industry can selectively choose to implement ERP modules that suit their business needs. The following describes segments of the audience in more detail.

Chief information officers (CIO). CIOs identify opportunities for their enterprise to move to the next level of performance; they take the lead role in coaching and coaxing business

colleagues about the potential uses of technology (Broadbent & Kitzis, 2005). As they have influence over technological implementations, it is important for CIOs to understand the implications of vanilla ERP software implementations.

Functional managers. These managers oversee day-to-day operations of business functions within an organization including finance, payroll, marketing, purchasing, and production (Stephens et al., 1992). They will be the users of ERP systems; therefore, they should understand how ERP software might affect their business before it is implemented.

Information technology consultants. Many companies hire IT consultants to implement ERP software (Karimi et al., 2007, pp. 105-106). As such, consultants require an understanding of the implications of ERP implementations before they can be hired as ERP implementers.

Information technology managers. These managers plan, coordinate and direct research, and design computer-related activities for organizations (McKay, 2010). Since they are involved directly with software implementation, they should understand user impacts and how these impacts can be mitigated.

Delimitations

Time frame. The selected literature for this study is limited to references published no earlier than 1998. The year 2000 is the year that “signaled both the maturing of the ERP industry and the consolidation of large and small ERP vendors” (Jacobs, 2007, p. 362). For example, in 2002, PeopleSoft, the third largest ERP vendor merged with the fourth largest ERP vendor, J.D. Edwards (Jacobs, 2007, p. 362). J.D. Edwards’ products were strong in manufacturing, accounting, and finance whereas PeopleSoft was strong in human resources; thus, the merger allowed the new company to offer a more complete software portfolio (Jacobs, 2007, p. 362).

Topic and focus. A myriad of factors reportedly contribute to the negative impact of ERP implementations. During the implementation process, there may be a lack of (a) teamwork and composition; (b) top management support; (c) business plan and vision; (d) effective communication; (e) good project management; (f) a project champion who strives to resolve issues and manage resistance; (g) a stable business setting; (h) a good change management program that educates people of ERP changes; and (i) willingness to change business process to fit the ERP software with minimal customization (Nah et al., 2001). This study focuses on the last factor on this list – changes to existing business processes as a result of minimal customizations due to vanilla ERP implementations. This researcher takes the position that most of the ERP difficulties experienced by organizations are caused by business process changes made to align with the ERP embedded processes.

Selection criteria. All literature is searched by key terms through the University of Oregon (UO) Library online portal. Literature is limited to scholarly peer-reviewed materials available online, which include journal articles, professional publications and conference proceedings. Selected literature includes case studies showing examples of how companies are impacted by ERP implementations and how the impacts are mitigated. To ensure the materials are credible, the quality, relevance, authority, and objectivity are assessed as described in the Research Parameter section of this paper (see Evaluation criteria).

Audience. As many organizations are finding ERP implementations to be challenging (Chen, 2001, p. 374), the audience selected for this study includes managers and consultants who not only lead ERP implementations, but also those who are directly affected by ERP implementations.

Reading and Organization Plan Preview

The initial reading plan involves a preliminary review of the references to determine how to best organize the presentation of information in the Annotated Bibliography. As a first step, conceptual analysis is used to categorize the reference by research sub-question topics:

- 1) vanilla ERP implementation strategy
- 2) business process alignment
- 3) ERP customization

The goal of this categorization is to partition the selected references into three content areas in preparation for a more detailed reading to identify factors for consideration related to each one. These same content areas serve as categories used to facilitate presentation of the resulting information in the Annotated Bibliography section of this document, according to the needs of the audience.

Definitions

The following definitions represent common terms used by organizations that implement ERP systems. The purpose of defining these terms is to enhance the understanding of the information presented in the Scholarly Annotated Bibliography, especially for those readers who may not be familiar with some of the business terminology used in this study.

Best Practice – *Best practices* will yield positive organizational impacts (Gattiker & Goodhue, 2002, p. 4799) because they standardize processes across the organization (Gattiker & Goodhue, 2002, p. 4807).

Business Functions – Business functions are activities conducted within an organization such as accounting, finance, sales and distribution, and material management (Mabert et al., 2001, p. 70).

Business Intelligence – “Business intelligence refers to the use of technology to collect and effectively use information to improve business effectiveness” (Nadeem & Jaffri, 2004, p. 1).

Business Process – “A business process is essentially composed of discrete and detailed activities performed on, or in response to, incoming information” (Karmi et al., 2007, p. 107).

Business Process Re-Engineering – Business process re-engineering involves changing ways of conducting work and the relationship between functions (Scapens et al., 1998, section titled: What is SAP?). This re-engineering process includes studying strategy changes, organizational structure, culture, approaches and human aspects (Al-Mashari & Al-Mudimigh, 2003, p. 22).

Centralized Approach – Centralize approach is where different functional views are unified, local application systems are connected to a centralized application, and all information across local sites are harmonized because data is centrally stored and managed (Lodestone, N.D).

Core Business Functions – Core business functions are the main activities within an organization such as payroll, financial, accounts payable, accounts receivable, manufacturing,

distribution, logistics, quality control, and human resources that keeps a company viable (Al-Mashari & Al-Mudimigh, 2003, p. 22; Wright & Wright, 2002, p. 107).

Embedded Business Processes – ERP systems embed *best practice* business processes in the design of the software (Liang et al., 2007, p. 60). This result in rigid ERP systems because assumptions about the organization’s business are also embedded (Daneva & Wieringa, 2006, p. 195). Unfortunately, if assumptions do not match the business, business requirements are not met (Daneva & Wieringa, 2006, p. 195).

ERP Configuration Tables – ERP configuration tables allow organizations to customize the system by making changes to table entries rather than modifying the ERP code (Haines, 2009, p. 184). These table configuration options allow organizations to modify the ERP system to fit its organizational needs (Luo & Strong, 2004, p. 324). Therefore, it is important to understand the meaning and consequences of each configurable option as there are many tables in a typical ERP system (Luo & Strong, 2004, p. 324). They can be a very complex and time-consuming when making configuration changes (Luo & Strong, 2004, p. 324).

ERP Customization – Customization is a specialization of an IT related business asset, which is driven by strategic business goals (Haines, 2009, p. 182). It involves the modification of an ERP software package to match the organization’s existing business processes (Rothenberger & Srite, 2009, p. 664). The goal is to solve function misalignment and facilitate integration (Chou & Chang, 2008, p. 151).

Enterprise Resource Planning (ERP) System – ERP is a comprehensive packaged software solution that delivers total integration of all business processes and functions within an organization (Parr & Shanks, 2000b).

ERP System Implementation – “ERP [system] implementation has the greatest effect on business process outcomes” (Karimi et al., 2007, p. 103) as it means businesses have to change their proven processes to fit the software in order to benefit from the improved processes and avoid upgrade costs (Nah et al., 2001, p. 286).

Functional-Based Organizational Structures – A functional-based organization has a “structure where the employees are grouped hierarchically, managed through clear lines of authority, and report ultimately to one top person” (BusinessDictionary).

Home Grown Software Systems – Home-grown software systems are software primarily developed or customized for a single organization (Gattiker & Goodhue, 2002, p. 4799).

Integrated ERP System - An ERP integrated system allows organizations “to leverage generic processes and data definitions across the whole organization” (Haines, 2009, p. 183). “The more organizational processes get integrated via the shared process and data environment, the more they get adapted to the default ERP structures” (Daneva & Wieringa, 2006, p. 199)

Operational Efficiency – Operational efficiency is achieved “by integrating business processes and providing better access to integrated data across the entire enterprise” (Chou & Chang, 2008, p. 149)

Real-Time Information – Real-time information means data is up to date as “there is no delay in the timeliness of the information provided” (Wikipedia, N.D.).

Vanilla ERP – *Vanilla* ERP is a minimally customized ERP system (Parr & Shanks, 2000a, p. 293) where the software implementation results in companies conforming to the ERP processes (Parr & Shanks, 2000b, p. 6).

Workaround – Workarounds provide the needed functionality without modifying the ERP system, which could mean a manual process or an alternative method in the ERP to perform the

function (Soh et al., 2000, p. 50). Workarounds are recognized as inefficient (Liang et al., 2007, p. 61).

Working Capital – Working Capital is a financial liquidity measure of an organization's operational efficiency. It represents money tied up in inventory or customers still owe money and cannot be used to pay off company debts. If an organization is not operating efficiently (slow in collection), there is an increase in working capital (Investopedia).

Research Parameters

This section describes the research design for this study, which includes listing the key search terms, databases and search engines used to access and retrieve literature. The documentation approach outlines how the information is recorded and stored. The literature evaluation criteria describe the framework used to determine the quality, relevancy, authority and objectivity of each selected reference. Finally, the reading and organization plan describes the approach taken to examine the selected literature and present the results in the Scholarly Annotated Bibliography.

Search Report

Search of the literature indicates that the number of ERP publications is growing. The UO catalog search results for “ERP Implementation Impact” show 60 publications in 2010, 49 in 2009 and 25 in 2006. These numbers support the claim by Liang et al. (2007) that ERP systems are becoming increasingly popular with medium and large size corporations (p. 60).

The selection of references to support this study focuses on three areas of literature: (a) vanilla ERP implementation strategy (Al-Mashari, 2003; Bingi et al., 1999; Chen, 2001; Gattiker & Goodhue, 2005; Hong & Kim, 2002; Kumar et al., 2002; Mabert et al., 2000; Mabert et al., 2001; Motwani et al., 2005; Nah et al., 2001; Parr & Shanks, 2000a; Parr & Shanks, 2000b; Tchokogue et al., 2005; Wright & Wright, 2002); (b) business process alignment (Al-Mashari, 2001; Al-Mashari & Al-Mudimigh, 2003; Chou & Chang, 2008; Daneva, 2004; Daneva & Weiringa, 2006; Davenport, 1998; Gattiker & Goodhue, 2002; Gattiker & Goodhue, 2004; Karimi et al., 2007; Soh et al., 2000); and (c) ERP customization (Dittrich et al., 2009; Haines, 2009; Ioannou & Papadoyiannis, 2004; Light, 2001; Luo & Strong, 2004; Rothenberger & Srite, 2009; Scott & Kaindl, 2000).

Searches are conducted through the UO Library online portal, in databases such as Academic Search Premier, ArticleFirst, Computer Source, UO Libraries' Catalog, Web of Science, and World Cat. In addition, searches are conducted in Google Scholar. The retrieval detail of references for the scholarly annotated bibliography is described below.

Key search terms.

- ERP implementation
- ERP strategy
- ERP implementation Impact
- ERP vanilla implementation
- ERP business processes
- ERP customization
- ERP vanilla process change
- Business process re-engineering
- ERP Business process change
- ERP strategic alignment
- ERP case study
- ERP planning
- ERP assimilation
- ERP effects

The initial search terms used are based on the focus areas around ERP implementation strategy, ERP business processes and ERP customization. Subsequent search terms and controlled vocabularies are mined from the analysis of retrieved literature.

Literature Collection

The literature is found in the UO libraries through key word searches using the search engines, indexes and databases listed below. The specific journals, professional publications and conference proceedings are also listed below.

Search engines and databases.

- Academic Search Premier
- ArticleFirst
- British Library Serials
- Business Source Complete
- Computer Source
- Elsevier SD North-Holland
- Elsevier B.V.
- Google Scholar search engine
- IEEE Xplore Journals
- JSTOR
- Sage Complete
- UO Libraries Catalog
- Web of Science

Journals and professional publications.

- Business Horizons
- Business Process Management Journal
- Communications of the ACM
- Computers in Industry

- Decision support systems
- Harvard Business Review
- IEEE Software
- IEEE Transactions on Engineering Management
- Information and Management
- Information Technology & People
- Information Systems Management
- International Journal of Human-Computer Interaction
- International Journal of Production Research
- International Journal of Production Economics
- Journal of Information Systems
- Journal of Information Technology
- Journal of Management Information Systems
- Journal of Operations Management
- Journal of Software Maintenance: Research and Practice
- Knowledge and Process Management Journal
- Management Accounting
- Management Information Systems Quarterly
- Production & Inventory Management Journal
- Requirements Engineering
- Science Technology Human Values
- Transportation & Distribution

Conference proceedings.

- 33rd Hawaii International Conference on System Sciences

Additional literature resources. Secondary sources cited and references listed in found literature provide additional material for this study. Also, many names of researchers are repeated in the citations of the found literature and thus, when searching for their work, many other material written by these researchers appear in the search results. This adds value to the inquiry.

Documentation Approach

Each selected reference is electronically stored in one of the three category folders: 1) vanilla ERP implementation strategy; 2) business process alignment; and 3) ERP customization. These folders reside on the researcher's computer and the categories are created based on the research sub-questions. The naming convention for the literature files is the author's last name followed by title. If there is more than one author, only the first author's name is used. This enables the files to be sorted and retrieved by author. Material that is eliminated after the preliminary analysis is kept in a folder labeled "not in use." All literature are kept electronically because it allows for key word search within each reference.

Notes for each reference are recorded on a separate Word document. Each note is labeled with author's last name and title. The notes consist of the following:

- Bibliographic information
- Page numbers
- How literature relates to the research questions
- Summary of the content. If there are not quotation marks, it is assumed that idea is paraphrased (Lester & Lester, 2009, p. 138).

Literature Evaluation Criteria

An evaluation framework is used to assess the following criteria to determine the quality, relevancy, authority and objectivity of each reference selected for inclusion in the Annotated Bibliography (Bell & Smith, 2009).

Quality. The abstracts, headings, tables and figures and conclusions of found literature are reviewed to determine the quality of the material. The quality assessment reviews the organization of information, presentation of graphics, the grammar and spelling of the work, and finally the completeness and accuracy of information, which includes documentation of sources (Bell & Smith, 2009). As this study is limited to scholarly sources, literature must include a bibliography, references, notes and/or works cited section (Bell & Smith, 2009, Scholarly vs. Popular).

Relevance. Once the literature has passed the quality assessment, the abstract is reviewed for relevancy. If an abstract does not exist, the introduction is read. The work is deemed relevant if it addresses the research question and the content is appropriate for the research topic.

Authority. If the quality and relevancy of the work is acceptable, the writer's authority is evaluated as per these guidelines:

- **Credentials** – Author must have at least one of these: 1) relevant university degree; 2) institutional affiliation; 3) relevant employment experience; and 4) past writings.
- **Reputation** – Author is cited in works of others. If this is a new writer, this criterion is not considered.
- **Publisher** – Publisher must be known for quality and/or scholarly publications

- Association – It is desirable but not mandatory for the author to be affiliated to a professional organization.

Objectivity. The objectivity of the authors is also evaluated. The abstract is read for the motive of the writing and existence of biasness. If the writing is deemed to be biased, the reference is eliminated.

Reading and Organization Plan

Reading plan. The reading plan for this study is designed in three stages and describes the approach to examine selected reference material related to vanilla ERP implementation, which has been vetted and has met the evaluation criteria described earlier in this Research Parameter section. In stage one, conceptual analysis, as described by Busch et al. (2005, Methods of Conceptual Analysis), is applied to determine the category of the references. This allows the researcher to “focus on, and code for, specific words or patterns that are indicative of the research question” (Busch et al., 2005, Methods of Conceptual Analysis). This method of analysis looks for occurrence of selected terms within the reference that relates to the categories, whether they are implicit or explicit (Bush et al., 2005, Conceptual Analysis). The term with the highest occurrence frequency determines the categorization of the reference; the three predefined content categories utilized in this study (based on research questions) are (a) vanilla ERP implementation strategy, (b) business process alignment, and (c) ERP customization.

In stage two, the preliminary reading involves reading the introduction, conclusion, and the first and last paragraph under each heading in each reference to verify the initial stage one categorizations. Any references that do not fit in any of these three categories are not used for this study. References are scanned to identify more detailed terms and concepts (defined at this point as preliminary potential factors) for each category as follows:

Category 1: Vanilla ERP implementation strategy –implementation, strategy, vanilla, competition, risks

Category 2: Business process alignment – business process, align, impacts, embedded process

Category 3: ERP customization – customization, limit

In stage three, during the detailed reading of the selected references, the contextual aspects of each identified potential factor are read and notes are written in order to clarify interpretation for final documentation in relation to the research questions. The goal of this detailed reading is to identify a full set of factors for consideration by the audience related to each category. References related to vanilla ERP implementation focus on factors that pertain to implementation strategy, managing competition and mitigating risks. References related to business process alignment center on issues resulting from aligning business processes to the ERP embedded processes and strategies on aligning them. References related to ERP customization discuss impacts of customizations and how they should be minimize for vanilla ERP implementation.

Organization plan. The organization plan describes how the information identified during the detailed reading of the selected literature is organized and presented in the Annotated Bibliography. Organization is designed thematically around research questions in order to allow the audience to efficiently navigate to a specific area of information that they need without reading through the entire Annotated Bibliography.

The selected references are organized into three thematic categories that align with the research questions. The following is the outline of the three categories and their sub-themes:

Category 1 identifies the implementation strategy to implementing a vanilla ERP system.

Sub themes include:

- Maintaining competitiveness
- Benefits of implementing vanilla ERP
- Weaknesses of implementing vanilla ERP
- Mitigating risks

Category 2 demonstrates the impact of implementing a vanilla ERP system. Sub themes include:

- Impacts of aligning business processes to embedded ERP processes
- Reasons for misalignments
- Strategies for alignment

Category 3 describes the implications of customizations and how they should be minimized when implementing a vanilla ERP system. Sub themes include:

- Impacts of customizations
- Strategies for minimizing customizations

Within each category, references are listed alphabetically by author. Each entry includes a four-part annotation, including the following elements: (a) the bibliographic citation in APA format; (b) a description of the main focus of the work; (c) an evaluation of the qualifications of the author(s); and (d) a summary of how the reference addresses the research questions.

Annotated Bibliography

This annotated bibliography consists of 31 selected references for the study. Annotations consist of three elements: (a) an excerpt from the reference abstract; (b) an assessment of the credibility of the references; and (c) a summary of the relevant ideas, in relation to this study. The ideas presented are either paraphrased or quoted from the selected references.

Content examines factors to be considered when implementing vanilla ERP systems. The three content areas of focus are: (a) vanilla ERP implementation strategy, (b) business process alignment, and (c) ERP customization. Factors are identified in the set of references selected for each area, as these are related to a research sub-question:

- Factors for consideration related to vanilla ERP implementation strategy (includes 14 references): How can organizations manage competition and risk during the implementation of a vanilla ERP system?
- Factors for consideration related to business process alignment (includes 10 references): What are the reported and potential impacts of aligning existing business processes with ERP embedded processes? What causes misalignments? What are the strategies to aligning business processes to the ERP system?
- Factors for consideration related to ERP customization (includes 7 references): What are the impacts of customization? As vanilla ERP implementations require minimal customizations, how can this be achieved?

Factors for Consideration Related to Vanilla ERP Implementation Strategy

Al-Mashari, M. (2003). A process change-oriented model for ERP application. *International Journal of Human-Computer Interaction*, 16(1), 39-55. Retrieved Mar 30 2011 from Academic Search Premier. doi: 10.1207/S15327590IJHC1601_4

Abstract. ERP systems are widely used as organizations believe these applications will bring an integrative approach and as a result, bring balance and consistency within the organizational structure. However, experiences with ERP systems demonstrate that the outcomes fall short of expectations. This article presents a process change management model that considers the key areas in ERP implementation, including strategy, business processes, structure, culture, information technology, and managerial systems.

Summary. Al-Mashari presents an ERP application model that attempts to align business processes, ERP modules, and organizational structure at the operational level as a way to address transformational change that must be strategically planned. This process involves identifying drivers for the needed strategic and operational changes and expected benefits. The goal is to educate employees, which includes a clear definition of new roles and responsibilities, and promotion of employee buy-in.

The ERP strategy can be delivered in many ways: (a) embedded in implementation objectives, (b) as part of organizational change management policies and (c) incorporated in an ERP deployment plan. ERP implementation provides opportunities for organizations to re-engineer processes and organizational structure into an integrative, cross-functional, and customer-oriented design to align with the ERP system. Effective ERP deployment depends on how much the strategy, structure, process, and system modules are aligned. ERP enforces contribution from all entities within an organization, making it important to define the different

roles and responsibilities for those involved before, during and after ERP implementation. Process changes have to be complemented by organizational structure changes and must be properly managed; otherwise opposition can result in ERP failure.

Credibility. Majed Al-Mashari is an assistant professor in the Information Systems department at the King Saud University in Saudi Arabia. He is also a visiting professor at the University of Bradford in England. He is the editor of the Business Process Management Journal and sits on the editorial board for the Journal of Logistics Information Management. He is the recipient of the ANBAR Citation of Excellence award. He has written several scholarly articles on ERP, which three of them are used for this study. This peer-reviewed article, which includes diagrams and tables to clarify the information presented, is published in the International Journal of Human-Computer Interaction.

Bingi, P., Sharma, M. K., & Godla, J. K. (1999). Critical issues affecting an ERP

implementation. *Information Systems Management*, 16(3), 7-14. Retrieved May 20 2011 from Computer Source. doi: 10.1201/1078/43197.16.3.19990601/31310.2

Abstract. This article presents (a) issues to consider when implementing enterprise resource planning (ERP) system software in an organization, (b) factors that contribute to ERP growth, (c) costs of an ERP system implementation, and (d) considerations to ensuring a successful ERP implementation.

Summary. Once an ERP system is implemented, it is expensive to undo; critical issues should be considered before implementing. For example, Unisource World wrote off \$168 million when it abandoned its ERP system. Dow Chemical spent half a billion dollars on implementing an ERP system over seven years before deciding to start over again on a new platform. In this global environment where companies are merging for competitive advantage, ERP systems help organizations integrate globally and provide a common language throughout the organization. Extensive preparation is required to ensure success. Due to the tight integration that ERP systems bring, any information changes to one department will be passed immediately to another in real time. This could magnify mistakes as they flow through the company. As such, it is necessary to establish an efficient means of communication between departments. A broad base of top management has to be involved throughout the ERP implementation; most companies make the mistake of handing the ERP implementation responsibility to the technology department.

Most organizations view that a single ERP system for the entire company would serve customers efficiently and ease maintenance. Business processes must conform to the ERP model but sometimes they are unique and cannot be changed. If that is the case, steps should be taken to

customize those processes because research shows that an application package can at best meet only 70 percent of organizational needs. When software is customized, the implementation cost rises; therefore, it is recommended that the ERP system be kept as vanilla as possible to reduce costs in customization, maintenance and upgrades.

Bing et al. assert that there is no one application that can meet all of a company's needs. Third party software has to be used to meet unique requirements. Doing so can cause integration problems because third party software may not support some of the ERP systems. Organizations should ask the ERP vendor for a certified third party vendor list because the ERP system will only be supported if certified software is utilized.

Credibility. Two of the authors, Prasad Bingi and Maneesh K.Sharma, work at Indiana University – Purdue University in Fort Wayne. Bingi works in the Department of Management and Marketing while Sharma works in the Department of Accounting and Finance. Jayantha K.Godla works at Pricewaterhouse Coopers in Michigan. This peer-reviewed article is published in the Information Systems Management journal.

Chen, I. (2001). Planning for ERP systems: Analysis and future trend. *Business Process Management Journal*, 7(5), 374-386. Retrieved April 3 2011 from Google Scholar.
<http://cis.csuohio.edu/~ichen/ERP.pdf>

Abstract. Many ERP failures can be attributed to inadequate planning prior to installation. This article analyzes critical planning issues, including needs assessment and choosing a right ERP system, matching business process with the ERP system, understanding the organizational requirements, and economic and strategic justification.

Summary. Chen's article focuses on activities prior to the decision to adopt an ERP system. CSR Wood Panels of Australia is described as an example of a company able to reduce its inventory by \$37 million a year after its ERP implementation because the company took the time to review and choose the software package that most closely matched its business processes. Top management has to decide the company's desired position in relation to its current competitive position before selecting the right ERP system. For an ERP implementation, the business process often has to be changed to match the system. Although some companies choose to extensively customize the ERP systems, it is not recommended because customizations are not only costly but they also jeopardize the key benefits of integration. Most companies that have ERP implementation successes have re-engineered their business processes to fit the system.

Chen states that the "competitive advantage brought by the ERP systems for these companies appears to hinge on who can achieve a tighter, smoother fit between its business process and the ERP system" (p. 379). Companies fail to realize ERP benefits because the organization is fragmented and not structured to benefit from it. It is the "behavior change

needed to support the new way of doing business that is most critical to provide ERP firms with unprecedented competencies” (p. 384).

Credibility. Injazz J. Chen is a faculty member of the College of Business Administration at Cleveland State University. She has been cited in other references used in this study. This peer-reviewed article is published in the Business Process Management Journal. The information presented is supplemented by diagrams.

Gattiker, T.F., & Goodhue, D.L. (Sep 2005). What happens after ERP implementation:

Understanding the impact of inter-dependence and differentiation on plant-level outcomes. *MIS Quarterly*, 29(3), 559-585. Retrieved May 10 2010, from Web of Science. <http://www.jstor.org/stable/25148695>

Abstract. Organizational information processing theory states that performance is influenced by the level of fit between information processing mechanisms and organizational context. Two important elements of this context are interdependence and differentiation among subunits of the organization. Gattiker and Goodhue explain why ERP impacts differ, based on data collected from a questionnaire survey of 111 manufacturing plants.

Summary. Some organizations will benefit more from ERP implementation than other organizations because benefits are influenced by the interdependence and differentiation between subunits of the organization. When subunits have a high level of interdependence, there is greater need for coordination because any changes in one subunit will affect the other. Since ERP increases the information link among subunits, ERP is expected to improve coordination. In other words, the greater the interdependence, the greater the ERP benefits. ERP systems impose standard processes and data on organizations. This means that organizations are subjected to the same ERP process at all levels of the organization. If one subunit has unique business processes, it will experience problems because ERP does not allow for local flexibility. Misalignments are a serious problem, especially those that are deep-structure and pervasive. The greater the differentiation between subunits, the lower the ERP benefits will be achieved. Customization can be used to align the unique business processes to the ERP systems; this will moderate the impact of differentiation among subunits and can in effect improve local efficiency. Although

customization has a positive role, it will not moderate the effect of differentiation. Differentiation will decrease the ERP benefits whereas interdependence will increase the ERP benefits.

This article describes the types of environment that would most benefit from ERP; vanilla ERP implementers should consider the factors presented here, because vanilla implementation requires an environment in which organizations need to adapt to ERP processes.

Credibility. Thomas F. Gattiker is an assistant professor in the Networking, Operations, and Information Systems Department at Boise State University. His work has been published in several reputable journals such as the International Journal of Production Research and the Decision Sciences Journal of Innovative Education. Dale L. Goodhue is a professor and department head of the MIS department, and the C. Herman and Mary Virginia Terry Chair of Business Administration at the University of Georgia. His work appears in scholarly journals like Management Science and Decision Sciences. Gattiker and Goodhue's peer-reviewed article is published in the MIS Quarterly. This research is supported by statistics.

Hong, K. K., & Kim, Y. G. (2002). The critical success factors for ERP implementation: An organizational fit perspective. *Information and Management*, 40(1), 25-40, Retrieved May 8 2011, from Elsevier SD North-Holland. doi:10.1016/S0378-7206(01)00134-3

Abstract. This study explores the root of high failure rate from an “organizational fit of ERP” perspective. The concept of organizational fit of ERP is defined; its impact on ERP implementation is examined, together with ERP implementation contingencies. Results from a field survey of 34 organizations show that ERP implementation success significantly depends on the organizational fit of ERP and certain implementation contingencies.

Summary. Three quarters of the organizations that have implemented ERP systems consider their projects as unsuccessful. Past studies have identified many possible root causes for the failures including difference in interests between customer organizations and ERP vendors, and the “relative invisibility of the ERP implementation process” (p. 26). Hong and Kim note that since ERP systems are process-based rather than function-based, disruptive changes to the organization are expected because alignment between ERP and organizational processes is crucial for a successful ERP implementation. However, there are conflicting views of whether the organizational processes should adapt to the ERP system or the ERP system should adapt to the organizational processes. Those who believe that organizations should adapt to the ERP model say that the ERP systems embody best practices and therefore, ERP should be implemented without any adaptations. Also, ERP vendors strongly recommend process adaptation because any changes made to the ERP can degrade performance and integrity as well as affect maintenance and future upgrades. Process adaptation requires a good change management program to assist in adapting existing business processes to standard ERP processes, which may lead to organizational resistance. Also, process adaptation has only

interaction effect on the organizational fit; it has no impact on the ERP implementation success. ERP adaptation, on the other hand, has “a significant threshold interaction effect of ERP adaptation on the relationship between the organizational fit of the ERP and ERP implementation success” (p. 36). Advocates of ERP adaptation believe that the “notion of ‘best practice’ is illusory and potentially disruptive” (p. 26) because the ERP systems do not provide processes for every industry. This adaptation will result in less organizational resistance, reduced training and less organizational changes. These are important considerations especially for a vanilla ERP implementation, as it will require process adaptation.

Credibility. In 2002, at the time of writing this article, Kyung-Kwon Hong was a doctoral candidate at the Graduate School of Management of the Korea Advanced Institute of Science and Technology (KAIST) in Seoul, Korea. He has a masters’ degree in Industrial Engineering from KAIST. Young-Gul Kim is an associate professor at KAIST. He has a PhD in MIS from the University of Minnesota. This article is published in the peer-reviewed journal of Information and Management.

Kumar, V., Maheshwari, B., & Kumar, U. (2002). Enterprise resource planning systems adoption process: A survey of Canadian organizations. *International Journal of Production Research*, 40(2), 509-523. Retrieved May 20 2011 from Business Source Complete. doi: 10.1080/00207540110092414

Abstract. The study investigates critical enterprise resource planning (ERP) adoption issues such as adoption motivations, justification, risks and criteria for a selection of product vendor and implementation partners. The innovation process study approach is taken and data are collected through a questionnaire and by structured interviews.

Summary. Kumar et al., focus on the ERP adoption process, which is comprised of activities that determine whether to proceed with the ERP implementation. This study shows that many organizations have similar motivations, concerns and strategies. One of the top reasons why most organizations implement ERP systems is that they believe the software will integrate and improve the quality of their information. However, implementation does not come without risks, as shown through the case example. ERP systems can result in:

- cost escalation
- lack of availability and retention of skilled people
- high degree of organizational change
- reluctance to accept the system
- incapability of organizational infrastructure to support ERP technology
- challenges in integrating legacy systems

These risks can be mitigated by several strategies. Organizations should seek professional assistance during the ERP adoption process. An example is partnering with ERP vendors or consultants because they can help facilitate the adoption, implementation, and stabilization of the

ERP systems. When selecting consultants, organizations need to look at their reputation, ERP experience, process engineering experience, industry specific knowledge, methodology and cost.

Also, organizations should:

- focus on change management
- make people accountable for company savings and losses
- invest in employees by providing proper training
- ensure project adheres to schedule
- create an awareness within the organization in regards to infrastructure updates.

As there is usually significant resistance to ERP systems, organizations need to get user buy-in. Some of the buy-in approaches are: (a) hold meetings; (b) hold information seminars; (c) broadcast email on ERP information and status; (d) train key members; (e) distribute newsletters; (f) conduct surveys; (g) hold ERP demonstrations; (h) have senior management support; and (i) provide a strong business case.

Credibility. Vinod Kumar, who holds a PhD, is a professor and head of the Technology and Operations Management department at Carleton University in Ontario, Canada. He has won several “Best Paper” awards dating back from 1985 to 2010. Bharat Maheshwari, who also has a PhD, is an associate professor of Management Science at the University of Windsor in Ontario Canada. Uma Kumar is a professor of Management Science and Technology Management and Director of the Research Centre for Technology Management at the Sprott School of Business in Carleton University. She has won Carleton’s prestigious Research Achievement Award and twice, the Scholarly Achievement Award. This peer-reviewed article is published in the International Journal of Production Research.

Mabert, V. A., Soni, A., & Venkataramanan, M. A. (2000). Enterprise resource planning survey of US manufacturing firms. *Production & Inventory Management Journal*, 41(2), 52–58. Retrieved Apr 25, 2011 from ArticleFirst.
<http://galenet.galegroup.com.libproxy.uoregon.edu/servlet/BCRC?srchtp=adv&c=1&ste=31&tbst=tsVS&tab=2&aca=nwmg&bConts=2&RNN=A65070020&docNum=A65070020&locID=s8492775>

Abstract. This article contains the findings of a recently completed survey of randomly selected U.S. manufacturing firms. Objectives of the study were to determine the extent of use of packaged enterprise resource planning (ERP) systems, important motivational factors, implementation experiences, and future directions. This study provides a view into the current experiences of small and large firms based on data collected from 479 respondents.

Summary. Manufacturing firms worldwide have implemented ERP systems on the basis that ERP systems would provide process integration across business functions. However, anecdotal evidence from past studies suggests that the ERP implementations have been difficult and benefits resulting from them are uncertain. As such, Mabert et al. conducted a survey to collect data of the experiences of U.S. manufacturing firms that use ERP systems. Their findings indicate that the most important motivations for implementing an ERP system are to replace legacy systems and to standardize systems. The least motivating factor is to restructure the organization. More than 80% of the firms surveyed expect the life of the ERP systems to exceed five years. Most of the firms required more than a year to implement their ERP system. This duration is largely affected by the implementation strategy, which lays out the milestones of when the ERP modules will be implemented. The cost of the implementation varied but the average investment is about 5.6% of annual revenues. The larger firms incurred higher

implementation costs but the annual revenues show that the economies of scales work in favor for larger firms over smaller ones. Most of the firms required minor ERP customizations, mainly on two modules. The most significant ERP implementation benefits experienced were (a) availability of information and (b) integration of business operations and processes. The firms did not see a significant decrease in information technology costs or improvement in personnel management. Mabert et al. note that the surveys of firms' experiences are different from the anecdotal statements published from past studies. They suggest that extreme experiences are reported rather than the more common outcomes. This account of ERP experiences should be taken into consideration when organizations decide to implement ERP systems.

Credibility. Vincent A. Mabert has a PhD and is a professor of operations management at the Kelley School of Business at Indiana University. Ashok Soni is an associate professor of decision sciences at the Kelley School of Business at Indiana University. He holds an MBA and DBA (Doctor of Business Administration) from Indiana University. M.A. Venkataramanan is a professor and chair of operations and decision technologies at Indiana University. The works of these authors appear in various publications including *Management Science* and *Decision Sciences*. This is a peer-reviewed article.

Mabert, V. A., Soni, A., & Venkataramanan, M. A. (2001). Enterprise resource planning:

Common myths versus evolving reality. *Business Horizons*, 44(3), 69–76. Retrieved Apr 24 2011, from ArticleFirst. doi:10.1016/S0007-6813(01)80037-9

Abstract. ERP software providers claim that these systems link the entire organization seamlessly, improve productivity and provide instantaneous information but yet companies have had disastrous experiences with ERP. Mabert et al. present ERP criticisms and realities, including strategies in implementing a successful ERP system.

Summary. Some organizations believe that ERP systems are key for gaining competitive advantage by streamlining, integrating and optimizing business processes. In effect, they claim that ERP will seamlessly link the entire organization, improve productivity and provide real-time information. However, there are other organizations that say failed ERP implementations can threaten the company's livelihood. They claim that ERP systems are expensive, inflexible and difficult to implement. Mabert et al. present their observations based on interviews with operational managers, IT personnel and consultants. The ERP implementation costs ranged between 3 and 6 percent of annual revenues for smaller companies and 1.5 and 2 percent for larger companies. These percentages suggest that large companies using ERP systems will realize some economies of scale. For most of the ERP implementations, the ERP software represented 15% of the total cost. The ERP implementation time ranged from 12 months to four years. The organizations that took a phased approach to implement across many sub-units took more time and coordination effort. Also, those that required extensive re-engineering of processes and customization of the ERP system extended the implementation period. One firm that customized its ERP system encountered implementation difficulties that delayed the project and caused cost overruns. In almost all cases, the companies did not experience reductions in

work force or operational costs in the short term. There were no performance problems reported as most of them were resolved during testing. “While ERP provides very fast and reliable transaction processing, it lacks decision support capabilities that would enable better decision-making or optimization of processes” (p. 74). Organizations that successfully implemented ERP had several common characteristics: (a) senior management established clear priorities and was involved throughout the project; (b) the organization utilized a cross-functional implementation team with a senior management leader; (c) the organization spent a major amount of time defining details on how to approach the implementation; (d) there were clear guidelines for performance measurement and how external consultants should be utilized; and (e) the organization had detailed training plans.

Credibility. Vincent A. Mabert, who has a PhD, is a professor of operations management at the Kelley School of Business at Indiana University. Ashok Soni is an associate professor of decision sciences at the Kelley School of Business at Indiana University. Soni holds an MBA and DBA (Doctor of Business Administration) from Indiana University. M.A. Venkataramanan is a professor and chair of operations and decision technologies at Indiana University. The works of these authors appear in various publications including *Management Science* and *Decision Sciences*. This is a peer-reviewed article.

Motwani, J., Subramanian, R., & Gopalakrishna, P. (Aug 2005). Critical factors for successful ERP implementation: Exploratory findings from four case studies. *Computers in Industry*, 56(6), 529-544. Retrieved Apr 18 2011, from Web of Science.
doi:10.1016/j.compind.2005.02.005

Abstract. As organizations move from functional to process-based IT infrastructure, ERP systems are becoming a widespread IT solution. However, not all firms have been successful in their ERP implementations. Using a case study methodology grounded in business process change theory, this research tries to understand the factors that lead to the success or failure of ERP projects.

Summary. Motwani et al. conduct a case study of four American companies to identify factors that facilitate and inhibit the success of ERP implementation. The study shows “that a cautious, evolutionary, bureaucratic implementation process backed with careful change management, network relationships, and cultural readiness can lead to successful ERP implementations” (p. 541). The ERP software selected should be one that best fits the existing business procedures as to minimize customizations. This requires a thorough analysis of current business processes. In all four cases, the companies re-engineered business processes to align to the ERP system. The task of customization and adaptation of ERP software to meet organizational requirements is usually performed with the assistance of experienced consultants that can provide expert advice. There has to be a clear understanding of strategic ERP goals to steer the project throughout the ERP life cycle. The ERP implementation has to be championed by senior management to show employees that company leaders are committed to ERP systems. The organization has to be culturally and structurally ready. “Open communication and

information sharing can promote a common culture and innovative behavior in the organization” (p. 536).

Credibility. Jaideep Motwani and Ram Subramanian work at the Seidman School of Business at Grand Valley State University in Minnesota. Pradeep Goppalakrishna works in the Department of Marketing and International Business at Pace University in New York. The findings are supplemented by a table of statistics and diagram of factors. The work of these authors has been cited in articles used in this study. This peer-reviewed article is published in the research journal *Computers in Industry*.

Nah, F. F., Lau, J. L., & Kuang, J. (2001). Critical factors for successful implementation of enterprise systems. *Business Process Management Journal*, 7(3). 285-296. Retrieved Apr 25 2011, from Google Scholar. doi: 10.1108/14637150110392782

Abstract. Enterprise resource planning (ERP) systems have emerged as the core of successful information management and the enterprise backbone of organizations. The difficulties of ERP implementations have been widely cited in the literature but research on the critical factors for initial and ongoing ERP implementation success is rare and fragmented. Through a review of the literature, Nah et al. identify eleven factors found to be critical to ERP implementation success.

Summary. Organizations usually have their own existing business processes that put them in a competitive advantage. However, once they implement an ERP system, they have to change their existing processes to fit the ERP to take advantage of the benefits. Changing the process rather than customizing avoids costly maintenance and upgrades.

Nah et al. identify eleven critical success factors (CSFs) in four phases of ERP implementation, which they describe in an ERP life cycle model. The first phase is *chartering*, which involves “decisions defining the business case and solution constraints” (p. 287). In this phase, there are seven CSFs. They are ERP team work and composition, top management support, business plan and vision, effective communication, project management, project champion, and appropriate business and IT legacy systems. The second phase is *project*, which involves activities performed to get the system in place and end users involved. The three CSFs in this phase are change management program and culture, business process reengineering with minimum customization, and software development, testing and troubleshooting. The third phase is the *shakedown*. This is the period when the ERP system goes live and any bugs are eliminated

until the system stabilizes. The CSF in this phase is monitoring and evaluation of performance. The final phase is the *onward and upward* where the system is in maintenance and upgrade mode because it is running normally to support daily operations. The CSF for this phase is business vision, which is the same as one of the seven factors identified under the chartering phase. These eleven CSFs that Nah et al. present are important considerations for any ERP implementations, including vanilla ones.

Credibility. Fiona F. Nah is an associate professor of management (MIS) at the University of Nebraska-Lincoln. She holds a PhD in Management Information Systems from the University of British Columbia in Vancouver, Canada. Her work appears in many academic journals such as MIS Quarterly, Journal of Association for Information Systems and Journal of Strategic Information Systems. Janet L Lau works for JD Edwards, an ERP vendor. In 2003, she co-authored another article with Nah. Jinghua Kuang is an actuary, working for the Texas department of insurance. This peer-reviewed article is published in the Business Process Management Journal.

Parr, A., & Shanks, G. (2000a). A model of ERP project implementation. *Journal of Information Technology*, 15(4), 289-303. Retrieved Mar 28 2011 from ArticleFirst. doi: 10.1080/02683960010009051

Abstract. This paper presents a project phase model (PPM) of ERP implementation projects that is a synthesis of existing ERP implementation process models. Two case studies of ERP implementation within the same organization, one unsuccessful and a later successful one, are reported and analyzed in order to determine which critical success factors (CSFs) are necessary within each phase of the PPM.

Summary. Project phase model (PPM) consists of two concepts: implementation phases and critical success factors. The three major PPM phases are planning, project, and enhancement. The focus of the model is on the ERP implementation. Critical success factors (CSFs) are critical areas that support the success of a business. It is important that they are identified because they provide guidance in the planning and monitoring of the implementation.

Parr and Shanks examine the relationship between the phases of the PPM and CSFs when comparing the differences between one successful and one unsuccessful case study. The first case study involves Oilco, a refiner and marketer of petroleum products in Australia. This company changed its business processes extensively to align with the ERP processes in order to maximize the integration benefits of ERP. The project significantly overran in both time and budget initially, but four years after the ERP implementation, Oilco experienced substantial business benefits. The second case study is Exploresco who is a major affiliate of Oilco and is an oil and gas exploration and production company in Australia. During the ERP implementation, Exploresco changed business processes to align with Oilco's existing ERP system. The project

was implemented on time and within budget. Fifteen months after the implementation, Exploreco achieved significant ERP benefits.

Although both companies achieved considerable business benefits from the ERP system, the Oilco implementation is considered a failure whereas Exploreco is considered a success. Parr and Shanks point out several similarities and differences in CSFs within each phase of the PPM between the two cases, related to three factors: (a) organizational learning, (b) the scope, and (c) complexity of the project. Oilco's implementation was inherently large and complex, which is a characteristic for failure. Large projects should be partitioned into several smaller and simpler implementations. This may partially explain why Oilco's project took longer than planned and went over budget. Exploreco, on the other hand, made the decision to adhere to deadlines, minimize customization, appoint a project champion and train employees using in-house experts, not consultants or senior managers. Essentially, they implemented a vanilla ERP system, which made the project manageable. Exploreco is a good example "of a successful 'vanilla' ERP implementation [that could] be considered a best-practice ERP implementation process model" (p. 302).

Credibility. During the writing of this article in 2000, Anne Parr taught at the School of Business Systems at Monash University in Australia. In addition to this article, she has written a paper for the Hawaii International Conference, which is used for this study. Graeme Shanks is a Professor of Information Systems at the University of Melbourne. He has a PhD in Information Systems from Monash University. Shanks' work has been published in leading international journals and conferences. He is a member of the editorial boards of several journals. This article is published in the peer-reviewed Journal of Information Technology.

Parr, A., & Shanks, G. (2000b). A taxonomy of ERP implementation approaches. *Proceedings of the 33rd Hawaii International Conference on System Sciences*. Retrieved Mar 28 2011, from Google Scholar:

<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.98.3458&rep=rep1&type=pdf>

Abstract. In this paper Parr and Shanks argue that the concept of an ERP implementation is not a generic concept, and they present a taxonomy of ERP implementation categories. The evidence for the taxonomy is drawn from previous studies and from a series of structured interviews with practitioners who are experts in ERP implementation. They further argue that understanding the differences between these categories is crucial if researchers are to do case study research of ERP implementation; otherwise, comparisons are being made between ERP implementation projects which are essentially incommensurate.

Summary. Studies show that 90% of ERP implementations result in budget and time overruns. As such, there is a need for a taxonomy to assist management to see the effect of key decisions made depending on the characteristics of the ERP implementation. The characteristics will differ with every implementation as the differences in motivation determine the scope, design, and approach of the implementation. The *technical motivations* to implement an ERP system are to replace obsolete legacy systems and to provide a common platform. The *operational motivations* are process improvement, data visibility, and operating cost reductions. The *strategic motivations* are multi-site standardization, customer responsiveness, decision-making improvement, need for efficiencies and integration, and business re-structuring.

The taxonomy presented has three implementation categories. The first implementation category is *comprehensive*, which is typically an ERP implementation that involves multiple sites and full functionality of the ERP, and all or most of the ERP modules are implemented. The

second implementation category is *middle-road*, which also involves multiple-sites but only core ERP modules are implemented. The third category is *vanilla*, which usually involves one site and only core ERP functionality is implemented with minimal customization because organizations are attempting to fully exploit the ERP process model.

Within each implementation category of the taxonomy, there are five ERP implementation characteristics. The first is the *physical scope*, which is dictated by the site numbers, geographical distribution of the sites, user numbers, and complexity of the system. The second is *business process re-engineering scope*. This is seen as a necessary activity for ERP implementations as business processes must be aligned to ERP processes. However, interviews conducted show that most companies deliberately choose to minimize business process changes. The third is *technical scope* where the implementation manager decides how much customization is required. The fourth is *module implementation strategy*. This involves selecting the ERP module and determining the process of connecting the modules to existing systems. The fifth characteristic is the *resource scope*, which refers to time and budget. “Taxonomy can be used to structure discussions about ERP implementation and make the decision making process more systematic” (p. 10). Because Parr and Shanks discuss more than vanilla ERP implementation, they give good insight and strong justification on why ERP should be implemented in vanilla form.

Credibility. During the writing of this paper in 2000, Anne Parr taught at the School of Business Systems at Monash University in Australia. In addition to this article, she has written an article on an ERP project implementation model, which is used for this study. Graeme Shanks is a Professor of Information Systems at the University of Melbourne. He has a PhD in Information Systems from Monash University. Shanks’ work has been published in leading

international journals and conferences. He is a member of the editorial boards of several journals.

This peer-reviewed paper was presented at of the 33rd Hawaii International Conference on System Sciences.

Tchokogue, A., Bareil, C., & Duguay, C. (Feb 2005). Key lessons from the implementation of an ERP at Pratt & Whitney Canada. *International Journal of Production Economics*, 95(2), 151-163. Retrieved May 3 2011 from British Library Serials.
doi:10.1016/j.ijpe.2003.11.013

Abstract. This article uses a case study approach to present lessons learned from a successful implementation of an ERP system. It points out some strategic, tactical and operational considerations inherent in an ERP implementation that are prerequisites to effective organizational transformation required by an ERP system implementation.

Summary. Tchokogue et al. offer a systematic empirical analysis of Pratt and Whitney Canada (P&WC)'s ERP implementation in order to better understand the factors necessary for a successful implementation. P&WC's implementation objective was to put in an information infrastructure that would give greater transparency and agility to world-wide customers. The methodology used for the implementation considers five key factors: (a) project management; (b) technology architecture; (c) process and systems integrity; (d) change management; and (e) knowledge transfer. The project team consisted of 345 employees, with 172 of them representing the main processes of the company such as sales and distribution, production, planning, materials management and finance. The large team provided the employees ownership of the project and was an effective means of knowledge and expertise transfer. P&WC deferred its process re-engineering until the ERP system went live so that they "could significantly seek out benefits because [it] no longer needed to implement other applications" (p. 158).

Although this ERP implementation is considered a success because it was well planned and executed and included a good change management system, there were still lessons learned at three levels. At the strategic level, P&WC had the capacity to change because the business model

incorporated the role of the ERP, along with the company's strategic priority. This affirmed the legitimacy and urgency of the project. In addition, top management demonstrated its support by committing a large number of employees to the ERP project until completion. At the tactical level, "P&WC redesigned its organization with a view to increasing coherence and rigor, at an opportune time" (p. 161). The project management established not only progress measures, but also result measures such as improve customer response time and reduce work-in process. At the operational level, P&WC deployed effective change leadership and knowledge transfer teams. Employees were used for the training program, rather than consultants. The change management strategy incorporated change sessions within the business units "where information can circulate directly between individuals and where modifications in roles and structures are addressed and taken into account at the lowest level" (p. 161).

P&WC identified five core competencies that are critical to a successful implementation (p. 162): (a) change strategy development and deployment; (b) enterprise-wide project management; (c) change management techniques and tools; (d) business process re-engineering integration with IT; and (e) strategic, architectural and technical aspects of ERP installation.

Credibility. The authors are professors at HEC Montreal. Andre Tchokogue has a PhD from the University of Bordeaux and teaches in the department of Operations Management and Logistics. Celine Bareil has a PhD from University of Montreal and teaches in the department of Information Management. Claude R. Duguay teaches in the Department of Logistics and Operations Management. This peer-reviewed article is published in the International Journal of Production Economics.

Wright, A, & Wright S. (2002). Information system assurance for enterprise resource planning systems: Unique risk considerations. *Journal of Information Systems*, 16(1), 99-113.

Retrieved Apr 18 2011, from Web of Science. doi: 10.2308/jis.2002.16.s-1.99

Abstract. Enterprise Resource Planning (ERP) systems inherently present unique risks due to tightly linked interdependencies of business processes, relational databases, and process reengineering. Knowledge of such risks is important in planning and conducting assurance engagements of the reliability of these complex computer systems. Wright and Wright conduct a semi-structured interview of 30 experienced information systems auditors who specialize in assessing risks for ERP systems in order to obtain an understanding of the unique risks involved with the implementation and operation of ERP systems.

Summary. ERP implementation often results in extensive business process re-engineering and implementation of ERP customizations in order to achieve functionality that is not offered in the ERP software. These activities can create significant risks because the implementers making these changes may not fully understand the functionality of the ERP software to know the implications of the customization or the re-engineered business processes. This potentially can result in misalignment between organizational requirements and ERP systems. Consequently, there may be inappropriate access, missing validation procedures or data-checking routines, missing or inappropriate operational steps, inappropriate output formats, and incorrect information. Misalignments can have an impact on the financial statements, which could result in the risk of financial statement misstatement, misclassifications, and defalcations. Many of the traditional controls relied on by auditors to separate duties and authorizations are working at cross-purposes with virtual re-engineered goals. Although the controls in this environment are automated and move away from manual intervention, the design of these new

controls is not sufficient. A study shows that there are a significantly greater number of errors found in computerized accounting systems compared to manual systems. The results of Wright and Wright's study show that users are not adequately involved in the design of ERP systems and thus controls are compromised, especially when business-process re-engineering or ERP customization is involved. Since vanilla ERP involves a fair amount of business-process re-engineering, the risks that Wright and Wright identify in this article are very relevant to vanilla ERP implementation. As such, they should be carefully assessed prior to implementation.

Credibility. Sally Wright is a visiting professor at the University of Washington and Arizona State University. She holds a DBA (Doctor of Business Administration) from Boston University and a MBA from Northeastern University. She has co-written many articles that are published in the *Journal of Emerging Technologies in Accounting* and *Journal of Information Systems*. Arnold M. Wright is a professor of accounting in the Carroll School of Management. He holds a PhD from the University of Southern California. He served on several editorial boards of auditing: *A Journal of Practice and Theory*; *International Journal of Auditing*; *The Accounting Review*, and *Advances in Accounting*. Wright and Wright's peer-reviewed article is published in the *Journal of Information Systems*.

Factors for Consideration Related to Business Process Alignment

Al-Mashari, M. (2001). Process orientation through enterprise resource planning (ERP): A review of critical issues. *Knowledge and Process Management Journal*, 8(3), 175–185. Retrieved Apr 25 2011 from Business Source Complete. doi: 10.1002/kpm.114

Abstract. The global information technology and the competitive market have forced many companies to transform their businesses. ERP is one of the process orientation tools that enable this transformation but although it presents opportunities, it has its challenges. Al-Mashari's paper provides a review of the ERP field relating to process management, organizational change and knowledge management.

Summary. ERP is a vehicle for transferring best practices and helps organizations to focus on core competencies to achieve a strategic competitive position. Despite the skepticism about implementing a vanilla (off the shelf) ERP system because organizations need a different process infrastructure than competitors to remain competitive, Al-Mashari recommends that organizations adjust their business processes to fit the ERP package.

Al-Mashari admits that ERP implementation can have a large scale effect on organizations because a process change, no matter how small, will affect another part of the organization. He promotes change management to manage changes related to IT, culture, structure, performance measures and management systems. Because organizational changes as a result of ERP implementation can introduce a functionality risk when there is not a fit between the ERP embedded business process and corporate strategy, top management needs to develop a vision and strategy for the ERP implementation.

ERP implementation is a knowledge-intensive process and a lack of knowledgeable employees will hamper the effort to continually improve processes as required by ERP systems.

Organizations need to leverage existing ERP knowledge to help with the technological and organizational demands of new ERP-related roles. Lessons learned during and after ERP implementation should be captured in a database where information can be used for future ERP implementations.

Credibility. Majed Al-Mashari is an assistant professor in the Information Systems department at the King Saud University in Saudi Arabia. He is also a visiting professor at the University of Bradford in England. He is the editor of the Business Process Management Journal and sits on the editorial board for the Journal of Logistics Information Management. He is the recipient of the ANBAR Citation of Excellence award. He has been cited in many of the other articles used for this research as he has written several articles on ERP. His article is published in a peer-reviewed journal, Knowledge and Process Management.

Al-Mashari, M., & Al-Mudimigh, A. (2003). ERP implementation: Lessons from a case study. *Information Technology & People, 16*(1), 21-33. Retrieved Apr 9 2011 from ArticleFirst: <http://ejournals.ebsco.com/direct.asp?ArticleID=9U41XDDRM2JBAHL7W61R>

Abstract. This paper describes a case study of a failed implementation of SAP R/3 to re-engineer the business processes of a major manufacturer. Lessons in terms of factors that led to failure and their future implications are discussed in the light of the contrasting experiences of several best practice companies.

Summary. Most organizations do not realize ERP benefits because ERP implementations are contextually complex because they involve changes across key areas within the organization related to strategy, technology, culture, management systems, human resources, and structure. Most organizations focus solely on the technical aspects. This approach has proven to be the source of failure. Al-Mashari examines a company who approached the ERP implementation as a re-engineering initiative to change the IT infrastructure because consultants suggested that the company needed to standardize information systems to take advantage of the re-engineering effort. The project did not result in dramatic improvement nor did it make any fundamental business process change and is considered a failure. There are many factors that contributed to the failure. One factor is *scope creep*. The project focus shifted from business process re-engineering (BPR) to optimizing functions because the BPR would have resulted in layoffs and that caused organizational resistance, which halted the re-engineering process. Other factors include *a lack of ownership and transference of knowledge*. Most of the knowledge was with the consultants as they were the decision makers. Moreover, they made bad decisions because there were no progress and performance measures. Although top management supported the re-engineering initiative, there was a *lack of change management* as they neglected to

consider the layoffs that would result from the change. Also, the company failed to communicate to affected employees on the change rationale and plans of the project. This *lack of communication* affected the commitment and support for the project. Furthermore, there was a *lack of performance measurement* as the company did not measure the project progress and its benefits. As a result, it was not able to track the implementation efforts, identify gaps and performance deficiencies. Finally, the business strategy and IT strategy did not align because the company failed to *isolate IT from the business*. To have an effective ERP implementation that aligns with the business regardless whether it is in vanilla form or not, these five core competencies are required (p. 32):

- Change strategy development and deployment
- Enterprise-wide project management
- Change management and technique tools
- BPR integration with IT
- Strategic, architectural and technical aspects of ERP installation

Credibility. Both Majed Al-Mashari and Al-Mudimigh are associate professors in the Information Systems department at the King Saud University in Saudi Arabia. Al-Mashari is also a visiting professor at the University of Bradford in England. This peer-reviewed article is published in the Information Technology & People journal.

Chou, S., & Chang, Y. (2008). The implementation factors that influence the ERP (enterprise resource planning) benefits. *Decision support systems*, 46(1), 149 -157, Retrieved Apr 18 2011, from Elsevier SD North-Holland. doi: 10.1016/j.dss.2008.06.003

Abstract. This study examines ERP performance at the post-implementation stage, particularly from the perspective of managerial intervention. Both customization and organizational mechanisms affect intermediate benefits (including coordination improvement and task efficiency), which in turn influence overall benefits.

Summary. ERP performance is influenced by two important interventions – organizational mechanisms (OM) and customization. OM involves interaction with users and refers “to those activities aimed at improving organizational acceptance of the system by bringing organizational processes into closer alignment with the best practices of ERP” (p. 150). Customization is the modification of ERP software to resolve functional misalignments between the embedded ERP processes and the existing business processes. Firms that implemented OM are more likely to be familiar with ERP and thus, would more efficiently apply ERP to the business, which leads to better coordination improvements and task efficiency. Customization achieves more ERP benefits than OM. The reason could be that resolving functional misalignments has a more direct impact on ERP benefits than adapting to processes. Utilizing OM requires more effort because it involves both strategic and operational alignment as it relates to organizational acceptance and usage of the ERP software. Nevertheless, these two mechanisms for alignment should be considered for ERP implementation, as there is a relationship between alignment and realizing ERP benefits.

Credibility. Shi-Wei Chou is a professor in the MIS department at National Kaohsiung First University of Science of Technology in Taiwan. Yu-Chieh Chang has a PhD in MIS from

National Kaohsiung First University of Science of Technology. Chou and Chang's peer-reviewed article, published in the Decision Support Systems Journal, describes their research model, hypothesis development, research methodology, data analysis and result in detail; findings are supported by statistics.

Daneva, M. (2004). ERP requirements engineering practice: Lessons learned. *Requirements Engineering, 11*(3), 194-204. Retrieved April 3 2011 from Academic Search Premier.
doi: 10.1109/MS.2004.1270758

Abstract. Although organizations implementing enterprise resource planning systems have increasingly adopted generic, off-the-shelf requirements engineering process models, little information exists about the challenges involved. Daneva discusses typical issues and solutions based on her experiences at Telus Mobility, a Canadian communications company.

Summary. Daneva describes lessons learned during her ERP experience with making an off-the-shelf ERP model become a live process. She says to reduce barriers to cooperation, the requirements engineering (RE) team should blend the off-the-shelf process into existing practices. When possible, the team should use known and proven practices and ensure stakeholders are aware of standard ERP practices. “This combination of blending practices and creating awareness [leads] to accurate and realistic process outcomes” (p. 28). ERP systems deliver an architecture framework that typically includes process models and predefined business rules. She suggests that RE teams use this framework as a requirements baseline and recommends establishing a reuse measurement process to measure how much of the existing technology and business can be re-used in the ERP-supported business processes. She says “an ERP RE process begins with reuse, ends with reuse, and includes reuse in every stage” (p. 30). This reuse measurement process improves the business process models, decision-making process and stakeholder communication as it expresses how much each business process can be reused. Daneva cautions that studies show that on average for any ERP implementations, “few process or data components are reusable at the 80 to 100 percent level” (p. 30). Therefore, it is critical that there is an upfront fit analysis of the business processes to identify gaps in the processes and

data flows to complete the fit. Stakeholders have to understand the risk in ERP reuse and customization as they will be less inclined toward reusing existing processes.

Credibility. Maya Daneva is a business analyst in the Architecture Group at Telus Mobility. She holds a PhD in computer science from the University of Sofia and the Bulgarian Academy of Sciences. Between 1997 and 2002, her teams at Telus completed thirteen ERP projects, including six new implementations, three enhancements, two upgrades, and two process alignment projects due to corporate mergers. This article is peer reviewed and published in the Requirements Engineering journal.

Daneva, M., & Weiringa, R. (2006). A requirements engineering framework for cross-organizational ERP systems. *Requirements Engineering, 11*(3), 194-204. Retrieved April 3 2011 from Academic Search Premier. doi: 10.1007/s00766-006-0034-9

Abstract. This paper reports on the outcomes of applying a coordination theory perspective to an analysis of the ERP misalignment problem. Daneva and Weiringa present a conceptual framework for analyzing coordination and cooperation requirements in inter-organizational ERP projects. The framework makes explicit the undocumented built-in assumptions for coordination and cooperation that may have significant implications for the ERP adopters and incorporates a library of existing coordination mechanisms supported by modern ERP systems.

Summary. ERP systems are being used to orchestrate cross-organizational changes by creating an open and collaborative environment between companies. However, using ERP to network the companies can be difficult. First, decisions are made by the head office and pushed down into the organization. Second, a company behaves to maximize its own interest and often assumes that this also maximizes common interests. Third, each company has its own infrastructure, enterprise systems, business processes, semantics of data, authorization hierarchies and notions of collaboration. To have a cooperative ERP network, the companies must be willing to change any of these items.

The ERP system is rigid as it imposes assumptions about business semantics, business processes, business communication channels and business goals. This rigidity allows for certain types of benefit of cross-organizational cooperation. “Flexibility decreases the benefits and at the same time increases the cost of implementing and maintaining the ERP system” (p. 195) as customizations will be required. ERP allows companies to enjoy integration benefits through

sharing of standardized processes and common data. Also, the more that is shared, the more the total cost of ownership will decrease. However, companies that decide to keep their own processes because they want the flexibility to customize their own solution will have more options to foster innovation but total ownership cost will increase because there will be additional costs in maintenance, testing and risks.

The coordination mechanisms for ERP adopters to achieve a sharing environment clearly support rigidity, reuse, standardization, and integration. Daneva and Wieringa discuss four coordination mechanisms for re-engineering to align business processes to an ERP networked environment:

- utility-oriented mechanisms – refers to partner’s agreement on goals and benefits of coordination
- process-oriented mechanisms – concerns establishing end to end inter-organizational processes
- semantics-oriented mechanisms – concerns the definition and use of common meanings on the partners’ agreement
- communication-oriented mechanisms – concerns the transmission and interpretation of network information

Credibility. Maya Daneva is a business analyst in the Architecture Group at Telus Mobility. She holds a PhD in computer science from the University of Sofia and the Bulgarian Academy of Sciences. Roel J. Wieringa holds a PhD and is the head of the Computer Science department at University of Twente in the Netherlands. He is also the scientific director of the Dutch national research school for information and knowledge systems. His work has been

published in books, review papers and professional publications. This article is peer reviewed and published in Requirements Engineering journal.

Davenport, D.H. (1998). Putting the enterprise into the enterprise system. *Harvard Business Review*, 76(4), 121-131. Retrieved May 20 2011 from Business Source Complete.

http://www.jps-dir.com/forum/uploads/12967/Davenport_1998.pdf

Abstract. Unlike computer systems of the past, which were typically developed in-house with a company's specific requirements in mind, enterprise systems are off-the-shelf solutions. They impose their own logic on a company's strategy, culture, and organization, often forcing companies to change the way they do business. Managers would do well to heed the horror stories of failed implementations. Drawing on examples of both successful and unsuccessful enterprise system projects, the author discusses the pros and cons of implementing an ERP system, showing how a system can produce unintended and highly disruptive consequences.

Summary. Davenport claims that ERP failures are attributed to business problems, not technical challenges. Companies fail to align the technical imperatives of the ERP system to the business needs of the organization. The ERP pushes an organization into using generic processes even though custom processes give the company competitive advantages. The reason is that ERP systems are designed to resolve the fragmented information within large organizations. An ERP system “streamlines a company’s data flows, provides management with direct access to a wealth of real-time operating information” (p. 124). These benefits translate to increased productivity. ERP clearly provides benefits, but often clashes with the organizational strategy. Since an ERP system consists of generic solutions and assumptions about company operations, it often conflicts with the company’s interest. As a result, companies will need to adapt or extensively change their processes to fit the ERP requirements. In the case of Compaq Computer, the company considered the strategic implications when it implemented its ERP system. It saw the risk of adopting processes that are indistinguishable from its competitors. Therefore, Compaq

decided to develop their own module to support forecasting and order-management processes. This meant the company had to forgo some integration benefits but Compaq saw that it was a strategic necessity to maintain this source of competitive advantage. On the other hand, companies that focus more on costs than on distinct products may decide to forgo an ERP implementation all together as they are huge investments. By doing so, they gain a cost advantage over competitors that use ERP systems. Because many organizations depend on electronic information, especially for sharing, it is hard to survive without an ERP system. Cost should be a primary concern but it would be in the company's interest to adapt its processes to the ERP system. Customization is expensive and the competitive advantage comes from doing the best at implementing the ERP system at a low cost. Furthermore, ERP systems have an impact on the organization and culture. The centralizing of information and standardizing of processes "are qualities more consistent with hierarchical, command-and-control organizations with uniform cultures" (p. 127). Some companies say ERP systems inject discipline into the organization. Others do not see it that way. They say ERP systems allow their people to be innovative and more flexible because it allows for sharing of real-time information. For some multi-national companies, the strict ERP process uniformity is counterproductive because regional units have unique processes. These business implications should not be resolved by a technologist but rather a "general manager [who] is equipped to act as the mediator between the imperatives of the technology and the imperatives of the business (p. 131).

Credibility. Thomas H. Davenport, who died in January 2011, had a PhD from Harvard University. He was a professor at the Boston University of Management in Boston, Massachusetts. He was a widely published author and highly praised speaker and consultant on the topics of business analytics, process management, information and knowledge management,

reengineering, enterprise systems, and electronic business and markets. His peer-reviewed article is published in the Harvard Business Review.

Gattiker, T.F., & Goodhue, D.L. (2002). Software-driven changes to business processes: An empirical study of impacts of Enterprise Resource Planning (ERP) systems at the local level. *International Journal of Production Research*, 40(18), 4799-4814. Retrieved Mar 28 2011 from Business Source Complete. doi: 10.1080/0020754021000033913

Abstract. This paper explores the impact of software-driven process changes on manufacturing organizations based on responses to 77 surveys. Gattiker and Goodhue present the following hypotheses: H1: ERP systems result in organizational subunits' changing their business processes. H2: ERP-driven changes in business practices are associated with positive impacts of using the software. Hypotheses are evaluated using a test of mean difference and a Pearson correlation on data gathered from a pencil-and-paper survey directed at subunits of manufacturing businesses.

Summary. The strategy to align business processes and embedded ERP processes is influenced by the ERP selection and the decision makers at the corporate level. However, the effects of these decisions are at the subunit level where those processes are executed. Because ERP is configured at the organization level, the business processes of the subunits that share the organization's ERP system are constrained by the ERP processes. ERP embeds business processes that are typically best practices. Therefore, organizational subunits that use ERP business process often experience performance improvement. The top motivator for organizations to adopt ERP systems is the ERP capability of standardizing. However, changing existing business processes will mean departing from optimal processes that may have been developed over time. Gattiker and Goodhue examine two areas: (a) impact of the subunits' business processes as a result of ERP implementation; and (b) the relationship between changes in business processes and the positive impacts. The study shows that ERP systems configured at

the corporate level require substantial business process changes among the subunits. However, Gattiker and Goodhue could not find a correlation between the amount of business process changes and positive impacts. The explanation for this lack of coordination is that their framework did not take into account the strategic importance of the business processes. When a process is strategic, it could either increase or decrease the alignment with business strategy. The framework should be enhanced as follows:

- When process change increases process-strategy alignment, ERP impact is improved.
- When process change decreases process-strategy alignment, ERP impact is decreased.
- When change is made to a non-strategic business process, there is little overall impact.

Gattiker and Goodhue's study demonstrates that vanilla ERP implementations will maximize ERP benefits as it strategically forces an organization and its subunits to change its processes to align with ERP system.

Credibility. Thomas F. Gattiker is an assistant professor in the Networking, Operations, and Information Systems Department at Boise State University. His work is published in the International Journal of Production Research and the Decision Sciences Journal of Innovative Education. Dale L. Goodhue is a professor and department head of the MIS department, and the C. Herman and Mary Virginia Terry Chair of Business Administration at the University of Georgia. His work appears in Management Science and Decision Sciences. This peer-reviewed article is published in the International Journal of Production Research.

Gattiker, T.F., & Goodhue, D.L. (2004). Understanding the local-level costs and benefits of ERP through organizational information processing theory. *Information and Management*, 41(4), 431-443. Retrieved May 11 2011 from Elsevier SD North-Holland. doi: 10.1016/S0378-7206(03)00082-X

Abstract. Gattiker and Goodhue suggest two organizational characteristics that may have received insufficient attention in other ERP literature: interdependence and differentiation. High interdependence among organizational sub-units contributes to the positive ERP-related effects because of ERP's ability to coordinate activities and facilitate information flows. However, when differentiation among sub-units is high, organizations may incur ERP-related compromise or design costs. Gattiker and Goodhue provide a case study that explores the viability of this framework.

Summary. The main characteristics of ERP systems are integration and standardization. Gattiker and Goodhue focus on two aspects of uncertainty that contribute to these characteristics: *interdependence* and *differentiation*. "Interdependence is the degree to which sub-units must exchange information...in order to complete their tasks" (p. 433). When the interdependence between sub-units increases, the ERP benefits will also increase because it results in better coordination and administrative efficiencies. Differentiation is the degree of uniqueness of tasks, technologies, environment and goals which exists across sub-units. When differentiation among organizational sub-units increases, costs will rise and as a result, ERP benefits will decrease. Gattiker and Goodhue describe two types of costs that will occur when an ERP system is implemented across a number of differentiated sub-units: *design* and *compromise*. The organization may choose to *design* a system to accommodate the different local needs of the sub-units, which will be a very difficult and expensive. However, if the organization decides to forgo

the design and implement a standardized ERP system across the sub-units, the sub-units will incur *compromise costs*. They will experience decreased performance and encounter irrelevant data as the data may not be related to another sub-unit. Gattiker and Goodhue describe a case where the company spent the entire implementation budget on four sub-units because of the high customization required to address the unique requirements. The project was stopped and restarted after the new vice president mandated a one business vision and enforced standardization by not allowing sub-units to modify the ERP code. Because one of the sub-units had unique processes and was not allowed to modify the ERP system, the company faced compromise costs. The sub-unit had inaccurate data and had to utilize several resource intensive manual systems. As vanilla ERP implementation will force sub-units across an organization to standardize, organizations should analyze any existing differentiation to determine potential impact and how it will be impacted by ERP before proceeding with the implementation.

Credibility. Thomas F. Gattiker is an assistant professor in the Networking, Operations, and Information Systems Department at Boise State University. His work has been published in several reputable journals such as the International Journal of Production Research and the Decision Sciences Journal of Innovative Education. Dale L. Goodhue is a professor and department head of the MIS department, and the C. Herman and Mary Virginia Terry Chair of Business Administration at the University of Georgia. His work appears in scholarly journals like Management Science and Decision Sciences. Gattiker and Goodhue's article is published in the peer-reviewed journal of Information and Management.

Karimi, J., Somers, T., & Bhattacharjee, A. (2007). The impact of ERP Implementation on business process outcomes: A factor-based Study. *Journal of Management Information Systems*, 24(1), 101-134. Retrieved Mar 28 2011 from Computer Source. doi: 10.2753/MIS0742-1222240103

Abstract. Karimi et al. examine why some firms benefit more from enterprise resource planning (ERP) implementation than others. They look at ERP implementation from a technological diffusion perspective, and investigate under what contextual conditions the extent of ERP implementation has the greatest effect on business process outcomes.

Summary. Karimi et al. study how the characteristic of technology and organizational factors affect business process outcomes in terms of ERP implementations. They look at four factors: (a) the radicalness of technology; (b) divisibility of technology; (c) extent to which products or processes have the potential to be innovatively improved; and (d) extent to which the organization has innovative capabilities. These factors are important considerations when implementing a vanilla ERP system as they will assist in the evaluation of expected business outcomes resulting from the ERP implementation.

Radicalness refers to the extent in which “an innovation represents technological changes and thus implies new behaviors for [the organization]” (p. 106). The radicalness of the ERP implementation is determined by the complexity of the business process and the amount of information processing required to manage operations. The greater the business process complexity and amount of information required to be processed, the higher the radicalness of the ERP implementation. The *divisibility* of ERP systems allow ERP to be implemented sequentially or incrementally by functions, departments, company, locations or regions. Thus, implementations involving greater functional, organizational, or geographic scope will receive

more benefits than a single function implementation. “The quantity of IT innovation has been conceptualized as the *extent* to which an organization adopts innovations” (p. 104). ERP enables firms to integrate processes by standardizing, innovating and improving. The outcome of innovation is not only dependent on the organization’s contextual factors, the innovation also has to be supported, managed, and nurtured (known as the innovation delivery system) by top management support, technology champion, training and use of consulting services. Karimi et al. suggest that the extent of ERP implementation directly influences business process outcomes but the ERP radicalness and delivery system moderate the influences. This means “the higher the extent of ERP implementation, the higher will be the association between the ERP radicalness and business process outcomes” (p. 124).

Credibility. Jahangir Karimi has a PhD in Management Information Systems from the University of Arizona and is a professor of Information Systems at the University of Colorado. Toni M. Sommers is an associate professor of Information Systems Management at Wayne State University. Anol Bhattacharjee has a PhD and MBA from the University of Houston and is an associate professor of Information Systems at the University of South Florida. This peer-reviewed article is published in the Journal of Management Information Systems and the findings are supported by statistics.

Soh, C., Kien, S. S., & Tay-Yap, J. (2000). Cultural fits and misfits: Is ERP a universal solution. *Communications of the ACM*, 43(4), 47–51. Retrieved Apr 25 2011, from ArticleFirst. doi: 10.1145/332051.332070

Abstract. This article focuses on whether enterprise resource planning (ERP) is able to provide the functionality that is required by an organization because a common problem with adopting ERP systems is the issue of “misfits.” Soh et al. analyze the misfits and recommend resolution strategies.

Summary. ERP implementations often result in *misfits*, which are gaps between the ERP functionality and the organizational processes. From data collected from public hospitals in Singapore, Soh et al. identify three types of misfits that arise from company-specific, public sector-specific, and country-specific requirements that do not match the ERP model. First, there are *data misfits* that arise from data format or data relationship misalignments. Second, there are *functional misfits* that result from processing incompatibilities. Third, there are *output misfits* arising from incompatibilities of presentation format and output content. When misfits occur, organizations have to choose to (a) adapt to the ERP functionality; (b) live with the shortfall; (c) institute workarounds; or (d) customize the ERP software. Soh et al. note that customizations should be avoided because of high maintenance costs and difficulties in upgrading the ERP. Analysis shows that misfits are a result of several factors. The embedded business model in ERP systems often reflects a bias towards Western practices. As such, there is a need to recognize unique cultural context when implementing an ERP system as organizations may need to allocate more funds to accommodate for change management issues. Not many organizational users fully understand the ERP functionality; therefore, vendors should spend time to explain embedded data requirements and processes to their customers. “The reference models that espouse industry

best practices are at too high a level for an effective assessment of how the ERP system would actually affect the organizational processes” (p. 51). Essentially, there is a knowledge gap in ERP implementations among the three parties: key users, IT personnel, and the ERP vendor. They each have different and specific knowledge. Although they interact with one another throughout the implementation project, the differences in background and interests make integration of knowledge difficult. These are especially important considerations for all vanilla ERP implementations because users need to tap into the vendor’s knowledge to understand the ERP model in order to make process adaptations.

Credibility. Christina Soh and Sia Siew Kien are professors at Nanyang Business School at Nanyang Technical University in Singapore. Soh has a PhD from the University of California and Kien has a PhD from Nanyang Technical University. Joanne Tay-Yap is a Director of Information Management at KK Women’s and Children’s Hospital in Singapore, where the data for this study was collected from. This peer-reviewed article is published in Communications of the ACM.

Factors for Consideration Related to ERP Customization

Dittrich, Y., Vaucouler, S., & Giff S. (Nov 2009). ERP customization as software

engineering: Knowledge sharing and cooperation. *IEEE Software*, 26(6), 41-47. Retrieved May 3 2011 from British Library Serials. doi: 10.1109/MS.2009.173

Abstract. Dittrich et al. present empirical research on customization practices of ERP systems. The article raises awareness about the increasingly important kind of software development and its challenges to software engineering foundations. It compares customization with other development practices that are based on integrating existing code. Results underline the need to rethink software engineering and programming methods and tools.

Summary. Dittrich et al. describe their findings from a study they conducted involving the implementation of two ERP systems that require customizations in a similar manner. The goal of these implementations is to use as much of the existing functionality within the ERP without customizing. The authors note that “major customizations often result in maintenance and evolution tasks, sometimes involving several developers” (p. 43). Educating customization developers is a challenge because they “must understand an existing, rather complex application, understand business administration to appreciate the rationale behind the base application, and understand how customizations can impact the base functionality” (p. 43). The customization developers for the study acknowledge that the major challenge of the work is understanding the ERP system as they have to integrate the customization to the existing code. One developer notes that he approaches understanding an unknown part of the ERP system by exploring and modifying the code and running it through the interface to see what it affects and how. Developers do not have control over the ERP architecture and therefore, must code around it. Testing customizations is difficult because it is hard to isolate the changes to the standard

system. Documentation on the ERP product is often insufficient for customizing. As a result, the code development relies on the knowledge of the developer. Furthermore, customizations often require changes to different parts of the ERP system, which makes it difficult to logically track the changes. Dittrich et al. claim that “customization practices seem to be based on exploration and experimentation rather than on reading documentation” (p. 47). This research conducted by Dittrich et al. suggests that ERP customizations should be minimized or avoided if at all possible and instead, implement ERP in its vanilla form.

Credibility. Dittrich holds a PhD in computer science from University of Hamburg, and is an associate professor at the IT University of Copenhagen. The co-author, Vaucoular, was a PhD candidate at University of Copenhagen in 2009 when this paper was written. The other co-author, Giff, works at Microsoft and holds a Master of Science in human factors and human-computer interaction. This article is peer-reviewed and supplemented by a diagram of an ERP information and communication technology ecosystem.

Haines, M. (2009). Understanding enterprise system customization: An exploration of implementation realities and the key influence factors. *Information Systems Management*, 26(2), 182-198. Retrieved Mar 30, 2011 from Computer Source. doi: 10.1080/10580530902797581

Abstract. Customizations are often not linked to strategic business goals and at times even run counter to these goals. Experiences show that these gaps can be costly and have severe business implications. Thus, it is important to understand how these discrepancies can occur, and how to develop approaches to avoid unnecessary customizations. This paper explores key influences on customizations and factors that impact customization.

Summary. Gaps between organizational requirements and ERP processes can be highly disruptive to the business operations; therefore, customizations have to be appropriately applied. There are three ways of customizing ERP: (a) the system can be figured through the ERP supplied tables, which are generally supported by the vendor; (b) the system can be extended by using vendor supported common interfaces, which are also known as user-exits; and (c) the ERP source code can be modified but this activity is not supported by the vendor.

Haines suggests several ways in which customizations can be reduced. Customizations often result from organizational resistance because people are not willing to change so the software is customized to function like the old system. To prevent resistance, organizations should increase user buy-in. Reducing the implementation time frame will decrease the opportunity for implementing customizations. He recommends that organizations have a rigorous customization request management process to reduce the number of customizations implemented. A strong ERP vendor relationship can also reduce customizations because the customer can influence the vendor to incorporate some of the organizational requirements into

the ERP software. The right selection of project team members can potentially decrease customizations; for example, an implementation team of business analysts rather than programmers will likely deflect customization requests.

Credibility. Haines is a faculty member in the School of Business Administration at the University of Wisconsin-Milwaukee. His research appears in several reputable publications such as International Journal of Human Computer Interaction and Information Resources Management Journal. He is chair of the HICSS mini-track on service-oriented architectures and Web services. His peer-reviewed article is supplemented by diagrams and tables to support his arguments. His main source of data is derived from interviews of participants from five different organizations that implemented customized ERP systems. This article is published in the scholarly journal of Information Systems Management.

Ioannou, G., & Papadoyiannis, C. (2004). Theory of constraints-based methodology for effective ERP implementations. *International Journal of Production Research*, 42(23), 4927-4954. Retrieved May 22, 2011 from Business Source Complete. doi: 00207540410001721718

Abstract. This paper addresses the reasoning behind long implementation times and organizational thunderstorms that tantalize the deployment of ERP systems. It focuses on two aspects of most implementation projects that generate the majority of technical and functional problems.

Summary. There is a notion of skepticism and reluctance in ERP implementations because packaged software like ERP has inherent problems that generate uncertainties and hidden costs. The root cause of high ERP failure rates is attributed to inconsistencies between the ERP functions based on best practices and the specific needs and processes of the organization. As such, customizations to ERP are required as most organizations operate on processes developed over time to achieve optimal operation and retain competitive advantages. However, to have effective customizations, the project team must know the full capabilities of the ERP system to make appropriate decisions on customizations.

Ioannou and Papdoyiannis present two aspects of ERP implementations that generate most of the technical and function problems, which are defined as the projects' bottlenecks. The first bottleneck relates to *the ERP code development* required to address key and unique requirements of the business. The process involves gathering and reviewing business requirements before developing, testing and debugging the code. Code development should be minimized to reduce the cost of maintaining the ERP system. The second bottleneck relates to *the localization and reporting needs* of the organizations. The authors suggest an approach to

group functions and business processes as either *business critical* or *legal*. “Business critical functionality refers to requirements arising from key and unique operational functions” (p. 4933). Legal requirements are a result of regulations, specific reporting or consolidation issues. Once the requirements are grouped, a further breakdown is required to establish whether they are supported by the ERP system or require to be addressed through code development. Ioannou and Papdoyiannis propose that a supplemental *bottleneck* thread runs parallel with the typical ERP implementation phases. This thread will solely handle the development code for business critical and legal requirements. The goal is to (a) continuously review and shift bottlenecks according to priority and (b) monitor and control the project execution. Theory of Constraints states that system performance improvement requires one to “concentrate only on the bottleneck since improvements in other system areas or parameters will not affect the overall system performance” (p. 4931). Although there are minimal customizations involved during vanilla ERP implementations, this bottleneck approach should still be considered.

Credibility. George Ioannou is a Professor of Management Science and Technology at Athens University of Economics and Business in Greece. He serves as the Acting Director of the International MBA Program, and directs the Operations and ERP Systems Center (Management Science Laboratory). He has a PhD in Mechanical Engineering from the University of Maryland at College Park. His publications appear in various archival journals and cover topics ranging from facility and material handling system design and operation, to Enterprise Resource Planning Systems. Costas Papadoyiannis was a PhD candidate at the Athens University of Economics and Business during the writing of this article in 2003. This peer-reviewed article is published in the International Journal of Production Research.

Light, B. (2001). The maintenance implications of the customization of ERP software. *Journal of Software Maintenance: Research and Practice*, 13(6), 415-429. Retrieved Apr 10, 2011 from Google Scholar. doi: 10.1002/smr.240

Abstract. This paper presents two case studies of ERP projects where customizations have been performed. The case analysis suggests that while customizations can give true organizational benefits, careful consideration is required to determine whether a customization is viable given its potential impact upon future maintenance.

Summary. Although benefits of implementing ERP systems are widely known, organizations are still choosing to customize. The reasons could be that (a) they may need to change their work procedures to align with the ERP system and as a result, they will become dependent on ERP vendor for maintenance; or (b) the ERP standard model just does not meet organizational requirements. The two cases in this study selected the ERP software that best mirrors their business processes regardless of the best strategy. One case outsourced its customization by working closely with the ERP vendor. By doing so, the vendor incorporated the customization into the ERP software and thus, eliminated the need for the company to develop ERP customization code. However, the concern is that the company could possibly not have control over future development of the ERP software. Other customers may convince the ERP vendor to make changes to suit their needs, which in effect may invalidate their processes. Nevertheless, the intention of both cases was to re-engineer the business processes to align with the ERP software but the organizations found that the standard model did not meet their organizational demands. Sometimes customizations are necessary but the maintenance implications have to be weighed. Depending on the scope of the customization, the increase in maintenance effort will vary. Organizations also have to take into account that customizations

may require ongoing maintenance outside of upgrades; they should consider the costs of supporting the life of the ERP system. Light's article highlights the importance of minimizing customizations, which is what occurs in a vanilla ERP implementation.

Credibility. Ben Light is a professor at the Information Systems Research Centre at the University of Salford in the United Kingdom. He was appointed the Senior Associate Editor for the European Journal of Information Systems from 2008 to 2010. This article is published in a peer-reviewed journal.

Luo, W.H., & Strong, D. M. (Aug 2004). A framework for evaluating ERP implementation choices. *IEEE Transactions on Engineering Management*, 51(3), 322-333. Retrieved Apr 10, 2011 from ArticleFirst. 10.1109/TEM.2004.830862

Abstract. In this paper, Luo and Strong advance a framework for supporting management decision-making about customization choices and the capabilities required to accomplish them; they identify various customization possibilities for business processes as well as ERP systems. This framework presents a methodology for choosing customization options based on an organization's capabilities. Organizations contemplating a vanilla ERP implementation can refer to it to ensure their organizations have the change process capabilities to perform this implementation task.

Summary. Implementing an ERP system is not simple, as they do not always align with the business processes because ERP vendors incorporate the needs and requirements of many customers into the software so that it will attract a large market share. Many researchers claim that molding the business processes to the ERP system is simpler and cheaper than changing the ERP system to conform to the business. Another study says that "fit can only be achieved through mutual adaptation of the ERP systems and organization processes" (p. 323). Adaptation of the ERP systems is when the ERP system is customized to fit the existing business processes. As such, the challenge is to determine how much customization should be applied to both the system and organization to attain the ERP and business process fit. Lou and Strong provide a framework that helps management identify the gap between customization options and change capabilities. The two types of customization are technical and process. Technical customization involves changing the software to achieve a fit between the ERP and business processes. This could be as simple as selecting specific modules for implementation or configuring ERP tables,

which are all vendor-supported activities. The non-vendor supported customization is modifying the ERP source code. Although code customization provides the greatest flexibility in the adaptation, it has the highest risks and costs. Process customization is achieving fit by changing the business processes. There are three classifications to this process: no change, incremental, and radical change. Each represents degrees of customization. Using the technical and process customizations as dimensions, Lou and Strong develop a table describing the different ERP customization choices. For example, *Fit Process to System* cell refers to making minor system changes but the business process is redesigned to fit the system process. The customization options are dependent on the organization's technical and process change capability. Technical change capability refers to the scope and depth of the organization's ability to understand the ERP model, make system changes, and manage extensive ERP implementation projects. Process change capability is the scope and depth of the organization's ability to understand existing processes, ability to design and make changes to processes and manage extensive organizational changes. When the technical and process change capabilities are combined, the organization's overall ability to implement the ERP system can be assessed.

Credibility. Wenhong Luo is an associate professor of the Account and Information Systems department at Villanova University in Pennsylvania. His work is published in Business Process Management Journal, International Journal of Production Research, and Communications of the ACM. Diane M. Strong has a PhD from Carnegie Mellon University. She is a professor and director of the Management Information Systems Program at Worcester Polytechnic Institute in Massachusetts. Her work is published in many academic journals including MIS Quarterly and Decision Support Systems. This peer-reviewed article is published in the IEEE Transactions on Engineering Management.

Rothenberger, M., & Srite, M. (Nov 2009). An investigation of customization in ERP system implementations. *IEEE Transactions on Engineering Management*, 56(4), 663-676.

Retrieved Apr 18 2011, from Web of Science. doi: 10.1109/TEM.2009.2028319

Abstract. This article investigates why certain enterprise resource planning (ERP) system adopters have pursued high levels of software customization during implementation despite the generally accepted best-practice heuristic of limiting customization. Qualitative data from eight ERP adoption projects and three consultants working with ERP implementations have been collected. This study empirically identifies customization drivers and explains their relationship to customization.

Summary. Extensive customizations to ERP systems may compromise an ERP implementation success because they increase costs and limit maintainability. Customizations should be limited to rare circumstances such as when a business process change will mean losing competitive advantage. Based on the analysis of the data collected, the authors discover relationships between pre-project and project characteristics. Pre-project characteristics are ERP knowledge, organizational project motivation, organizational culture on decision, and risk taking. Project characteristics are experience of implementation team, reliance on consultants, involvement of operational departments, ERP project acceptance, and fear of personal disadvantage. For each of the relationships between the pre-project and project characteristic, Rothenberger and Srite describe in detail the circumstances in which high customization can occur. The results of the study suggest that high customization may occur because:

- implementation team lacks experience and therefore does not have sufficient knowledge of the ERP system standard. Consequently, they can inadvertently develop a functionality that is already available in the ERP system.

- there is resistance to changing existing business processes because of low acceptance of the project and cultural issues exist.
- the implementation team has limited ERP experience and thus, do not have much weight on recommendations.
- implementation teams consisting of mainly consultants would show little opposition to customization requests.
- implementation teams with little knowledge of the organization's processes will retain many existing business processes as they see them unchangeable.

These characteristics (which align closely with concepts described by others as *factors*) support vanilla ERP implementation as it minimizes customizations and maximizes ERP benefits.

Credibility. Marcus A. Rothenberger has a PhD from Arizona State University. He is an associate professor in the department of Management Information Systems at the University of Nevada in Las Vegas. He has published papers in the Journal of Management Information Systems and the Decision Sciences Journal. Mark Srite has a PhD from Florida State University. He is an associate professor in the Management Information Systems Area at the Sheldon B. Lubar School of Business at University of Wisconsin-Milwaukee. He has authored and co-authored papers published in the Management Information Systems Quarterly and Decision Support Systems. This peer-reviewed article is published in IEEE Transactions on Engineering Management.

Scott, J. E., & Kaindl, L. (2000). Enhancing functionality in an enterprise software package.

Information and Management, 37(3), 111-122. Retrieved May 21 2011, from Elsevier SD North-Holland. doi:10.1016/S0378-7206(99)00040-3

Abstract. Although enterprise resource planning (ERP) packages strive to integrate all the major processes of a firm, customers typically discover that some essential functionality is lacking. To address this issue and to complement their capabilities, both ERP vendors and customers increasingly recognize the importance of collaboration. Using a grounded theory approach, this study's objective is to derive a theoretical understanding of how customers collaborated on enhancements to an ERP module.

Summary. Customers find that ERP systems are missing at least 20% of needed functionality. This is typical as package software is built to be generic, parameterized and flexible to appeal to a wide customer base. To address this lack of functionality, customers are either forcing their business processes to fit the software or adding customized code to the ERP, which increases the implementation time and maintenance costs. ERP vendors recognize this and are using different strategies, including acquisitions, when they add new features to the ERP software. SAP, a major ERP vendor, used a collaborative approach by (a) forming a steering committee consisting of seven large global firms from various industries; (b) inviting Price Waterhouse Coopers (PWC), who worked closely with SAP to develop the treasury module, to act as facilitators; and (c) inviting customers to meetings. The steering committee, SAP developers and facilitators met over a period of eighteen months to discuss functional requirements, training, marketing and prototype feedback.

Scott and Kaindl provide a conceptual model on how SAP enhanced the functionality of the treasury module. This model demonstrates two key processes in establishing an effective

collaboration environment. First is the participant selection process. SAP narrowed the customer participants from fifteen organizations to seven. It selected organizations with the latest treasury knowledge and companies that were willing to adapt to best practices. SAP also used judgment in selecting the appropriate meeting facilitators. Second is the inter-organizational collaboration process where participants from various organizations share their diverse knowledge and best practices. The model also shows factors that can impact the functionality enhancement process. *Occupational community* promotes trust because of common professional interests. *Conflict resolution* offers opportunities to generate alternatives. *Informal networks* emerge from socialization and will lower transaction costs. Scott and Kaindl's findings are beneficial to those organizations contemplating a vanilla ERP implementation because this strategy can be utilized to minimize customizations.

Credibility. Judy E. Scot is an assistant professor in the Management Science and Information Systems department at the University of Texas. She has an MBA and PhD from the University of California. Her work is published in various journals like Communications of the ACM, Decision Support Systems, and Data base. Lisa Kaindl has an MBA and is a project manager at Dell Computer Corporate. This article is published in the peer-reviewed journal of Information and Management.

Conclusion

This study presents factors to consider when implementing a vanilla ERP system. Since vanilla ERP systems involve implementing only ERP functionality with minimal customizations (Parr & Shanks, 2000b), organizations may be required to change their business processes to align with the ERP model. As such, implementation strategies to minimize risks and maintain competitive advantage are described. Also, reported and potential impacts of aligning existing business processes with ERP embedded processes are explored.

Analysis of 31 references selected for this annotated bibliography suggests that the success of an ERP implementation is determined by the alignment of organizational strategy, organizational structure, business processes, and the ERP system. All organizational changes have to be properly managed; otherwise, there will be organizational resistance, which will most likely result in ERP failures (Al-Mashari, 2003).

Vanilla ERP implementations are supposed to reduce implementation, maintenance, and upgrades costs because they propose to limit customizations. Although customizations allow ERP systems to adapt to the organizational requirements, they have substantial cost implications (Haines, 2009). This study reveals strategies on how to minimize customizations.

Factors for Consideration Related to Vanilla ERP Implementation Strategy

Vanilla ERP implementation provides opportunity for organizations to re-engineer processes and organizational structure to align with the ERP system (Al-Mashari, 2003).

Unfortunately, while most companies are not motivated to restructure the organization (Mabert et al., 2000), vanilla ERP implementation results in process changes that must be complemented by organizational changes (Al-Mashari, 2003). A successful ERP implementation requires a

behavior change to support the new processes (Chen, 2001). Organizational adaptation leads to greater ERP implementation successes (Chen, 2001) but it requires *a good change management system* to prepare the organization culturally and structurally for the change and to reduce resistance (Al-Mashari, 2001; Al-Mashari, 2003; Al-Mashari & Al-Mudimigh, 2003; Hong & Kim, 2002; Kumar et al., 2002; Motwani et al., 2005; Nah et al., 2001; Soh et al., 2000; Tchokogue et al., 2005). This involves holding information seminars, training employees, distributing newsletters, and conducting surveys (Kumar et al., 2002). The *employees should be trained by in-house experts*, not consultants (Parr & Shanks, 2000a; Tchokogue et al., 2005).

Although ERP adaptation may result in less resistance, reduced training, and less organizational changes (Hong & Kim, 2002), it requires customization, which increases costs (Chen, 2001; Nah et al., 2001; Soh et al., 2000). That is why many companies are opting to implement ERP systems with minimal customizations (Parr & Shanks, 2000a), which means organizational processes have to adapt to the ERP system. *Transformational changes have to be addressed in the ERP strategy*, which can be delivered in many forms such as in the implementation objectives, change management policies, and ERP deployment plan (Al-Mashari, 2003). For a successful ERP implementation, there has to be a clear ERP vision (Nah et al., 2001; Al-Mashari, 2001), clear business plan (Nah et al., 2001), clear understanding of ERP goals (Motwani et al., 2005), clear priorities (Mabert et al., 2000), and an effective communication plan (Nah et al., 2001).

Large projects should be partitioned into smaller implementations (Parr & Shanks, 2000a) and the *teams should consist of mainly employees* as they provide a means for knowledge and expertise transfer within the organization (Tchokogue et al., 2005). As the purpose of ERP systems is to integrate, the implementation *team should be cross-functional* (Al-Mashari, 2003;

Kumar et al., 2002; Mabert et al., 2001; Motwani et al., 2005; Nah et al., 2001; Tchokogue et al., 2005). It is also critical that *top management supports the ERP implementation* throughout the project (Bingi et al., 1999; Chou & Chang, 2008; Kumar et al., 2002; Liang et al., 2007; Motwani et al., 2005; Nah et al., 2001; Parr & Shanks, 2000a). As well, *there should be a project champion* who takes charge and oversees the entire implementation (Motwani et al., 2005; Nah et al., 2001; Parr & Shanks, 2000a). *Users should be involved in the ERP design*; otherwise, controls will be compromised (Wright & Wright, 2002). *Clear performance measurements* are necessary for the ERP implementation to succeed (Mabert et al. 2001); therefore, organizations need to establish progress and result measures (Tchokogue et al., 2005). Moreover, the implementation *management team should be held accountable* for company savings and losses (Kumar et al., 2002) and project managers should always ensure that *the ERP project adheres to the schedule* (Kumar et al., 2002).

Gattiker and Goodhue (2005) state that the *potential for ERP benefits will vary* as they are influenced by factors of interdependence and differentiation. The higher the interdependence between sub-units, the greater the ERP benefits because there will be larger coordination improvements (Gattiker & Goodhue, 2005). On the other hand, the higher the differentiation between sub-units, the lower the ERP benefits because some sub-units may lose their competitive advantage due to standardized processes (Gattiker & Goodhue, 2005). ERP adopters should note that ERP systems do not necessarily result in reduction of IT costs or improvements in personnel management (Mabert et al., 2000). Bingi et al. (1999) say *ERP systems cannot meet all organizational needs*. Sometimes third party bolt-on software is required (Bingi et al., 1999). If this is the case, organizations should contact their ERP vendor for a certified software vendor list (Bingi et al., 1999). As ERP implementation is a knowledge-intensive process, the *knowledge*

and lessons learned should be captured in a database so that they can be leveraged for future ERP implementations (Al-Mashari, 2001).

Figure 1 provides a summary list of factors related to vanilla ERP implementation strategy.

Factor	Description	Reference(s)
Utilize a change management system	Prepare the organization for ERP changes in order to reduce resistance. This involves holding information seminars, training employees, distributing newsletters, and conducting surveys.	Al-Mashari, 2001; Al-Mashari, 2003; Al-Mashari & Al-Mudimigh, 2003; Hong & Kim, 2002; Kumar et al., 2002; Motwani et al., 2005; Nah et al., 2001; Soh et al., 2000; Tchokogue et al., 2005
Train employees using in-house experts	Use employees to conduct ERP training sessions, not consultants.	Parr & Shanks, 2000a; Tchokogue et al., 2005
Address transformational changes in ERP strategy	Deliver ERP strategy in implementation objectives, change management policies, and ERP deployment plan. The vision, business plan, goals, priorities, and communication plan must be clearly stated.	Al-Mashari, 2001; Al-Mashari, 2003; Mabert et al., 2000; Motwani et al., 2005; Nah et al., 2001
Partition large projects into smaller implementations	Break down large projects into several simpler and smaller projects because large projects are difficult to implement on time and within budget.	Parr & Shanks, 2000a
Build implementation team of mainly employees	Select team members from the internal workforce as they will be the ones transferring ERP knowledge within the organization.	Tchokogue et al., 2005
Build a cross-functional team	Select team members from various business units because a multi-skilled ERP implementation team is required for the wide enterprise scope.	Al-Mashari, 2003; Kumar et al., 2002; Mabert et al., 2001; Motwani et al., 2005; Nah et al., 2001; Tchokogue et al., 2005
Obtain top management	Obtain support from top	Bingi et al., 1999; Chou &

support	management as they will be required to enforce policies for a successful implementation.	Chang, 2008; Kumar et al., 2002; Liang et al., 2007; Motwani et al., 2005; Nah et al., 2001; Parr & Shanks, 2000a
Appoint a project champion	Select a project champion that would take charge and oversee the entire implementation.	Motwani et al., 2005; Nah et al., 2001; Parr & Shanks, 2000a
Involve users in the ERP design	User participation is necessary for the ERP design; otherwise, controls will be compromised.	Wright & Wright, 2002
Establish clear performance measures	Progress and result measures are necessary for a successful implementation.	Mabert et al., 2001; Tchokogue et al., 2005
Hold management accountable	Implementation managers should be held accountable for company savings and losses.	Kumar et al., 2002
Adhere to project schedule	Project manager must ensure that tasks do not stray from the project schedule.	Kumar et al., 2002
Expect to achieve varying ERP benefits	The ERP benefits achieved will vary depending on the degree of interdependence and differentiation. Also, ERP systems do not necessarily result in lowering IT costs or improving personnel management.	Gattiker & Goodhue, 2005; Mabert et al., 2000
Communicate with the ERP vendor for certified software list due to unmet needs	When third party bolt-on software is required because ERP does not completely meet the organizational requirements, the ERP vendor should be contacted to provide a certified software list.	Bingi et al., 1999
Capture knowledge and lessons learned	Document learned knowledge and lessons in a database for future reference.	Al-Mashari, 2001

Figure 1. Factors for consideration related to vanilla ERP implementation strategy

Factors for Consideration Related to Business Process Alignment

Business process alignment is critical to the success of an ERP implementation. When misalignments occur, organizations can address them a number of ways: (a) adapt to the ERP functionality; (b) live with the shortfall; (c) use a workaround; or (d) customize the software (Soh et al., 2000). Additionally, the radicalness and divisibility of the ERP technology and the extent of the innovation environment will affect the business outcomes of the ERP implementation (Karimi et al. 2007). *Innovation has to be supported, managed and nurtured* in order to support the required changes necessary for a successful ERP implementation (Karimi et al., 2007).

Chou and Chang (2008) claim that aligning the organization to the ERP system using organizational mechanisms results in better coordination improvement and task efficiency. In other words, *organizations should adapt to ERP functionality*, which is an inherent requirement for vanilla ERP implementations. As one way to do this, Daneva (2004) suggests that organizations should blend the ERP process into existing practices. Also, they should *use a re-use measurement* process to measure how much of the existing technology and business can be re-used as only a few processes are re-useable at the 80 to 100 percent level (Daneva, 2004). Daneva and Weiringa (2006) propose that organizations *use coordination mechanisms to achieve a sharing environment* for alignment as they support rigidity, reuse, standardization, and integration.

Any process change will most likely affect other parts of the organization (Al-Mashari, 2001). Processes that are strategic will either increase or decrease alignment with the business strategy (Gattiker & Goodhue, 2002). ERP is a rigid system designed to achieve cross-organizational cooperation benefits. Flexibility can be achieved through customizations, which

will increase implementation and maintenance costs (Davena & Weiringa, 2006). Organizations need to *consider strategic and cost implications* of implementing an ERP system that requires process adaptation because the implementation may put the organization in a disadvantage due to loss of unique processes or high ERP implementation costs (Davenport, 1998). Furthermore, business implications resulting from ERP implementations should be resolved by a general manager, not a technologist (Davenport, 1998).

There are many factors that contribute to organizational misalignment. Soh et al. (2000) say ERP models are built based on Western practices; therefore, organizations need to *recognize the cultural context when implementing an ERP system* outside the United States as it may result in gaps. When extensive processes are changed to fit the ERP system, it is important to *evaluate the organization's process change capacity* (Lou & Strong, 2004). In addition, the lack of understanding the ERP functionality can cause difficulties in aligning the organization (Soh et al., 2000). Hence, *ERP vendors need to clearly explain the ERP functionalities* to their customers (Soh et al., 2000). Most often, there is a knowledge gap among key users, IT personnel, and ERP vendor, which also contributes to organizational misalignments (Soh et al., 2000). Also, business strategy and ERP strategy often do not align because organizations fail to *isolate IT from the business* (Al-Mashari & Al-Mudimigh, 2003).

Figure 2 provides a summary list of factors related to business process alignment.

Factor	Description	Reference(s)
Innovation has to be supported, managed and nurtured	The extent of the innovation environment will affect the business outcomes of the ERP implementation; therefore, it must be supported, managed and nurtured to support the required changes.	Karimi et al., 2007
Adapt existing business practices to ERP functionality	Use organizational mechanisms for better coordination improvement and task efficiency. Blend ERP process into existing practices.	Daneva, 2004
Use a re-use measurement	Establish a process to measure how much existing technology and business can be re-used.	Daneva, 2004
Use coordination mechanism to achieve sharing environment	Establish coordination mechanisms that support rigidity, reuse, integration, and standardization.	Daneva & Weiringa, 2006
Process change will most likely affect other parts of the organization	Processes that are strategic will either increase or decrease alignment with the business strategy.	Al-Mashari, 2001; Gattiker & Goodhue, 2002
Consider strategic and cost implications	Implementation may put organizations in a disadvantage due to loss of unique processes or high implementation costs. Also, business implications should be resolved by a general manager, not a technologist.	Davenport, 1998
Recognize cultural context	ERP models are built based on Western practices; therefore, there may be gaps if implementation occurs outside the United States.	Soh et al., 2000
Evaluate organization's process change capacity	When extensive process changes are required, organizations must evaluate whether they have the capacity to make these changes.	Lou & Strong, 2004

Clarify ERP functionalities	ERP Vendors need to spend time to explain the embedded data and processes to their customers as they need to better understand the ERP system.	Soh et al., 2000
Isolate IT from business	Organizations must separate the technical perspective from the business perspective because the technical perspective does not drive the business.	Al-Mashari & Al-Mudimigh, 2003

Figure 2. Factors for consideration related to business process alignment

Factors for Consideration Related to ERP Customization

When aligning processes to the ERP system, organizations need to keep in mind that *differentiation among sub-units will increase costs and decrease ERP benefits* (Gattiker & Goodhue, 2004). The organization will need to choose to design a system to accommodate its uniqueness or forgo the customization and incur compromise costs (Gattiker & Goodhue, 2004). Customizations to ERP systems should be minimized because they jeopardize key benefits of integration (Chen, 2001). Since the developer has to fully understand the ERP system in order to integrate the customization into existing code (Dittrich et al., 2009; Ioannou & Papadoyiannis, 2004) and vendor provided documentation is often insufficient for customization, there is an added risk to customized ERP implementations (Dittrich et al., 2009). For these reasons, organizations need to *deploy strategies to decrease customizations* (Haines, 2009). By minimizing customized code, the organization can reduce maintenance and upgrade costs (Ioannou & Papadoyiannis, 2004).

There are several strategies to minimize customizations. First, organizations need to *convince users to buy into the ERP system* as it reduces resistance (Al-Mashari, 2003; Haines,

2009; Kumar et al., 2002). Resistance results in customizations because people are not willing to change the way of doing things and therefore, the ERP software is customized to function like the old replacement system (Haines, 2009). Second, organizations should *reduce the implementation time frame* because it decreases the opportunity for implementing customizations (Haines, 2009). Third, *having a rigorous formal customization request management process* will screen incoming customization requests and only allow those that are critical to business operations to be implemented (Haines, 2009). Fourth, *building a strong relationship with the ERP vendor* can influence the vendor to incorporate organizational requirements into the ERP software (Haines, 2009; Light, 2001). Fifth, *having a team of business engineers rather than technical programmers* will likely deflect customization requests because it reduces the inclination to modify the ERP software to resolve misalignments (Haines, 2009). Lastly, because organizations should expect that ERP systems are missing some of the functionality needed to operate efficiently, *vendors and organizations should take a collaborative approach* to encourage communication when enhancing ERP systems (Scott & Kaindl, 2000). Alternatively, there are methods of customizing the ERP system that would not increase maintenance and upgrade costs and yet, are supported by the vendor (Lou & Strong, 2004). They involve *configuring ERP tables and implementing specific modules* (Lou & Strong, 2004).

Figure 3 provides a summary list of factors related to ERP customization.

Factor	Description	Reference(s)
Differentiation among sub-units affects costs and benefits	Organizations may decide to forgo customizations but that would result in compromise costs.	Gattiker & Goodhue, 2004
Deploy strategies to decrease customizations	There is risk to customizations because the developer has to fully understand the ERP system in order to integrate	Dittrich et al., 2009; Haines, 2009; Ioannou & Papadoyiannia, 2004

	the customization into existing code.	
Convince users to buy into ERP system	Obtaining user buy-in would reduce resistance, which will minimize customizations.	Al-Mashari, 2003; Haines, 2009; Kumar et al., 2002
Reduce the implementation time frame	Shortening the implementation time frame will decrease the opportunity for implementing customizations.	Haines, 2009
Establish a formal customization request management process	Establishing a rigorous formal customization request management process will screen customization requests and only implement those that are critical to the business operations.	Haines, 2009
Build a strong relationship with ERP vendor	A good relationship with vendors can influence them to incorporate organizational requirements into the ERP software.	Haines, 2009
Build a team of business engineers	Having a team of business-minded members instead of technical programmers will deflect customization requests.	Haines, 2009
Build a collaborative approach between vendors and organizations	Organizations are working closely with customers to incorporate requirements into ERP enhancements by inviting them to meetings.	Scott & Kaindl, 2000
Configure ERP tables and implement specific modules	Rather than customizing code, organizations can configure ERP tables and implement selected modules to avoid high maintenance and upgrade costs	Lou & Strong, 2004

Figure 3. Factors for consideration related to ERP customization

References

- Al-Mashari, M. (2001). Process orientation through enterprise resource planning (ERP): A review of critical issues. *Knowledge and Process Management Journal*, 8(3), 175–185. Retrieved Apr 25 2011 from Business Source Complete. doi: 10.1002/kpm.114
- Al-Mashari, M. (2003). A process change-oriented model for ERP application. *International Journal of Human-Computer Interaction*, 16(1), 39-55. Retrieved Mar 30 2011 from Academic Search Premier. doi: 10.1207/S15327590IJHC1601_4
- Al-Mashari, M., & Al-Mudimigh, A. (2003). ERP implementation: lessons from a case study. *Information Technology & People*, 16(1), 21-33. Retrieved Apr 9 2011 from ArticleFirst: <http://ejournals.ebsco.com/direct.asp?ArticleID=9U41XDDRM2JBAHL7W61R>
- Bell, C., & Smith, T. (2009). Critical evaluation of information sources. Retrieved from University of Oregon, Applied Information Management Program site: <http://libweb.uoregon.edu/guides/findarticles/credibility.html>
- Bingi, P., Sharma, M. K., & Godla, J. K. (1999). Critical issues affecting an ERP implementation. *Information Systems Management*, 16(3), 7-14. Retrieved May 20 2011 from Computer Source. doi: 10.1201/1078/43197.16.3.19990601/31310.2
- Broadbent, M., & Kitzis, E. (2005). *The new CIO leader*. Boston: Harvard Business School Press.
- Busch, C., De Maret, P., Flynn, T., Kellum, R., Le, S., Meyers, B., Saunders, M., White, R. & Palmquist, M. (2005a). *Conceptual analysis*. Writing@CSU. Colorado State University. Retrieved May 17, 2011 from <http://writing.colostate.edu/guides/research/content/com2b1.cfm>

- Chen, I. (2001). Planning for ERP systems: analysis and future trend. *Business Process Management Journal*, 7(5), 374-386. Retrieved April 3 2011 from Google Scholar.
<http://cis.csuohio.edu/~ichen/ERP.pdf>
- Chou, S., & Chang, Y. (2008). The implementation factors that influence the ERP (enterprise resource planning) benefits. *Decision support systems*, 46(1), 149 -157, Retrieved Apr 18 2011, from Elsevier SD North-Holland. doi: 10.1016/j.dss.2008.06.003
- Daneva, M. (2004). ERP requirements engineering practice: Lessons learned. *Requirements Engineering*, 11(3), 194-204. Retrieved April 3 2011 from Academic Search Premier. doi: 10.1109/MS.2004.1270758
- Daneva, M., & Weiringa, R. (2006). A requirements engineering framework for cross-organizational ERP systems. *IEEE Software*, 21(2), 26-33. Retrieved May 8 2011 from IEEE Xplore Journals. doi: 10.1007/s00766-006-0034-9
- Davenport, D.H. (1998). Putting the enterprise into the enterprise system. *Harvard Business Review*, 76(4), 121-131. Retrieved May 20 2011 from Business Source Complete.
http://www.jps-dir.com/forum/uploads/12967/Davenport_1998.pdf
- Dittrich, Y., Vaucouler, S., & Giff S. (Nov 2009). ERP customization as software engineering: Knowledge sharing and cooperation. *IEEE Software*, 26(6), 41-47. Retrieved May 3 2011 from British Library Serials. doi: 10.1109/MS.2009.173
- Functional organization. (N.D.). *BusinessDictionary*. Retrieved on May 1 2011, from <http://www.businessdictionary.com/definition/functional-organization.html>
- Gattiker, T.F., & Goodhue, D.L. (2002). Software-driven changes to business processes: An empirical study of impacts of Enterprise Resource Planning (ERP) systems at the local

- level. *International Journal of Production Research*, 40(18), 4799-4814. Retrieved Mar 28 2011 from Business Source Complete. doi: 10.1080/0020754021000033913
- Gattiker, T.F., & Goodhue, D.L. (2004). Understanding the local-level costs and benefits of ERP through organizational information processing theory. *Information and Management*, 41(4), 431-443. Retrieved May 11 2011 from Elsevier SD North-Holland. doi: 10.1016/S0378-7206(03)00082-X
- Gattiker, T.F., & Goodhue, D.L. (Sep 2005). What happens after ERP implementation: Understanding the impact of inter-dependence and differentiation on plant-level outcomes. *MIS Quarterly*, 29(3), 559-585. Retrieved May 10 2010, from Web of Science. <http://www.jstor.org/stable/25148695>
- Haines, M. (2009). Understanding enterprise system customization: An exploration of implementation realities and the key influence factors. *Information Systems Management*, 26(2), 182-198. Retrieved Mar 30, 2011 from Computer Source. doi: 10.1080/10580530902797581
- Hong, K. K., & Kim, Y. G. (2002). The critical success factors for ERP implementation: an organizational fit perspective. *Information and Management*, 40(1), 25-40, Retrieved May 8 2011, from Elsevier SD North-Holland. doi:10.1016/S0378-7206(01)00134-3
- Ioannou, G., & Papadoyiannis, C. (2004). Theory of constraints-based methodology for effective ERP implementations. *International Journal of Production Research*, 42(23), 4927-4954. Retrieved May 22, 2011 from Business Source Complete. doi: 00207540410001721718
- Jacobs, F., & Weston, F. (2007). Enterprise resource planning – a brief history. *Journal of Operations Management*, 25(2), 357–363. Retrieved Apr 10 2011, from Elsevier B.V. doi:10.1016/j.jom.2006.11.005

- Karimi, J., Somers, T., & Bhattacharjee, A. (2007). The impact of ERP Implementation on business process outcomes: a factor-based Study. *Journal of Management Information Systems*, 24(1), 101-134. Retrieved Mar 28 2011 from Computer Source. doi: 10.2753/MIS0742-1222240103
- Kitto, S., & Higgins, V. (January 2010). Working around ERPs in technological universities. *Science Technology Human Values*, 35(1), 29-54. Retrieved Apr 10, 2011 from Sage Complete. doi: 10.1177/0162243908329535
- Kumar, V., Maheshwari, B., & Kumar, U. (2002). Enterprise resource planning systems adoption process: A survey of Canadian organizations. *International Journal of Production Research*, 40(2), 509-523. Retrieved May 20 2011 from Business Source Complete. doi: 10.1080/00207540110092414
- Lester, James D. and Lester, James D. Jr. (2009). *Writing Research Papers (13th Edition)*. New York: Longman Press.
- Liang, H., Saraf, N., Hu, Q., & Xue, Y. (2007). Assimilation of enterprise systems: The effect of institutional pressures and the mediating role of top management. *Management Information Systems Quarterly*, 31(1), 59-87. Retrieved Mar 28 2011 from Computer Source. <http://aisel.aisnet.org/misq/vol31/iss1/6/>
- Light, B. (2001). The maintenance implications of the customization of ERP software. *Journal of Software Maintenance: Research and Practice*, 13(6), 415-429. Retrieved Apr 10, 2011 from Google Scholar. doi: 10.1002/smr.240
- Luo, W.H., & Strong, D. M. (Aug 2004). A framework for evaluating ERP implementation choices. *IEEE Transactions on Engineering Management*, 51(3), 322-333. Retrieved Apr 10 2011 from ArticleFirst. doi: 10.1109/TEM.2004.830862

Lodestone Management Consultants. (N.D.). Success story centralized ERP system. Retrieved May 3 2011 from Lodestone website:

http://www.lodestonemc.com/files/templates/Success_Story_Novartis_MDM.pdf

Mabert, V. A., Soni, A., & Venkataramanan, M. A. (2000). Enterprise resource planning survey of US manufacturing firms. *Production & Inventory Management Journal*, 41(2), 52–58.

Retrieved Apr 25, 2011 from ArticleFirst.

<http://galenet.galegroup.com.libproxy.uoregon.edu/servlet/BCRC?srchtp=adv&c=1&ste=31&tbst=tsVS&tab=2&aca=nwmg&bConts=2&RNN=A65070020&docNum=A65070020&locID=s8492775>

Mabert, V. A., Soni, A., & Venkataramanan, M. A. (2001). Enterprise resource planning:

Common myths versus evolving reality. *Business Horizons*, 44(3), 69–76. Retrieved Apr

24 2011, from ArticleFirst. doi:10.1016/S0007-6813(01)80037-9

McKay, D. R. (2010). *Computer and information systems manager: Career information*.

Retrieved from http://careerplanning.about.com/od/occupations/p/comp_sys_mgr.htm

Motwani, J., Subramanian, R., & Gopalakrishna, P. (Aug 2005). Critical factors for successful

ERP implementation: Exploratory findings from four case studies. *Computers in*

Industry, 56(6), 529-544. Retrieved Apr 18 2011, from Web of Science.

doi:10.1016/j.compind.2005.02.005

Nadeem, M., & Jaffri, S. (2004). Application of business intelligence in banks (Pakistan). n.p.:

Retrieved on May 3 from <http://arxiv.org/ftp/cs/papers/0406/0406004.pdf>

Nah, F. F., Lau, J. L., & Kuang, J. (2001). Critical factors for successful implementation of

enterprise systems. *Business Process Management Journal*, 7(3), 285-296. Retrieved Apr

25 2011, from Google Scholar. doi: 10.1108/14637150110392782

- Parr, A., & Shanks, G. (2000a). A model of ERP project implementation. *Journal of Information Technology*, 15(4), 289-303. Retrieved Mar 28 2011 from ArticleFirst. doi: 10.1080/02683960010009051
- Parr, A., & Shanks, G. (2000b). A taxonomy of ERP implementation approaches. *Proceedings of the 33rd Hawaii International Conference on System Sciences*. Retrieved Mar 28 2011, from Google Scholar:
<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.98.3458&rep=rep1&type=pdf>
- Real-time data. (N.D.). *Wikipedia*. Retrieved on May 3 2011, from
http://en.wikipedia.org/wiki/Real-time_data
- Rothenberger, Marcus, & Srite, Mark. (Nov 2009). An investigation of customization in ERP system implementations. *IEEE Transactions on Engineering Management*, 56(4), 663-676. Retrieved Apr 18 2011, from Web of Science. doi: 10.1109/TEM.2009.2028319
- Scapens, R., Jazayeri, M., & Scapens, J. (1998). SAP: Integrated information systems and the implications for management accountants. *Management Accounting*, 76(8), 46-48. Retrieved Apr 25 2011, from Business Source Complete.
<http://web.ebscohost.com.libproxy.uoregon.edu/ehost/detail?sid=7b815627-0139-4b87-98c4-bdeef3ec8b76%40sessionmgr13&vid=1&hid=21&bdata=JnNpdGU9ZWU9ZWhvc3QtbGl2ZSZZy29wZT1zaXRl#db=bth&AN=1085898>
- Scott, J. E., & Kaindl, L. (2000). Enhancing functionality in an enterprise software package. *Information and Management*, 37(3), 111-122. Retrieved May 21 2011, from Elsevier SD North-Holland. doi:10.1016/S0378-7206(99)00040-3

- Soh, C., Kien, S. S., & Tay-Yap, J. (2000). Cultural fits and misfits: Is ERP a universal solution. *Communications of the ACM*, 43(4), 47–51. Retrieved Apr 25 2011, from ArticleFirst.
doi: 10.1145/332051.332070
- Stephens, C. S., Ledbetter, W. N., Mitra, A., & Ford, F. N. (1992). Executive or functional manager? The nature of the CIO's Job. *Management Information Systems Quarterly*, 16(4), 449-467. Retrieved Apr 10, 2011, from JSTOR.
<http://www.jstor.org/stable/249731>
- Tchokogue, A., Bareil, C., & Duguay, C. (Feb 2005). Key lessons from the implementation of an ERP at Pratt & Whitney Canada. *International Journal of Production Economics*, 95(2), 151-163. Retrieved May 3 2011 from British Library Serials.
doi:10.1016/j.ijpe.2003.11.013
- Trunick, P.A. (1999). ERP: promise or pipe dream? *Transportation & Distribution*, 40(1), 23-26. Retrieved Apr 25 2011, from British Library Serials.
<http://web.ebscohost.com.libproxy.uoregon.edu/ehost/detail?sid=aa716c5f-16f7-43c4-829d-ff41cf6bdda1%40sessionmgr10&vid=1&hid=21&bdata=JnNpdGU9ZWZWhvc3QtbGl2ZSZzY29wZT1zaXRl#db=voh&AN=1482161>
- University of North Carolina. (2007a). *The writing center: Literature reviews*. Retrieved from http://www.unc.edu/depts/wcweb/handouts/literature_review.html
- University of North Carolina at Chapel Hill (2007b) *The writing center: Annotated Bibliographies*. Retrieved May 17, 2011 from http://www.unc.edu/depts/wcweb/handouts/annotated_bibliographies.html

WorkingCapital. (N.D.). *Investopedia*. Retrieved on May 1 2011, from

<http://www.investopedia.com/terms/w/workingcapital.asp>

Wright, A, & Wright S. (2002). Information system assurance for enterprise resource planning systems: Unique risk considerations. *Journal of Information Systems*, 16(1), 99-113.

Retrieved Apr 18 2011, from Web of Science. doi: 10.2308/jis.2002.16.s-1.99