The Importance of Business Process Alignment for IT Project Management of Commercial Software with Case Studies

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Abstract

Companies invest significant sums of money for major IT projects, yet success remains limited. Despite an abundance of IT Project Management (ITPM) resources, such as the PMI Body of Knowledge, IT standards and governance, a large percentage of IT projects continue to fail and ultimately get scrapped. Recent studies have shown an average of 66% IT project failure rate, with 52% of the projects being cancelled, and 82% being delivered late (Visitacion, M. 2006). The purpose of this research is to identify potential causes of IT project failures by the examination of four real world Commercial Off-the-Self Software (COTS) projects. The research approach involved the development of a systematic and holistic ITPM conceptual solution, which considers critical project management success factors including Business Process and IT Alignments, System Design, IT Architectural Foundations, Organizational Dynamics, IT Governance and Standards, and Software Vendor Responsiveness. The solution provides a method to evaluate the various critical success factors of a project, and their alignment with each other. The contribution of this research is summarized in terms of the design and development of the conceptual model; the validation of this model by industry experts, and its refinement into a conceptual solution; and the development of a systematic methodology for successfully implementing the conceptual solution. By following this methodology, a COTS project is expected to have a considerably increased potential for success, and a project leader would be alerted of problems throughout the life of the project.

Keywords: information systems, IT project management, Commercial Off-the-Shelf Software, COTS, Business Processes, Organizational Dynamics, IT Governance.

1. INTRODUCTION

Despite the body of knowledge on IT project management, IT 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).

The Chaos Report by the Standish Group in 1995 shows 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 reported that American companies and government agencies would spend $81 billion dollars for canceled software projects. An additional $59 billion will be spent for software projects, which are completed, yet beyond their original time estimates (www.it-cortex.com).

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 (Hollaway, 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.

An historical trend analysis for Project Success and Project Failures based upon the statistics provided by Standish Group International can be found in Figure 1 for the period of 1994 to 2000. (Humphrey W., 2005) Figure 2 shows the same Project Statistics from the Standish Group International for the 2000 to 2006 with the 1994 baseline date for comparison (Liao, J., 2007; Glass, R. L, 2002; Glass, R. L., 2005).

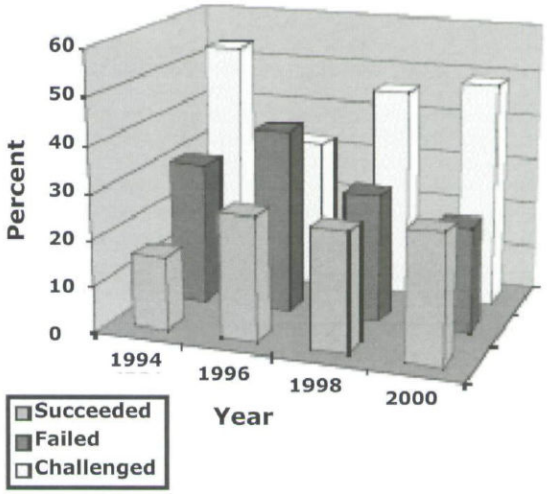

Figure 1 Standish Int'l. Project Statistics 1994-2000.

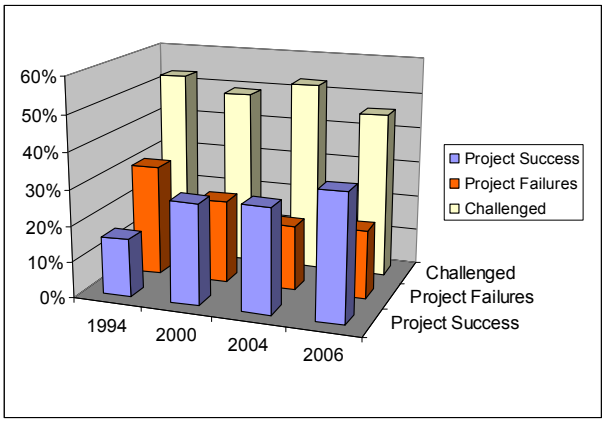

Figure 2 Standish Int'l. Project Statistics 2000-2006.

The overall project success rate has increased from sixteen percent to thirty five percent for the period 1994 to 2006, and much of this improvement was due to more widespread use of sound project management practices (Humphrey W., 2005). Yet the eight-year period shows projects, which are challenged, those that are over budget and /or did not meet requirements, is consistently above forty percent. Projects failures are defined as those projects, which were cancelled prior to completion, or completed and never used. Project failures decreased from thirty-one percent to nineteen percent (Lino, J., 2007) for the period of 1994 to 2006. Clearly additional information and research is required to understand what factors contribute to project success and failure, and what can be done to increase the probability of project success.

2.0 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 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.

Project success factors found in the literature include measures such as on-time project delivery to the customer, adherence to the project schedule, project cost and budget control, quality of the project management process and customer satisfaction. "Measures of project success need to include the diversity of shareholder interests" (Milosevic and Patankul, 2005). Additionally, standardized project management tools, processes, and skills, in conjunction with project team interpersonal relationships and organizational culture also affect project success.

Jugdev and Muller (2005) provide a retrospective look at project management success over the years, and states that the period of 1960's to 1980 was one where success was measured in subjective terms such as time, cost and compliance to specifications, and performance. During the 1980's to 1990 the focus was on Critical Success Factors (CSF) lists, and the literature stressed the importance of stakeholder satisfaction and satisfying end user needs, with an emphasis on project deliverables and customer expectations. During the 1990's to 2000 period project success was more stakeholder dependent, and the success was impacted by interactions between the internal and recipient organization. During this time the focus was at the business operational level, with success interpreted as the project being done well, with appropriate project management methods to meet financial and technical requirements.

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" (Jugdev and Muller, 2005).

The most recent literature by Jugdev and Muller (2005) on project management summarizes several empirical studies and "outlines the following four necessary but not sufficient conditions for project success:

- Success criteria should be agreed on with the stakeholders before the start of the project.
- A collaborative working relationship should be maintained between the project business owner or sponsor and the project manager both viewing the project as a partnership.
- The project manager should be empowered with flexibility to deal with unforeseen circumstances as they see best and collaborate with the business owner giving guidance as to how they think the project should best be achieved.
- The owner should take an interest in the performance of the project"

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.

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.

A research project funded by the PMI and conducted by Tesch et al. (2003) aimed to

extract useful project management information from the information systems and information technology fields. Eight commercial databases were searched using predetermined search terms, and an initial search produced 9,332 records with each abstract being reviewed to yield a total of 784 records. The remaining records were analyzed by project management IS/IT professionals to identify "lessons learned". Many practitioners that participated in the study expressed concern that "Some of the more advanced research does not necessarily closely relate to everyday project issues and demands" (Tesch et al., 2003). These sources reaffirm the fact that information systems research in the area of project management lacks relevance to practice.

Current IT Project Management literature and research topics are lacking relevance to real-life practical applications, and do not closely relate to everyday project issues and demands. The reviewed literature was consistent in identifying the following critical success factors for project management:

- Management support for the project.
- Well Defined Project Management Methods and Practices.
- 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.

3.0 PROPOSITION AND RESEARCH QUESTIONS

The purpose of this research is to expand the body of knowledge related to IT Project Management of COTS software procurement and implementation. The research will identify additional critical success factors for the implementation of COTS software applications including Business Process and IT Alignments, System Design, IT Architectural Foundations, Organizational Dynamics, IT Governance and Standards, and Software Vendor Responsiveness. This research is motivated by clear evidence that there is insufficient understanding of the high rate of failure in COTS projects, and that complying with the traditional IT project management methodology may not be enough to ensure successful procurement and implementation of COTS based IT projects.

"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 and Evaristo, 2006). Despite the established body of knowledge on project management and proliferation of publications an obvious need remains to improve project management success rates. IT alignment planning is seen as a necessary task of many senior managers supported by commercial IT research organizations such as Gartner that have listed IT alignment as a top issue of American companies (Peak et al., 2005).

A number of questions have been considered during the initiation of this research project, including:

1. What business processes should be redesigned to align with the overall system design of the IT application thereby improving the outcomes of the IT project?

2. What is the relationship between business requirements and the overall system architecture?

3. How should business requirements and business processes be shaped and/or formulated so that the performance and functionality of the overall system might be enhanced?

4. How could consistency be achieved between a newly proposed system architecture and IT Governance in an enterprise?

5. How are IT standards effectively implemented in IT projects?

6. What roles might IT project managers and software vendors' play in order to influence changes to IT standards to promote the success of projects within an enterprise?

7. How might the organizational dynamics be managed to advance the success rate of IT projects?

8. What might be the ideal (and potentially optimal) relationship between IT Project Managers and the business community in order to improve project success?

Following on these questions the research proposition to be examined is formulated as follows:

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

4.0 Focus of Research Area

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.
- Improvement 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 proper alignment of the Business objectives to the project objective and underlying IT architecture is also one of the underlying reasons behind the failure of Business Process Reengineering (Paper and Chang, 2005). This research identified the following five interdependent components that lead to structural change:

1) Environmental factors including top-management support, risk disposition, organizational learning, teaming, compensation and reward systems, information sharing and resources. Top management must cultivate an environment conductive to change to make business process reengineering successful.

2) People – Change and business transformation hinges on the creativity, knowledge, training and openness to change. A shift in skills sets is often required; hence organizational training and learning must be planned. Education and training are the single most powerful tools in cultural transformation, since they increase awareness and understanding of the business and customer.

3) Methodology keeps people focused by facilitating cross-functional team meetings, and performs project tracking, control, monitoring and reporting.

4) IT Perspective – Technology implementation must be considered as organizational intervention and integral to the successful implementation of business process redesign. The role of technology is to enable and facilitate new business processes.

5) Transformation (Change) Vision – Strategic objectives are pushed down to the process or project level; the project goals are aligned with the business goals. The vision must be fully communicated to all and be enacted since it offers the blue print for directing change.

Change management is very difficult because people react negatively to change. "Hence a top down vision tempered with the involvement from the process workers is imperative because it helps people understand the reasons for the change" (Paper and Chang, 2005).

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). A Critical strategic factor for success includes 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).

Project management is often viewed as one of the important means of implementing strategy, with corporate strategy reflecting how an organization's corporate goals and objectives will be achieved and organized at a "strategic business unit" level (Morris and Jamieson, 2005). Projects and programs are important ways for strategy to be implemented and the formal vehicles of the organization's strategy implementation. "Only recently have researchers started to explore the alignment of project management and business strategy more thoroughly and the need for this is growing" (Srivannaboon and Milosevic, 2006).

Projects are often chosen as the vehicles to implement and execute innovative business strategies in order to stay competitive; hence companies must ensure that the projects are executed fully in line with the business strategies they support. The company and business unit make strategic choices by selecting target objectives, which provide competitive advantages such as time to market, quality, cost, features etc. These choices drive the different projects in terms of the project contents and focus.

The framework for aligning the project management with the business strategy purposed by S. Srivannaboon and D. Z. Milosevic is developed by the propositions which connect the business strategy to each Project Management element and is shown in Figure 3.

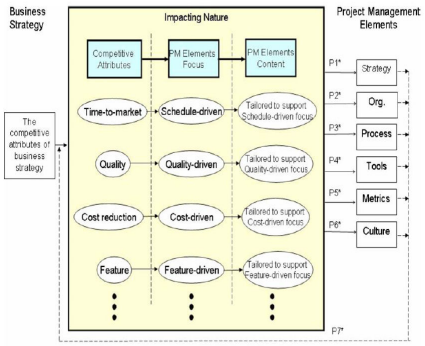

Figure 3: Aligning PM with Business Strategy (Srivannaboon and Milosevic, 2006)

The alignment of Project Management to Business Strategy framework shown in Figure 3 "is expected to logically help organizations make a strategic choice by selecting competitive attributes as the bases of their business strategies, using the competitive attributes to direct the focus and content of PM elements. The chosen competitive attributes are then used to determine the focus and content of PM elements" (Srivannaboon and Milosevic, 2006).

5.0 Research Process

The Research Process Model given in Figure 4 illustrates the processes to be followed in the main stages of the dissertation research project. The overall research design consists of four steps, as illustrated in Figure 4. Each step is described below.

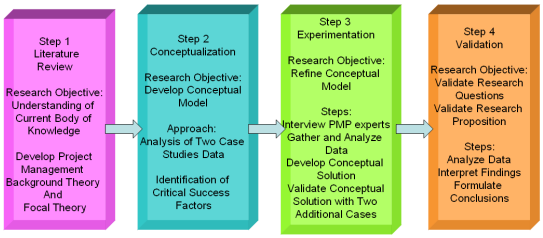

Figure 4: Research Design Process

Step 1: Literature Review. Perform an analysis of the literature in order to identify key

variables and factors contributing to success and failure of COTS IT PM and implementation. Develop an understanding of trends regarding the research topic.

Step 2: Conceptualization. Develop a conceptual model of the research problem. An analysis was performed to investigate the historical documentation of the first two case studies in order to identify key variables and to formulate an initial/draft conceptual model in terms of critical success factors and the potential dependencies among them. The conceptual model was based on the insight gained from the review of literature and the researcher's experience and expertise in the field. The conceptual model contains the variables and factors that impact the project management failures and successes in these cases. The outcome of Step 2 is the draft conceptual model.

Step 3: Experimentation. The conceptual model was evaluated and validated with certified project management professionals using structured interviews and surveys. The purpose of the interviews was to refine the conceptual model by developing the conceptual solution. Additionally the interviews were developed to identify additional critical success factors, based upon the insights of the industry experts. The experimentation phase was accomplished utilizing a mixed methods approach. The quantitative data consists of the survey results and the qualitative data consists of the critique of the conceptual model and interview process.

Step 4: Validation. The results of the two additional case studies were investigated to validate the conceptual solution. Conclusions and topics for additional research were identified during this step as well.

5.1 Research Methodology

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, and an evaluation and comparison of four different case histories used 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 versus 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. 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.

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 was attempting to be utilized 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.

6.0 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 solution has been developed based upon the case studies analysis and interviews with project management subject matter experts. The case studies and interview results were analyzed to evaluate the rankings of the different critical success factors. The purpose of the conceptual solution is to provide an early indication of when projects will require attention or remediation action to prevent the likelihood of project failure.

The project management interview and survey data collection was accomplished using subject matter experts and project management professionals (PMP certified) industry practitioners. Each project manager was asked to rank on a Likert scale of one to five the importance of the critical success factors, which were organized into the following categories:

1. Project Management Practices
2. Business Process Alignment
3. System Design and Architecture Alignment
4. Organizational Dynamics
5. IT Governance and Standards
6. IT Governance and Project Management
7. Software Vendor/Supplier Responsiveness.

The results of Likert rankings for each subject area were totaled since a major advantage of the Likert scale is the ability to obtain a summated value or total score. The total score would be an index of attitudes toward the major subject area as a whole (Alreck and Settle, 1985). The total values for each subject area is provided in Table 1 and a bar chart plot of the resultant totals is provided in Figure 5.

Table 1: Summarized Survey Results

Subject Area	1	2	3	4	5
Project Management Standards & Practices:	1		5	25	29
Business Process Alignment		3	8	19	30
System Design and Architecture Alignment	7	3	10	30	34
Organizational Dynamics	4	5	12	32	54
IT Governance and Standards	6	4	12	22	16
IT Governance and Project Management	1	2	3	23	19
Software Vendor/ Supplier Responsiveness	5	2	6	23	12

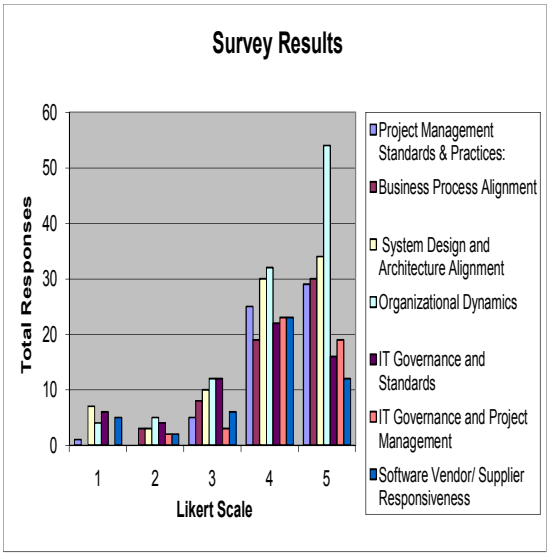

Figure 5: Survey Results for Critical Factors

The high number of total responses for each of the seven critical success areas of the survey confirms that the research development of the conceptual solution addresses those critical success factors, which are considered important or highly important by the project manager experts.

The conceptual solution is divided into two separate activities. The first activity examines the critical success areas for the business domain including the business processes, business goals and objectives, and the overall organizational dynamics. The second activity examines the critical success areas for the IT domain including IT governance, project management standards and practices, adaptability and flexibility of IT governance, and the responsiveness and adaptability of the software vendor.

The conceptual solution for the business domain is shown in Figure 6 and the conceptual solution for the IT domain is shown in

Figure 7. As can be seen, there is a linkage from each domain, such that when the analysis of the business domain is complete, the analysis must then be performed on the IT domain. The conceptual solution illustrates how critical success factors and key project performance criteria affect the probability of project success. The key project performance criteria are illustrated by the ovals. The interdependence or alignment between the different performance criteria is given by the following propositions:

- **P1:** Business Processes of tasks and requirements must be aligned and satisfied with the overall System Design and Functionality.
- **P2:** Business Requirements for Performance and Functionality must be aligned with the overall System and Infrastructure Architecture.
- **P3:** The System Architecture must be in agreement and aligned with the overall IT Governance and Standards
- **P4:** Project Management Standards and Practices for the System Delivery Life Cycle must be followed according to the existing IT Standards.
- **P5**: 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.
- **P6:** 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.
- **P7:** The IT Governance and Standards committee will make requests to the software vendor for changes based upon the proposed system architecture.

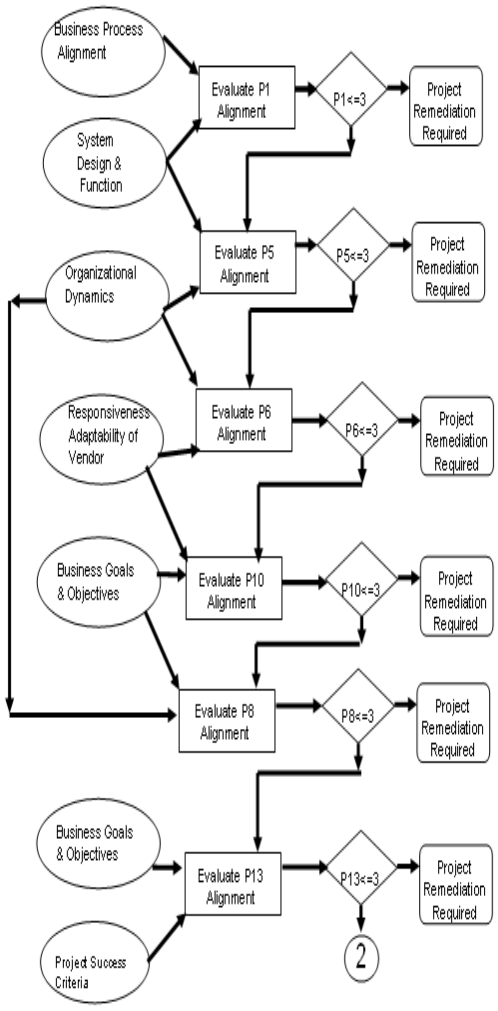

Figure 6: Conceptual Solution Implementation for Business Domain

- **P8:** As the organizational project team works together, knowledge and experience of the project will increase. This will result in refinements and updates to the overall business goals and objectives.
- **P9:** 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.
- **P10:** The response of the software vendor to the business organizational dy-

namics will impact the degree to which the business requirements and objectives will be satisfied.

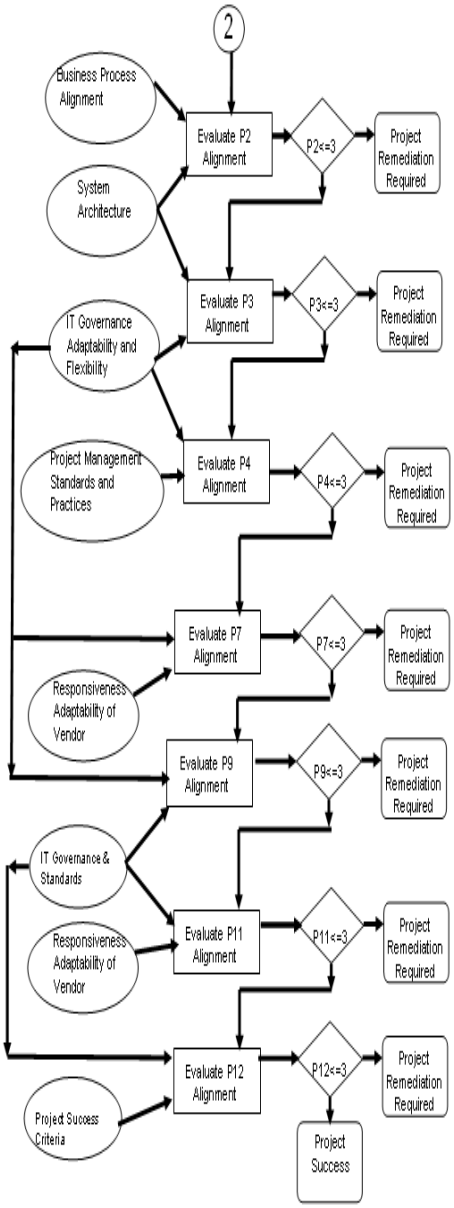

Figure 7: Conceptual Solution Implementation for IT Domain

- **P11:** 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.
- **P12:** Project success is contingent upon satisfying the Business Goals and Objectives.
- **P13:** Project success is contingent on satisfying the IT Standards and governance policies set at the corporate level.

6.1 Case #1 – Manufacturing Quality Desktop Application

Major factors contributed to the failure of the Desktop PFMEA project including the change of scope from a desktop-based solution to a centralized web hosted server. The software vendor's lack of system administration expertise resulted in the server having to be reloaded numerous times as a result of software locking up. The overall failure to comply to corporate standards for the computer architecture requirements of utilizing a CITRIX™ server was an additional contributing factor to this project failure.

Additional factors included complexity of the software, based upon the fact that the user interface was not acceptable to the casual plant user, and there was an overall lack of a good implementation methodology. The training and user support from the software vendor were not acceptable. A summary of the evaluation for the desktop PFMEA COTS application is shown in the Kiviat diagram in Figure 8.

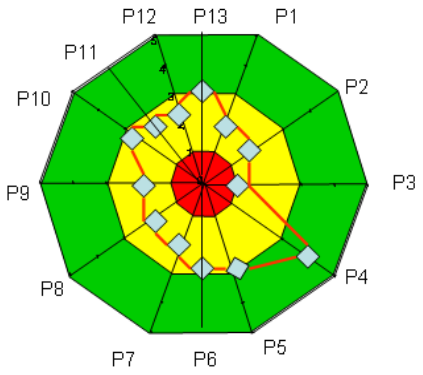

Figure 8: Desktop PFMEA Conceptual Solution Assessment

6.2 Case #2 – Manufacturing Quality WEB Based Application

The PFMEA COTS project was an overall successful project. The project was started and successfully deployed within 18 months. Factors which contributed to the success of this project are:

- Compliance to IT standards for software project management. The system delivery project management company standards were instrumental is providing a structured methodology for the system delivery project management process.
- Understanding of Business Requirements and the End User Requirements was very thorough.
- Ability of the software vendor to satisfy corporate IT standards for hardware and operating system infrastructure. The software vendor was willing to support the migration of their application to the BEA Web Server technology mandated by Corporate IT standards.
- Ability of software vendor to satisfy corporate IT standards for software technology. The software vendor was willing to provide equivalent functionality utilizing Oracle, a company standard for databases.
- Ability of the software vendor to satisfy new business requirements for enterprise wide reporting were not part of the base software application. Development was completed in approximately nine months and Powertrain was used as the pilot site. The new functionality was viewed as a major enhancement to the overall reporting module, which provided a competitive advantage to the software vendor.

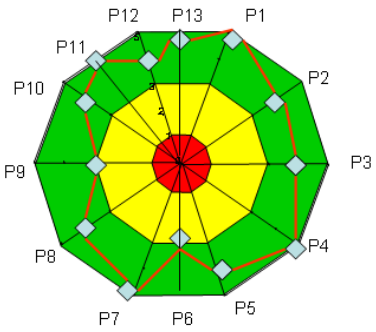

Figure 9: PFMEA Conceptual Solution Assessment

A summary of the evaluation for the FMEA COTS web based application is shown in the Kiviat diagram in Figure 9.

6.3 Case #3 – CAD Data Management

The AutoCAD Data Management project was an overall very unsuccessful project. The project was started and was not able to be deployed after six years of dedicated effort. Factors which contributed to this project failure are:

- Resistance to change Organizational Dynamics: Lack of management direction and support to encourage and foster an organizational climate which would be acceptable to changes in the business practices.
- Lack of software vendor support since the product direction and marketing plans for Team Center did not support AutoCAD™.
- Business processes which were not consistent and not supported by the design architecture of Team Center.
- Lack of management support to request changes of the IT standards committee to have the Meridian™ product added.

A summary of the evaluation for the CAD Data Management COTS application is shown in the Kiviat diagram in Figure 10 below.

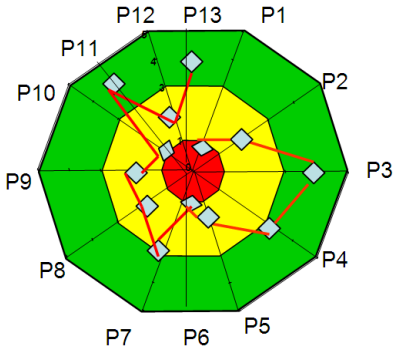

Figure 10: CAD Conceptual Solution Assessment

6.4 Case #4 – Advanced Invoice Management System

The AIMS project was an overall successful project. The project was started and successfully deployed within 12 months.

Factors which contributed to the success of this project:

- Executive sponsorship and leadership to influence both the legal suppliers and vendors submitting the invoices and the business user community.
- The willing of the business user community to participate on the project, identify their requirements, work with the software vendor to develop training materials, and the testing process.
- Compliance to IT standards for software project management. Understanding of Business Requirements and the End User Requirements was very thorough. The software vendor was very willing to develop custom guide rules for invoice validation and data migration scripts.
- Ability of the project management staff to obtain the Microsoft SQL server deviation approval from corporate IT standards for hardware and operating system infrastructure.

A summary of the evaluation for the AIMS E-commerce COTS application is shown in the Kiviat diagram in Figure 11.

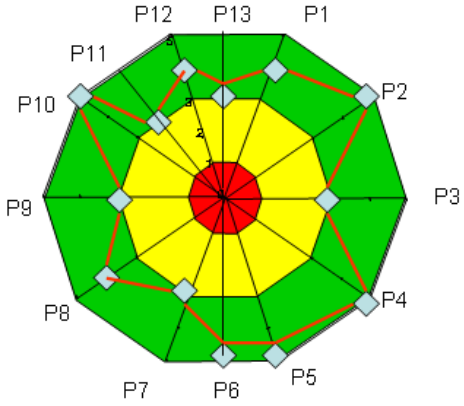

Figure 11: AIMS Conceptual Solution Assessment

7.0 CONCLUSIONS AND RECOMMENDATIONS

This research project has been an attempt to predict and improve the future of COTS application project management by implementing the conceptual solution produced by this research. This research effort yielded a systematic and holistic approach to project management by providing an optimized conceptual solution and some diagnostic tools for estimating and improving the likelihood of project success or failure. Due to the high failure rate of IT projects in recent years, the commercial benefits of this research effort can best be appreciated by examining recent trends in the IT and software engineering fields.

Despite the broad body of knowledge for project management, there are a number of diverse critical success factors beyond those of the "iron triangle" that can impact the project outcome. The project estimation process, requirements tracking, resource allocation, and project budget and schedule must not be planned only once. Rather, they should be constantly adjusted and updated to respond to project dynamics. These project activities must be reviewed, refined and modified by all appropriate stakeholders as part of the continual process of project monitoring and control. The ongoing review and refinement of project planning activities with all project participants could eliminate potential conflicts and ensure stakeholders participation and agreement.

The traditional project management techniques of cost, schedule, resources, and scope must be expanded to include business process alignment, IT governance flexibility, and organizational dynamics. 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. Project managers must recognize the relationship of the project and proposed system to the whole organization, and possess skills in organizational politics.

Companies who understand and leverage the business IT partnership are leveraging IT as a business strategy enabler. IT align-

ment planning must take a strategic view across the corporation and adequately allocate IT resources to meet the corporate business objectives. The effective IT alignment process could 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.

7.1 Conclusion

This research effort has culminated in the development of a conceptual solution, which serves as a diagnostic tool to predict those projects that are likely to become challenged and require immediate attention and potential project remediation. It is envisioned by the researcher that the application of the conceptual solution, which addresses new critical success factors and alignment areas for the management of COTS application projects, could improve the likelihood of project success rates.

The research findings discussed here clearly indicate that applying the conceptual solution to the four case studies yields a significant business benefit in understanding those factors that contributed to the success or failure of each case study. The researcher has concluded that the systematic and holistic approach to the project management of COTS applications using the conceptual solution provides a useful diagnostic tool and beneficial project management method for estimating the likelihood of project success or failure.

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

7.2 Opportunities for Future Research

This research was based on the project management experiences of the researcher and included four case studies from a large automotive firm. Limiting the research to the experience of one project manager clearly presents a limitation. Additional case studies from other industries and a wider representation of COTS applications project activities should be analyzed to further validate the conceptual solution and potentially modify it with the addition of newly identified critical success factors.

Additional research should be performed for different industry sectors and various organizational sizes. Organizations, which are small to midsize companies were not included in this research effort. Hence the need to include various size organizations in future research. Additionally there is a need to identify if the scope of the company operations being a global industry versus a small sized national company has any impact on the research findings.

The case studies analyzed by this research were representative an organization that had a very well structured project management office (PMO) and thoroughly documented project management deliverables and methods. An additional limitation of this research is that is did not consider what impact different types of project management offices have on the conceptual solution and the likelihood of project success. The difference in project management practices across different industries and organizations was not fully explored or evaluated by this research effort. Project management practices and organizational differences in enforcing project management office procedures, methods and practices could be investigated further as part of additional research activities

7.3 Recommendations

Most organizations face significant pressures in attempting to grow the business and improve visibility. Progressively, they are turning to technology to help drive profitable growth. The traditional approach to project management, which was focused on the performance measures of the "iron triangle", has not served as an effective mechanism for improving project management success rates. "The problem for most organizations is that there is a fundamental disconnect between corporate strategy and day-to-day activities" (Business Credit, 2005).

The key to improving project performance management lies in the alignment of project performance to business strategy and processes. These two factors are essentially intertwined and should not be separated. The development of the conceptual solution presented in Section 6.0 provided a syste-

matic and holistic approach for project management, which addresses the alignment of the IT COTS project to the business strategy and the organizational dynamics.

This research strongly recommends implementing the proposed conceptual solution to future projects. Furthermore, this research recommends that future project activities leverage this research activity in industry with the expectation of improving overall project success rates for the future. Improvement to project management performance should enable companies to successfully execute their strategy, and leverage IT investments to drive business growth.

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