ISSN: 1545-679X

Information Systems Education Journal

Volume 6, Number 63 http://isedj.org/6/63/ December 23, 2008

In this issue:

Systematic and Holistic IT Project Management Approach for Commercial Software with Case Studies

Theresa A. Kraft
University of Michigan Flint
Flint, MI 48502 USA

Abstract: IT is fast becoming intrinsic to our daily existence. Companies invest large sums of monies for major IT projects with very limited success. Despite the abundance of IT project management (ITPM) resources (Body of Knowledge, IT standards, governance), a large percentage of IT projects continue to be scrapped, over budget, and/or delayed. In a few decades, a large-scale IT failure will become more than just an expensive inconvenience: it will put our way of life at risk. Recent studies have shown a 66% IT project failure rate, with 52% of the projects being cancelled, and 82% being delivered late. Of the companies surveyed, 67% feel their PM programs/practices are "in need of repair". Thus, complying with traditional IT/Business governances and project management methodology may not be enough to ensure enterprise IT project success/performance. Implementing a more systematic and holistic approach might demonstrate improved project success factors. A systematic and holistic project management methodology would address the following questions to improve the success of IT projects: • How should business processes be redesigned to be aligned with the overall system design and functionality in order to improve the outcomes/performance of IT project? • What is the relationship between business requirements and the overall system IT architecture and infrastructure? • How could alignment be achieved between the overall system architecture and IT Governance in today's business environments? • Case histories of IT Commercial Off-the-shelf Software (COTS) projects will be researched based upon these questions and utilized to develop a conceptual model.

Keywords: Project Management, Commercial Software, Conceptual Model, Business Processing, IT Architecture

---

Recommended Citation: Kraft (2008). Systematic and Holistic IT Project Management Approach for Commercial Software with Case Studies. *Information Systems Education Journal, 6* (63). http://isedj.org/6/63/. ISSN: 1545-679X. (Preliminary version appears in *The Proceedings of ISECON 2007:* §3152. ISSN: 1542-7382.)

This issue is on the Internet at **http://isedj.org/6/63/**

The **Information Systems Education Journal** (ISEDJ) is a peer-reviewed academic journal published by the Education Special Interest Group (EDSIG) of the Association of Information Technology Professionals (AITP, Chicago, Illinois). • ISSN: 1545-679X. • First issue: 8 Sep 2003. • Title: Information Systems Education Journal. Variants: IS Education Journal; ISEDJ. • Physical format: online. • Publishing frequency: irregular; as each article is approved, it is published immediately and constitutes a complete separate issue of the current volume. • Single issue price: free. • Subscription address: subscribe@isedj.org. • Subscription price: free. • Electronic access: http://isedj.org/ • Contact person: Don Colton (editor@isedj.org)

This paper was selected for inclusion in the journal as part of the ISECON 2007 best papers group. Best papers received preliminary reviews by three or more peers placing them in the top 30% of papers submitted and final reviews placing them in the top 15% by three or more former best papers authors who did not submit a paper in 2007.

EDSIG activities include the publication of ISEDJ, the organization and execution of the annual ISECON conference held each fall, the publication of the Journal of Information Systems Education (JISE), and the designation and honoring of an IS Educator of the Year. • The Foundation for Information Technology Education has been the key sponsor of ISECON over the years. • The Association for Information Technology Professionals (AITP) provides the corporate umbrella under which EDSIG operates.

Systematic and Holistic IT Project Management Approach for Commercial Software with Case Studies

Theresa A. Kraft
thereakraft@aol.com
College of Management, Lawrence Technological University
Southfield, MI 48075, USA

ABSTRACT

IT is fast becoming intrinsic to our daily existence. Companies invest large sums of monies for major IT projects with very limited success. Despite the abundance of IT project management (ITPM) resources (Body of Knowledge, IT standards, governance), a large percentage of IT projects continue to be scrapped, over budget, and/or delayed. In a few decades, a large-scale IT failure will become more than just an expensive inconvenience: it will put our way of life at risk. Recent studies have shown a 66% IT project failure rate, with 52% of the projects being cancelled, and 82% being delivered late. Of the companies surveyed, 67% feel their PM programs/practices are "in need of repair". Thus, complying with traditional IT/Business governances and project management methodology may not be enough to ensure enterprise IT project success/performance. Implementing a more systematic and holistic approach might demonstrate improved project success factors. A systematic and holistic project management methodology would address the following questions to improve the success of IT projects: • How should business processes be redesigned to be aligned with the overall system design and functionality in order to improve the outcomes/performance of IT project? • What is the relationship between business requirements and the overall system IT architecture and infrastructure? • How could alignment be achieved between the overall system architecture and IT Governance in today's business environments? • Case histories of IT Commercial Off-the-shelf Software (COTS) projects will be researched based upon these questions and utilized to develop a conceptual model.

Keywords: Project Management, commercial software, conceptual model, Business Processing, IT Architecture

1. INTRODUCTION

Companies invest large sums of money for major information technology projects yet achieve limited success. In efforts to reduce the risks associated with the failure of information technology projects, enterprises have opted to replace existing legacy systems with packaged solutions. Some use commercial-off-the-shelf (COTS) software, rather than incurring the costs and risks involved in software development. Software project management, outsourcing of IT projects and corporate IT governance and standards policies are some of the strategies being utilized to improve the success rate of IT systems procurement.

Despite the body of knowledge on IT project management, standards and governance, a large percentage of IT projects are scrapped, over budget, or delayed. A comparison of project management studies by Forrester Research Inc. has shown that there is a sixty-six percent project failure rate, with fifty two percent of the projects being cancelled and eighty two percent being delivered late. Sixty seven percent of the companies surveyed feel their program or project management practices are "in need of repair"

(Visitacion, 2006). Other research states "five to fifteen percent of the IT projects initiated will be abandoned before, or shortly after, delivery as hopelessly inadequate and many others will arrive late and over budget or require massive reworking" (Charette, 2005).

Failing to properly manage IT projects, or improve the IT project success rate, can lead to a variety of problems including substantial cost and schedule over runs, unmet business requirements, disgruntled business users and clients, and the delivery of IT systems that do not deliver business value (Wallace et al., 2005). The Chaos Report by the Standish Group (1995) reported that over thirty-one percent of projects will be cancelled, and over fifty-two percent of projects will have cost over runs in excess of 189% of their original estimates.

The 1995 estimate by the Standish Group also reported that American companies and government agencies would spend $81 billion dollars for canceled software projects. An additional $59 billion would be spent for software projects that are completed, yet beyond their original time estimates. Other research by KPMG International, which surveyed over 600 organizations across 22 countries, reported that 86% of the respondents stated the loss of up to a quarter of their targeted benefits across their project portfolios (Holloway, 2005). A previous survey by KPMG Canada in 1997 sent out 1450 questionnaires to public and private sector organizations and 176 were analyzed. Over 61% of these projects were deemed to have failed by the respondents, with more than three quarters exceeding their schedule by 30% or more and over half exceeded their budgets by a substantial margin. These IT project statistics include a range of procurement and acquisition strategies including the implementation of ERP systems, the purchase of commercial software, and both internal and out-sourced software development.

2. LITERATURE REVIEW

The purpose of the initial literature review is to understand the existing subject matter on project management, and determine what gaps exist in the project management body of knowledge pertaining to the new industry trend of COTS application software procurement and implementation. The literature review will focus on the following subject matters:

- Factors contributing to the success and failure of IT project management and IT systems delivery.
- A examination and review of existing scholarly journals and articles on the body of knowledge for IT Project Management.
- Examination of Project Management articles for COTS application software projects.

Typical project management articles have documented factors that contribute to project success or failure in terms of budget constraints, resource costs, ability to meet schedules, and satisfy objectives. Despite numerous methods and techniques for project management that have been developed and documented, "project management remains a highly problematic endeavor" (White & Fortune, 2002). A research method involving project management questionnaires and a survey has recently been used to determine the factors that lead to successful projects by Verner and Evanco (2005). The survey evaluated 122 projects with inputs from 101 respondents, of which 62% were regarded as successful with the remaining 38% being unsuccessful. The research by Verner and Evanco (2005) illustrated that good scheduling and resource estimates will also contribute to project success. This survey evaluated the impact of requirements gathering, requirements management, and cost and effort estimation and scheduling. The authors conclude, "the greatest opportunity for improvement is at a project's start, in the requirements and risk identification and control areas (Verner & Evanco, 2005).

The article "Critical Success Factors in Software Projects" by Reel (1999) states that success factors to manage a software project include: starting on the right foot by establishing realistic objectives and expectations, establishing the right project team, and funding the team with adequate resources to promote productivity and minimize distractions. Then the project team momentum must be maintained by keeping attrition low, monitoring quality to ensure development of high quality code, and management of the product more than the people. Monitoring and controlling the

project with work activity progress tracking, project scheduling, making sound decisions and performing a post-mortem analysis are other suggestions for improving project success rate.

Additionally research conducted by White and Fortune (2002) illustrated that "project success criteria of on-time, on-budget and to specifications are not the sole criteria by which project outcome was judged." This research utilized a questionnaire sent to 995 project managers representing 620 organizations in both public and private sectors. One of the major criteria for project success identified by this research is the fit between the project objectives and that of the organization, and the impact of the project on business performance. The respondents stated there is a requirement to meet the organizational objectives and to minimize business disruption. This clearly indicates that the project must address the business processes and objectives, and that there must be alignment between business objectives and project deliverables. The conclusion of the research is that there needs to be "a greater understanding of the effects of the various interacting processes and decisions that take place throughout the life of a project, thus building up a more holistic view of project management" (White & Fortune, 2002).

White and Fortune (2002) identified 19 critical factors based upon a literature study and the survey of 236 respondents who were asked to indicate which factors they regarded as critical to a project's outcome. The survey identified the critical factors for a project's outcome as shown in Table 1.

An extensive literature search was conducted to understand the current level of knowledge for project management and what was being investigated to address the high rate of failure. The Project Management Journal published an article titled "The Current State of Project Management Research: Trends, Interpretations and Predictions", by T. Kloppenborg and W. Opfer in 2002. The focus of this research was a review of all relevant research articles on project management, which had been reported in the literature since 1960 to 1999. The materials searched for this project included scholarly periodicals and journals, conference proceedings, research papers, PMI conference proceeding, theses and dissertations.

Keywords used to review, classify and catalog the citations included: the nine knowledge areas of project management as defined in the PMBOK guide, the application of project management to different industries, the process aspects of project life cycle stages, and management processes. A total of 92 people worked approximately 6,000 hours to construct a data base of 3,554 records and utilized a number of techniques to analyze the data base for determining trends and performing interpretation. The data base analysis of the project management keywords used for searching is given in Table 2.

PROJECT CRITICAL FACTORS	COUNT
Clear Goals and Objectives	206
Realistic Schedule	185
Support from Senior Management	176
Adequate Funds/Resources	164
End User Commitment	159
Clear Communication Channels	144
Effective Leadership/Conflict Resolution	138
Effective Monitoring and Feedback	135
Flexible Approach to change	133
Taking Account of Past Experience	121
Recognizing Complexity	121
Taking Account of External Influences	120
Effective Team Building Motivation	117
Effective Management of Risk	117
Training Provision	98
Contextual Awareness	94
Provision of Planning and Control System	88
Appreciating the Effect of Human Error	53
Considering multiple views of the project	47
Having access to innovative talented people	8
Other Factors	7
Having Relevant Past Experience	3
Support from Stakeholders / Champions	3
Having a Clear Project Boundary	2

(White & Fortune 2002)

Table 1: Project Critical Factors

KNOWLEDGE AREA	FREQUENCY CITED	PROCESS AREA	FREQUENCY CITED
• Cost	28%	• Plan	29%
• Time	24%	• Control	23%
• Quality	12%	• Lead Direct	17%
• Risk	10%	• Improve	14%
• Communication	8%	• Execute	1%
• Integration	5%		
• Scope	5%		
• Human Resources	4%		
• Procurement	4%		

Table 2: Project Management Keywords from Literature Search

The work of Kloppenborg and Opfer (2002) illustrates that during the 1970's the industry trend was the development and use of automated software, such as PERT charts, with a focus on cost and schedule control. Factors of project risk management and design to cost, and life cycle costing topics in-

creased during the 1980s. Human resource aspects of team building, leadership and motivation comprised a large percentage of the research topics in the 1990s.

Additional research was funded by the Project Management Institute (PMI) to expand on the earlier work of Kloppenborg and Opfer (2002). The article "Project Management Learning What the Literature Has to Say" reported on a search of eight commercial databases to conduct a thorough literature review of project management topics including trends, major issues and research contributions from each of the nine (PMBOK) knowledge areas. An initial database of 9,332 records was refined based upon selected publications that are not research oriented. The resulting database of publications from 1999 or later resulted in 784 records (Tesch, Kloppenborg, & Steemer, 2003). A total of 223 different journals are represented in the final database, and the database also included 253 conference proceedings, and 33 theses or dissertations. The database was divided among five focus groups with the following distributions as shown in Table 3.

ABSTRACT FOCUS GROUP	TOTAL ABSTRACTS EXAMINED
Cost, Procurement, Life Cycle	130
Leadership, Teamwork, HR, Communications	137
Quality, Risk, Integration	79
Schedule, Scope	170
Information Systems Success and Failure	165

Table 3: Focus Group of Literature Search

Comments about the research articles are "the more advanced research does not closely relate to everyday project issues and demands, and practitioners asked repeatedly how they could apply a particular finding, especially those that were published in the more highly regarded academic journals" (Tesch et al., 2003). Future research suggested by the article includes "describing factors related to the success of project management efforts and an examination of factors contributing to project failure" (Tesch et al., 2003).

A journal article by Jugdev and Muller (2005) states that project management can have strategic value when the project's products and services provide a business value. Literature topics on the tradeoffs between time, cost, quality and scope indicate that scope is one of the primary determinants of project success. The Meta analysis of the literature search indicates that the project management publications are primarily focused on tools and techniques, and project management methodology at the tactical level. "Few publications discuss project management in the context of strategic planning, company mission, and the importance of corporate management performance" (Judgev & Muller, 2005). The most recent literature by Jugdev and Muller (2005) on project management summarizes several empirical studies and states that project management success at the organizational level must shift attention away from performance and effectiveness metrics, and reflect a more holistic view of the value of the project management as a core or strategic value.

Research by Nasir (2005) attempted to identify possible trends and changes in Management Information System (MIS) concepts by performing an analysis of business and marketing journals over the 33 year period from 1970 to 2002, and a total of 136 articles were reviewed (Nasir, 2005). The analysis of these articles over the past three decades is illustrated in Figure 1.

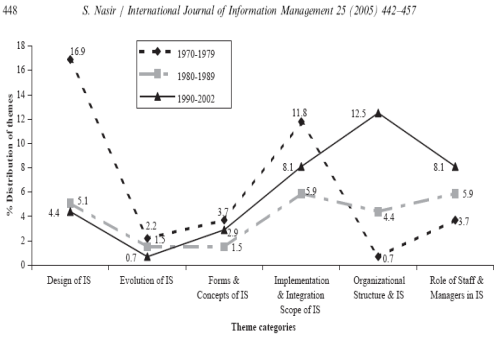

Figure 1: Distribution of Literature Themes over Time

As seen in Figure 1, the design of Information Systems has experienced a notable decrease in percentages of article coverage since the 1970-1979 periods. Recent trends of the 1990-2002 period show a high percentage of articles focusing on Organizational Structure & Information Systems. The Organizational Structure & Information Systems category covered topics about the rise

of integration systems, development of cross functional teams, inter-organizational IS, problems linking data across functions, selection of a compatible IT structure for an organization and the issue of whether to outsource IS or to use in-house IS. The significance of collaboration and interaction among high-level executives, user, and information system managers contributed to the increase coverage of articles on Organizational Structure & IS. The Role of Staff & Managers in Information Systems also experienced a notable increase in percentage of articles for the period of 1990-2002.

Extensive literature searches were performed for the two keywords of Commercial Software and Project Management and the two keywords of COTS and Project Management. This literature search for the two keywords COTS and Project Management was neither beneficial nor applicable. A second literature search for the single term COTS and commercial software produced the following results:

- An article by Keil and Tiwana (2005) examined how managers evaluate COTS applications and stated that that functionality and reliability are important factors affecting a COTS package and stressed the importance of vendor support.
- An approach for evaluation of COTS applications and identification of costs associated with COTS including integration, maintenance and customization are provided by Minikiwicz (2004).
- Additional literature by Maden, Ncube and Moore (1997) discussed the COTS requirements acquisition and production selection process for the U.K. Ministry of Defense, and provides suggestions for improvement to the COTS selection process.
- An article by Wesenberg, Landre and Ronnenberg addresses the evaluation of COTS software for supply chain activities in the oil trading industry.
- A COTS integration Case Study Approach by T. Row Price Investment Technologies (Balk & Kedia, 2000) for a project tracking system and implementations of ERP COTS software in the public sector.

3. PROPOSITION AND RESEARCH QUESTIONS

"IT is fast becoming intrinsic to our daily existence. In a few decades, a large-scale IT failure will become more than just an expensive inconvenience: it will put our way of life at risk" (Charette, 2005). Yet the statistics indicate that between fifty (50%) and eighty (80%) of IT projects are unsuccessful (Desouza & Evaristo, 2006). Despite the proliferation of publications and the existing body of knowledge on project management, there is an obvious need to improve IT project management success rates by implementing a more holistic and strategic view. IT alignment planning has emerged as a necessary task of many senior managers, while commercial IT research organizations such as Gartner have listed IT alignment as top issue of American companies.

COTS purchases now represent about "70 percent of all corporate business software expenditures and recent estimates put the annual market for COTS at almost US $200 Billion worldwide. Industry is attempting to utilize COTS applications as an economic necessity to shorten the implementation timeline, lower software costs, and lessen the unpredictability associated with developing custom applications (Keil & Tiwana, 2005). Although studies have been done to understand what factors contribute to project success and failure in software development projects, and what can be done to increase the probability of project success (Verner & Evanco 2005) there is little evidence of research on COTS implementations.

The traditional Project Management metrics of cost, schedule, resources, and scope should be expanded and research should look beyond the management of traditional software development projects, to address problems related to the implementation of COTS software applications. The primary purpose of this research is to expand the body of knowledge of IT Project Management of COTS software procurement and implementation, with focus on factors contributing to the successes and failures of managing such projects. This research is motivated by clear evidence that complying with the traditional IT project management methodology may not be enough to ensure successful procurement and implementation

of COTS based IT projects. The research proposition is stated as follows:

The adoption of a systematic and holistic approach to COTS IT projects improves the potential for the successful implementation of COTS solutions.

As shown in the literature review traditional project management research has focused on factors for the success or failure of IS projects based upon the tactical objectives such as cost, schedule, scope, resources, and risk management. The theoretical conjecture here is that these traditional approaches need to be expanded upon if the industry is to improve the success rate for COTS Information System projects. Furthermore an approach focused on IT alignment to business requirements, and which adopts a more strategic methodology may improve COTS IT project success rates.

Such a strategic methodology would consider the following additional questions:

- What business processes (of tasks and requirements) should be redesigned to be aligned with the overall system design and functionality in order to improve the outcomes/performance of IT project?
- What is the relationship between business requirements and the overall system (project) architecture and infrastructure?
- How should business requirements and business processes be shaped and/or formulated so that the performance and functionality of the overall system or project might be enhanced?
- How could alignment be achieved between the overall system architecture and IT Governance in today's business environments?
- How are IT standards effectively implemented in business projects?
- What roles might IT Project Managers and software vendors play in order to influence changes to IT standards or system architecture to promote the success of projects within an enterprise?
- How might the organizational dynamics be managed and leveraged to advance the success rate of IT projects?
- What might be the ideal (and potentially optimal) relationship between IT Project Managers and the business community in order to improve project success?

4. FOCUS OF RESEARCH AREA

Factors that contribute to Information Technology failures have been well documented in the literature. The primary purpose of this research is to expand the body of knowledge of IT Project Management for COTS software procurement and implementation, with focus on factors contributing to the successes and failures of managing such projects. One important factor to consider is the collection of the business requirements and the alignment of the business requirements and business processes to the corporate IT standards and functionality of IT software applications.

All too frequently, information technology projects fail to address the alignment of the business requirements and business processes to the software functionality and IT standards. Business process re-engineering is often overlooked as part of the IT project management steps, and IT standards although essential are too often inflexible and unresponsive to the business requirements. The research project will investigate:

- The alignment of the business process requirements with the commercial software system functionality.
- Improvements required by commercial software system functionality to address business process requirements
- Improvements in the alignment of Organizational Dynamics of structure and culture to business changes required by new commercial software system functionality.

The importance of the alignment of Organizational Dynamics is illustrated by Benjamin and Levison (1993), who states, "that the benefits of IT are often not realized because investment is biased towards the technology and not toward managing change in the process, organizational structure and culture (Benjamin and Levinson, 1993).

Critical strategic factors for success are:

- The existence of a clear dependency and linkage from the IT features which enables a set of changes in business working processes and practices to occur.

- The change to the business processes will contribute to the desired business goals and objectives.
- Both IT management and business management must be involved in the project.
- Education to ensure the stakeholders understand why the IT investment is being made, what benefits they and the overall business will obtain, and the changes required to achieve them. Education is also required to explain the operation of the new IT system. (Dhillon, 2005).

"Real benefits reside not within the domain of the IT system but in the changes to the organizational activities that the IT system has enabled" (Dhillon, 2005).

The Business IT alignment method (BITAM) proposed by Chen, Kazman and Garg describes one approach for unifying the business and IT architecture by addressing the following three alignments:

- We ensure alignment between business models and the business architecture via the creation/exercising of operational scenarios that satisfy the business requirements.
- We ensure alignment of business architecture with the IT architecture via the exercising of the same set of operational scenarios.
- We ensure alignment of the business model with the IT architecture via the creation/exercising of scenarios that satisfy the business drivers (quality attribute requirements) (Chen, Kazman, Garg, 2006).

5. RESEARCH PROCESS

The DMIT Research Process Model given in Figure 2 illustrates the processes to be followed in the main stages of a DMIT research project.

The first phases of the research process involve research planning, which includes the definition and identification of the research problem, the exploratory and initial literature reviews, which refine the research problem and provide assurance that problem and area being researched are unique and contribute to the body of knowledge. The research planning phases also includes the documentation of the research methods and techniques, the development of the research schedule, the completion and defense of the research proposal.

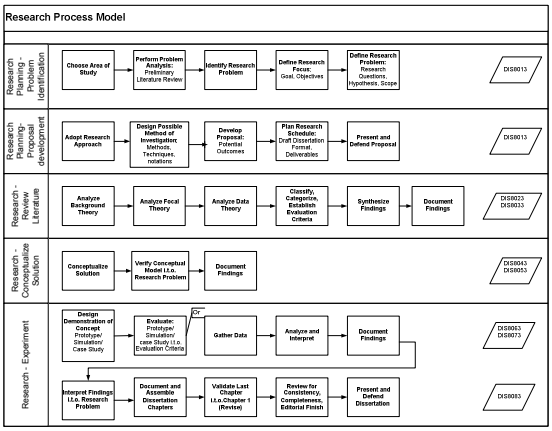

Figure 2: DMIT Research Process Model

The research literature review phase requires an analysis and synthesis of leading journals and articles to refine the research approach and develop an increased understanding and breadth of knowledge of the topic being investigated. The results of the literature review are utilized with the researcher's personal expertise, industrial experience and subject matter knowledge to conceptualize solutions to the research proposition and questions.

The research phase is the actual development and refinement of the conceptual solution. The conceptual solution is a model or representation of inputs, processes and outputs, which are representative of the research topic. The conceptual model will include key factors or variables that are typically the inputs to the system or research topic, the processes or transformations performed on these input variables, and the overall output and response of the system being modeled to the inputs and processes in terms of output variables. Thus, the conceptual model includes input variables, transformation or processes, and output variables and identifies the relationships and dependencies of the variables and the predicated output response of the system being researched. The research experimentation stages will validate and refine the conceptual model. The completion of the research phase includes the documentation of the research finding and the actual dissertation completion with publications in appropriate peer reviewed academic journals.

5.1 Research Methodology

The application of this research process to a systematic and holistic approach for COTS IT projects will be accomplished using the methodology shown in Figure 3.

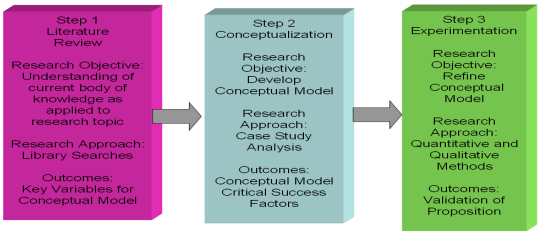

Figure 3: Research Methodology

The research methodology has three phases, namely:

Phase 1: Perform an analysis of the literature in order to identify key variables and factors contributing to success and failure of COTS IT project procurement and implementation. An understanding of literature trends regarding this research topic is developed. The review has two parts, namely a study of the background theories and the focal theories of the research area of study. An analysis will be done on the historical documentation of the case studies to attempt to identify key variables and formulate a conceptual model in terms of critical success factors and the potential dependencies between them.

Phase 2: Develop and model a conceptual solution to the stated research questions and proposition. This conceptual model will be based on a case study approach of two COTS software projects, which were utilized to satisfy a manufacturing quality initiative for Failure Mode Effect Analysis (FMEA). The first of these projects for FMEA software was not successful and the second attempt was a successful implementation. The contrast of the two cases, which were performed to satisfy the same business requirements, will be utilized to develop the initial conceptual model.

The conceptual model will identify the variables and factors that impacted the project management failures and successes for these two cases. The development of the conceptual model will have an emphasis on the variables of business process alignments, the IT governance and standard alignments, the responsiveness and flexibility of the software vendor or development team, and the organizational dynamics. The conceptual model and critical key variables of the initial conceptual model will be reviewed and evaluated based upon the first two case studies. The value of the case studies is that the conceptual model will be evaluated in terms of real-world project experiences to confirm the interdependencies among the critical success factors and variables. The outcome of Phase 2 is the conceptual model.

Phase 3: The experimentation and validation of the conceptual model will be performed by evaluation of the model against two additional case studies. The purpose of the experimentation is to demonstrate the validity of the conceptual model and refine the conceptual model based upon additional data.

The case study analyses for the research conceptualization and experimentation phases will focus on the five major project management life cycle phases of plan, define, construct, test and deploy for each case. Each of these project management steps has standard deliverables such as business requirements, system requirements, information flow diagrams, test cases, system architectures and end users feedback. The project management deliverables will be evaluated against the underlying factors and variables for the development of the conceptual model.

The experimentation phase will be accomplished utilizing a mixed methods approach since there is both quantitative and qualitative historical data available. The quantitative historical data consists of the business users completion of the user acceptance testing, the software evaluations, and other data collected from the business user community with surveys and questionnaires. Other data such as the architecture designs and the compatibility of the proposed IT architecture with the IT governance and standards is qualitative. A qualitative research method, based upon case studies will be adopted. An evaluation and comparison of four different case histories will be utilized to develop and validate the conceptual model with the intent to predict IT COTS project management success based upon propositions. The use of qualitative modeling allows the researcher to view the organization's synergistic existence as a whole entity ver-

sus the sum of it parts, in supporting the overall organization's objectives and functions and the alignment to the IT system (Johnson, Leach, Liu, 1999).

5.2 Case Study Research

Case study research is appropriate and useful when the phenomenon cannot be easily quantified and where multiple contextual variables influence organizational behavior (Yin, 1994). Case study research is also useful to research questions that are exploratory, confirmatory or explanatory in nature and consists of a detailed investigation that attempts to provide an analysis of the context and processes involved (Eisenhardt, 1989). According to Eisenhardt, the case study research is necessary "at times when little is known about a phenomenon and current perspectives seem inadequate because there have little empirical substantiation" (Eisenhardt, 1989). Thus, it is appropriate to use case study research methodology as the first step to develop a strategic vision of project management critical success factors, since there is little documented about the dependencies between IT project success rates and the alignments of the business processes, IT standards and governance, and organizational dynamics to the proposed IT solution.

Case study research is therefore appropriate in this research project, since there is little known about the dependencies among the mentioned factors and current perspectives about the project management body of knowledge on COTS procurement and implementation seems inadequate to explain the phenomenon of high rate of IT project failures.

Three requirements must be satisfied to use case study research to investigate questions of an explanatory nature:

- The case study must begin with theory and the development of a research hypothesis or proposition.
- A systemic research design must be followed.
- Evaluation criteria must be determined and used for the independent assessment of potential biases and to ensure the methodological rigor of the case studies (Johnson, Leach, Liu, 1999).

The fundamental goal of conducting case study research using several case studies is to allow for the investigation of differences across the cases and to determine if the data across the cases provides sufficient evidence to support the initial proposition. The case study approach is being utilized to understand the interactions between IT project management processes, IT governance standards, and the impact on the organization in implementing IT projects to satisfy business requirements and objectives. The case studies are summarized in the next sections.

5.3 The Case Studies

5.3.1 Case #1 – Manufacturing Quality-Desktop Application

The first case study is the original attempt to satisfy the business requirements for the manufacturing process failure mode effect analysis (PFMEA) using a vendor based software application for data entry and reporting. This original attempt selected a software application which had failed attempts for implementation by the manufacturing plant sites for over three years with major problems, unresolved issues and very dissatisfied end users.

5.3.2 Case #2 – Manufacturing Quality WEB Based Application

The second project was a manufacturing quality initiative to perform manufacturing process failure mode effect analysis (PFMEA) using a centralized web based server for data entry and reporting. The project goal was to select a COTS application to satisfy all the PFMEA requirements of the global manufacturing plant sites and to ensure the plants complied with the QS9000 quality standards. The project was started and successfully deployed within 18 months.

5.3.3 Case #3 – CAD Data Management

The third project was the data management of AutoCAD drawings files using Product Data Management (PDM). The project goal was to replace the legacy application developed internally using the relational database Ingress with a corporate COTS standard PDM application, Team Center from Unigraphics solutions.

The business organization had originally developed the customized data management

system based upon Ingress for the document management of the machinery drawings and related bill of materials (stock lists). The custom application called Plant Management Information System accomplishes Manufacturing Engineering data management, change management and support of the process for machine maintenance and parts procurement processes. The Plant Management Information System is currently deployed at over 20 different manufacturing plants and contains over 1.5 million data records of various types.

The management direction and vision is to replace the legacy system, which is costly to maintain and upgrade with a commercially available package Team Center/IMAN from Unigraphics Solutions. The business unit has been conducting pilot testing with Team Center/IMAN for the last five years and has uncovered numerous functional gaps and deficiencies in the Team Center/IMAN Software application when mapped to the business processes.

5.3.4 Case #4 – Advanced Invoice Management System

The fourth project Advanced Invoice Management System (AIMS) is the implementation of an E-Commerce invoicing system for the Legal department that provides for electronic invoice delivery, management and workflow. It will allow for online review, adjustment and approval of invoices. This project also includes integration with the Case Matter Management System Team Connect (TCE) COTS Project. The purpose of the AIMS project is to replace the existing invoicing system (PFM), which is no longer supported since the software vendor has discontinued the product.

5.4 Outcome Analysis

As stated earlier the primary purpose of this research is to expand the body of knowledge regarding factors that contribute to COTS IT project management success. The goal is to expand the traditional project management techniques of cost, schedule, resources, and scope to include business process alignment, IT governance and flexibility, and organizational dynamics. The conceptual model which has been developed based upon the case studies analysis to describe the factors which contribute to the success or failure of an IT COTS Project is shown below in Figure 4.

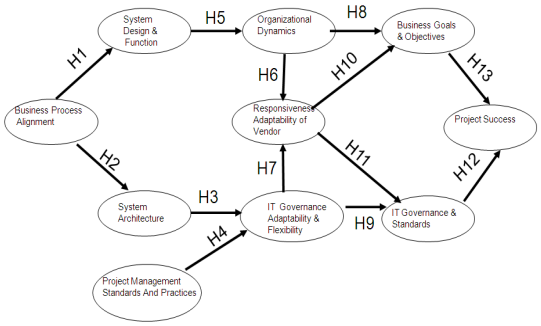

Figure 4: Conceptual Model

The circles represent key project performance criteria and factors which will impact the probability of the IT COTS project success.

The key project performance criteria are defined as follows:

Business Process Alignment - The business processes and business activity must be compatible to the functionality and design intent of the IT application, and the application must be able to support the new business processes.

System Design & Functionality – The features and functions supported by the new software application are developed based upon the system requirements, business requirements and the logical and physical design specifications.

Organizational Dynamics – The organizational dynamics refers to the composition of the project team, the level of management support for the project, and the culture of the organization. Other organization factors are the level of support and involvement from the end user community, quality and quantity of training and user support, and lastly the organization culture to embrace change and new technology.

System Architecture - The system architecture refers to the design and structure of the physical components, the implementation of the hardware, software and networking infrastructure.

Project Management Standards & Practice – The methodology and techniques such as project scheduling, resource allocation, risk management, cost monitoring, and the de-

gree to which the project management standards are utilized and supported within a project management office.

IT Governance Adaptability and Flexibility - The ability of an enterprise to change and revise their corporate policies, procedures, standards, and organizational processes for IT governance in a manner which provides competitive advantage and allows the firm to utilize next generation technology.

IT Governance and Standards - Corporate policies, standards, and procedures established by company leadership with "supporting organizational structures and processes that ensure the organization's IT utilization sustains and extend the organization's strategies and objectives" (IT Governance Institute, 2003).

Responsiveness & Adaptability of the Software Vendor – The customer may have various degrees of influence on future software enhancements and software product direction. The responsiveness and ability to address and satisfy new customer requirements by the software vendor is ultimately driven by financial considerations of potential market demands for the new functionality or custom funded development.

Business Objectives & Goals - The goals of the business unit or division could include faster response times, reduction of costs, improvements to quality etc. The business objective and goals are the drivers to implement business process changes and utilize new information technology systems.

The interdependence or relationship between the different performance criteria is given by the following hypothesis or propositions.

H1: Business Processes of tasks and requirements must be aligned and satisfied with the overall System Design and Functionality.

H2: Business Requirements for Performance and Functionality must be aligned with the overall System and Infrastructure Architecture.

H3: The System Architecture must be in agreement and aligned with the overall IT Governance and Standards. If the proposed System Architecture does not comply to the IT standards, then the software vendor may be requested to transfer their application to the supported architecture or the IT standards may need to be modified.

H4: Project Management Standards and Practices for the System Delivery Life Cycle must be followed according to the existing IT Standards. Depending upon the scope, size and complexity of the particular project, certain project deliverables may have to be tailored or modified. The ability of the IT Governance and Standards committee to address particular project management requirements and be flexible and adaptable is a factor contributing to project success.

H5: The System design and functionality must be aligned with the organizational dynamics. The user interface must be sufficiently friendly for the anticipated user community level of computer proficiency. The system functionality and design intent would be aligned and compatible with business culture if the business is willing to be innovative and accept process changes.

H6: The business community, based upon the organizational dynamics and the existing system design functionality, will make requests to the software vendor for modifications and enhancements.

H7: The IT Governance and Standards committee will make requests to the software vendor for changes based upon the proposed system architecture.

H8: As the organizational project team works together, knowledge and experience of the project will increase. Project team members will develop improved understanding of each users requirements and what is and is not feasible as possible enhancements and limitations of the software design functionality. This will result in refinements and updates to the overall business goals and objectives.

H9: Lessons learned from the project improvements and changes made to the IT standards will be included the overall company IT governance and Standards for future projects. The IT governance and standards must be dynamic and evolving based upon the project experiences.

H10: The response of the software vendor to the business organizational dynamics will impact the degree to which the business requirements and objectives will be satisfied.

H11: The degree of responsiveness and flexibility of the software vendor to accept changes recommended by the IT standards committee will result in updated status and re-evaluation of the software vendor rankings by the IT standard group.

H12: Project success is contingent upon satisfying the Business Goals and Objectives.

H13: Project success is contingent on satisfying the IT Standards and governance policies set at the corporate level.

6. CONCLUSIONS

This research paper explains factors to consider to reduce the risks associated with implementation of COTS IT projects, with the expectation of reducing the IT failure rate. The literature review and background theory of project management has provided consistency among the finding and identified several IT Project critical success factors.

The traditional PM "triple constraint" or "iron triangle" techniques (cost, schedule, scope) must be expanded to include business process alignment, IT governance and flexibility, and organizational dynamics. Additional success factors for IT projects include the following:

- Well Defined Project Management methods and practices.
- Management support for the project.
- Project Manager skills in leadership and vision.
- Organizational culture supporting of project management process and project objectives.
- Commitment, Agreement and participation for all project stakeholders.
- IT Alignment of the project goals and objectives to corporation goals and strategy.

Project managers must recognize the interdependencies and the inter-relationships of the project. Furthermore, they should be able to effectively communicate the proposed system to the entire organization, especially senior stakeholders and funding sources. Hence, it is essential for project managers to possess both interpersonal and political skills. The human relation factors of project team dynamics including interpersonal skills, conflict resolution, project team autonomy, and the goal orientation and motivation of project team members all contribute to the critical success factors of project management.

One of the key conclusions that resulted from performing this research is that IT alignment planning must take a strategic view across the corporation. Business must allocate adequate IT resources to meet the corporate business objectives. Companies who understand and leverage the business IT partnership are utilizing IT as a business strategy enabler.

An effective IT alignment process will anticipate future IT requirements of the company, and ensure that adequate IT capabilities and functionality exist to meet the challenges of the competitors, customers, government legislature, and other external factors. Business IT alignment is not a single event but a rather a process of continuous adaptation and change. The Business IT alignment must examine the fit between the business strategy, information technology (IT) strategy, organizational infrastructure and the IT infrastructure and processes.

In summary, the adoption of a systematic and holistic approach to COTS IT projects improves the potential for the successful implementation of COTS solutions.

7. REFERENCES

"Failure Rate – Statistics over IT project failure rate", retrieved from http://www.it-cortex.com/Stat_Failure_Rate.html Nov. 16, 2006

Balk L.D., Kedia A., (2000), PPT: A COTS integration case study, *ACM Press,* Proceeding of the 22nd International Conference on Software Engineering, 2000, 42 - 49

Benjamin, R. I., Levinson E., (1993) A framework for managing IT-enabled changes. *Sloan Management Review*, Summer 1993, pg 23-33

Charette R. N. (2005). Why Software Project Fails*,* IEEE *Spectrum*, Sept 2005, pgs 42-49. www.spectrum.ieee.org

Chen H.M., Kazman R., Garg A., (2006) BITAM: An Engineering Principled Method for managing misalignments between

Business and IT architectures, Science of Computer Programming, 2006, Vol. 56, pg 5-26.

Desouza K.C., Evaristo J. R, (2006) Project Management Offices: A case of knowledge-based archetypes, *International Journal of Information Management,* 2006, Vol. 26, pg 414-423

Dhillon, G., (2005) Gaining benefits from IS/IT implementation, Interpretations from Case Studies, *International Journal of Information Management*, 2005, vol. 25, pg 502-515

Eisenhardt, K.M., (1989), Building Theories from Case Study Research, Acad Manage Rev, 1989, Vol. 14, pg. 532-50

Gowan Jr. J. A., Mathieu R. G., (2005)The Importance of Management Practices in IS Project Performance - An Empirical Study, Journal of Enterprise Information Management, 2005, Vol. 18, No 2 Page 235-255

Hansen, B., Rose J., Tjornehoj, G., (2004), Prescription, description, reflection: the shape of the software process improvement field, *International Journal of Information Management*, Volume 24, 457-452.

Harmon, P., (2003) Business Process Change: A Manager's Guide to Improving. Redesigning, and Automating Processes, 1st Edition, Morgan Kaufman Publishers, San Francisco, Calif.

Hollaway, A., (2005) KPMG Highlights IT Project Failures, *Accountancy Age*, Nov 25, 2005

IT Governance Institute 2003, "Board Briefing on IT Governance, 2nd Edition". Retrieved January 18, 2006 from http://www.isaca.org/Content/ContentGroups/ITGI3/Resources1/Board_Briefing_on_ITGovernance/26904_Board_Briefing_final.pdf

Johnson W. J., Leach M. K., Liu A. H., (1999) Theory Testing Using Case Studies in Business to Business Research, *Industrial Marketing Management*, Vol. 28, Issue 3., May 1999, 201-213.

Jugdev K. Muller R., (2005) A Retrospective Look at Our Evolving Understanding of Project Success, *Project Management Journal*, Dec 2005, Vol. 36, Issue 4, 19-31.

Keil M. Tiwana A., (2005), Beyond Cost: The Driver of COTS Application Value, IEEE Computer Society, *IEEE Software*, May/June 2005

KloppenBorg T., Opfer W. (2002), The Current State of Project Management Research: Trends, Interpretations, and Predictions, *Project Management Journal,* June 2002, Vol. 33, No 2, 5-18.

Maiden N., Ncube C., Moore A., (1997), Lessons Learned During Requirements Acquisition for COTS Systems, *Communications of the ACM,* Dec. 1997, vol. 40, No. 12, 21-25.

Milosevic D., Patanakul P., (2004) Standard Project Management may Increase Development Project Success, *International Journal of Project Management,* Sept. 2004, vol. 23, 181-192.

Minikiewicz, A. F. (2004), Are software COTS solutions an affordable alternative, Aerospace Conference, *2004 IEEE Proceedings*, March 2004 Vol. 6, 6-13.

Nasir S. , (2005) The development, change and transformation of Management Information Systems (MIS): A content analysis of articles published in business and marketing journals, *International Journal of Information Management,* 2005, Vol. 25, 442-457.

Peak D., Guynes G.S., Kroon V., (2005) Information Technology Alignment Planning – A case study, *Information and Management*, 2005, Vol. 42, 635-649.

Reel J. S., (1999) Critical Success Factors in Software Projects, *IEEE Software*, May/June 1999

Tesch D. Kloppenborg T., Stemmer J., (2003) Project Management Learning What the Literature Has to Say, *Project Management Journal*, December 2003; Volume 34, Issue 4, 33-39

Thomas G., Jajodia S.. (2004) Commercial-Off-The- Shelf Enterprise Resource Planning Software Implementations in the Public Sector, Journal of Government Financial Management, Summer 2004; 12-18

Verner J., Evanco W., (2005) What Project Management Practices Lead to Success?*, IEEE Computer Society,* IEEE Software, January/February 2005.

Visitacion M. (2006). What Successful Organizations Know about Project Management, www.forrester.com

Wallace L, Keil M., Rai A, (2004) Understanding Software Project Risk: A Cluster Analysis, Information & Management, March 19, 2004, www.sciencedirect.com

Wang Y., Li D., He X., A Process Management Tool Supporting Component Based Process Development and Hierarchical Management Mechanism, Proceedings of the 2005 Fifth International Conference on Computer and Information Technology, IEEE Computer Society, 1-5.

Wesenberg H., Landre E. Ronneberg H.,(2006) Using Domain-Driven Design to Evaluate Commercial Off the Shelf Software, *ACM Press*, ACM SIGPLAN Conference on Object-oriented Programming systems, languages and applications, 2006, 824-829

Weill P., Ross J. W., (2004), IT Governance, 1st edition, Harvard Business School Press, Boston Mass.,

White D. Fortune J. Current Practice in Project Management – an Empirical Study. *International Journal of Project Management*, Vol. 20, 2002 www.ebsevier.com

Yin, Robert K. (2003), Case Study Research: Design and Methods ,3rd edition, Sage Publications, Thousand Oaks, California

Yin. Robert.K.: (1994) Case Study Research: Design and Methods, 2nd edition, Sage Publications, Thousand Oaks, California