Risk Factors in Enterprise Wide Information Management Systems Projects

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ABSTRACT

In the past several years many organizations have initiated enterprise-wide information management systems projects, using such packages as SAP, Peoplesoft, and Oracle. These projects often represent the single largest investment in an information systems project in the history of these companies, and in many cases the largest single investment in any corporate-wide project. These enterprise-wide information management systems projects bring about a host of new questions, because they represent a new type of management challenge. Some of these questions and issues are:

- What are the major risk factors associated with implementing traditional MIS projects?
- What are the major risk factors associated with enterprise-wide information management projects?
- What new risk factors need to be addressed in ERP projects? What are some of the risks in MIS projects that are not factors in ERP projects?

Based upon the findings, enterprise-wide information management systems projects pose new opportunities and significant challenges. Some of the "summary" ideas which are re-iterated throughout the case studies are:

- Justify the enterprise-wide projects based upon cost-justification and economies of scale.
- Re-engineer business processes to "fit" the package, rather than trying to modify the software to "fit" the organization's current business processes.
- Identify and implement strategies to re-skill the existing IT workforce and acquire external expertise through vendors and consultants when needed.
- Utilize "business analysts," with both business knowledge and technology knowledge.
- Obtain top management support for the project and establish strong project leadership.
- Make a commitment to training end-users in custom report development.
- Manage change through leadership, effective communications, and the role of a champion.

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1. INTRODUCTION

In the past several years many organizations have initiated enterprise-wide information management systems projects, using such packages as SAP, Peoplesoft, and Oracle. These projects often represent the single largest investment in an information systems project in the history of these companies, and in many cases the largest single investment in any corporate-wide project.

These enterprise-wide information management systems projects bring about a host of new questions, because they represent a new type of management challenge. The management approaches for these projects may be altogether different from the managerial approaches for traditional MIS projects. Some of these questions and issues are:

- What are the major risk factors associated with implementing traditional MIS projects?
- What are the major risk factors associated with enterprise-wide information management projects?
- What are the differences? What new risk factors need to be addressed in ERP projects? What are some of the risks in MIS projects that are not factors in ERP projects?

Most organizations have extensive experience managing traditional MIS projects, but these new ERP projects may represent new challenges and present new risk factors that must be handled differently. This paper will provide case studies of seven organizations implementing enterprise-wide information management systems projects and will provide insight into each of these questions based upon their experiences.

2. RISKS IN IMPLEMENTING INFORMATION SYSTEMS PROJECTS

A simple definition of "risk" is a problem that hasn't happened yet but could cause some loss or threaten the success of your project if it did (Wiegers, 1998). A number of research studies have investigated the issue of the relative importance of various risks in software development projects and have attempted to classify them in various ways. Much has been written about the

causes of information systems project failures. Poor technical methods is only one of the causes, and this cause is relatively minor in comparison to larger issues, such as failures in communications and ineffective leadership.

In their study of the factors that software project managers perceive as risks, Keil, Cule, Lyytinen and Schmidt organized risks into four quadrants, including risks associated with customer mandate, scope and requirements, execution, and environment. They also posed strategies to minimize risks in each of these categories. Customer mandate deals with the risks of lack of senior management commitment and lack of user commitment. Risks associated with scope and requirements include misunderstanding requirements and failing to manage change properly. Risk factors in the execution quadrant include issues of inappropriate staffing, lack of an effective methodology, and poor estimation. In the environment quadrant, the risks deal with issues over which the project manager may have no control, such as changing scope/objectives and conflicts between user departments (Keil, Cule, Lyytinen, Schmidt, 1998).

In a study of issues that contribute to the cancellation of information systems development projects, Ewusi-Mensah points to lack of agreement on a set of project goals/objectives, lack of a measurement system for assessing and controlling project risk, lack of adequate technical expertise and application knowledge, lack of an adequate technology infrastructure to support project requirements, lack of senior management involvement, and escalating time and cost overruns are all associated with project abandonment (Ewusi-Mensah, 1997).

In their paper, Barki, Rivard and Talbot propose a variety of risk factors associated with software development projects. Some of these risk factors include technological newness (need for new hardware, software), application size (project scope, number of users, team diversity), expertise (lack of development expertise, task of application-specific expertise, lack of user experience), application complexity (technical complexity, links to existing legacy systems), organizational environment (task complexity, extent of changes, resource insufficiency, and magnitude of potential loss). While this research constructs and attempts to validate risk measures, it does not address the issue of what risk control strategies are most directly associated with managing project risk and in assuring project success (Barki, Rivard, and Talbot, 1993).

In his paper, "Software Risk Management: Principles and Practices," Barry Boehm identifies ten software risk factors, including personnel shortfalls, unrealistic schedules and budgets, developing the wrong functions, developing the wrong user interface, "gold-plating," a continuing stream of changes in requirements, shortfalls in externally furnished components, shortfalls in externally performed tasks, performance shortfalls, and strained technical capabilities (Boehm, 1991). In addition, McFarlan developed dimensions of project risk based upon project size, experience with the technology, and project structure (McFarlan, 1981).

Robert Block, in his text on factors contributing to project failure, notes numerous causes of project failure, including resource failures (conflicts of people, time, and project scope), requirement failures (poor specification of requirements), goal failures (inadequate statement of system goals), technique failures (failure to use effective software development approaches), user contact failures (ineffective communications with users), organizational failures (lack of leadership), technology failures (vendor failure, failure of hardware/software to meet specifications), size failures (excessive size), and people management failures (conflict, antagonism). In addition, project management and control failures, caused by inadequate planning and tracking, can contribute to project failure (Block, 1983).

3. RISKS IN CLIENT-SERVER SYSTEMS

With systems that involve the use of new client-server technology, it is often critical to acquire external expertise, including vendor support, to facilitate successful implementation. Also, the costs of training and support are often under-estimated, and these costs may be many times greater than originally anticipated. Client-server implementations often bring "surprises" with respect to cost, because of the costs of decentralized servers, systems integration software, technical support, and software updates and version control. In actuality, the total cost of a client server implementation can be three to six times greater than for a comparable mainframe-based system. Even though there are great cost reductions possible through moving off the mainframe, the costs of learning the new technology and of acquiring technical support are substantial. (Caldwell, 1996).

4. WHAT ARE THE MAJOR RISK FACTORS ASSOCIATED WITH ENTERPRISE-WIDE INFORMATION MANAGEMENT PROJECTS?

The purpose of this study is to develop a better understanding of the major risk factors associated with enterprise-wide information management projects. These case studies will examine these risk factors. The case studies describe the experiences of seven companies implementing enterprise-wide information management systems using SAP, Peoplesoft, and Oracle. The case studies were developed using in-depth interviews with the senior managers responsible for planning and implementing enterprise-wide systems within the respective organizations. In addition to assessing the risks associated with technology, organizational fit, people factors, and size, the case studies provided insight into the critical success factors associated with successful project implementation and control.

The findings describe seven case studies which have been accomplished as a "pilot" study for this research. These case studies will highlight the issues of project justification, organizational fit, technology fit, people and skill mix, critical success factors, and factors associated with project "failure." They deal with three SAP Projects, two Peoplesoft Projects, and two Oracle Projects.

Lack of adequate technology infrastructure	Ewusi-Mensah, 1997.
Technological newness, strained technical	Barki, Rivard, Talbot, 1993, Boehm, 1991, Block,

capabilities, failure of technology to meet specifications.	1983, Cash, McFarlan, 1992.
Lack of agreement on project goals	Ewusi-Mensah, 1997, Block, 1983.
Lack of technical expertise	Ewusi-Mensah, 1997.
Lack of application knowledge	Ewusi-Mensah, 1997, Barki, Rivard, Talbot, 1993.
Lack of user commitment, ineffective communications with users	Keil, Cule, Lyytinen, and Schmidt, 1998. Block, 1983.
Lack of senior management involvement	Ewusi-Mensah, 1997, Keil, Cule, Lyytinen, and Schmidt, 1998.
Application complexity (technical complexity)	Barki, Rivard, Talbot, 1993.
Misunderstanding requirements, changes in requirements	Keil, Cule, Lyytinen, and Schmidt, 1998, Boehm, 1991. Block, 1983, Cash, McFarlan, 1992.
Organizational environment (resource insufficiency, extent of changes)	Barki, Rivard, Talbot, 1993, Block, 1983.
Unrealistic schedules and budgets	Boehm, 1991.
Lack of an effective methodology, poor estimation, failure to perform the activities needed	Keil, Cule, Lyytinen, and Schmidt, 1998, Block, 1983.
Changing scope and objectives	Keil, Cule, Lyytinen, and Schmidt, 1998.
Conflicts between user departments	Keil, Cule, Lyytinen, and Schmidt, 1998.
Inappropriate staffing, personnel shortfalls	Keil, Cule, Lyytinen, and Schmidt, 1998, Boehm, 1991, Block, 1983.
People and personality failures	Lack of effort, antagonistic attitudes, people clashes, Block, 1983.
Lack of measurement system for controlling risk, inadequate project management and tracking.	Ewusi-Mensah, 1997, Block, 1983.

Table 1: Summary of Risk Factors in Information Systems Projects

5. FINDINGS

The case studies are based upon the experiences of seven companies implementing enterprise-wide information management systems using SAP, Peoplesoft, and Oracle. These are all Fortune 500 companies representing a variety of industries, as you can see from Table 2:

6. PROJECT JUSTIFICATION

Beginning in 1996, the pharmaceutical manufacturer started a corporate-wide SAP project. The business justification for the project was operational excellence, e.g. cutting the costs of core transactions-processing systems, such as order processing and inventory management. In addition, an integrated package could support worldwide business operations and replace division-level systems. Before SAP, the pharmaceutical firm had four purchasing packages—one for each business unit. SAP provided economies of scale in development, maintenance and operations. Its overall costs were divided by a much larger number of users. For example, buying a $100,000 package to support 5000 users is less expensive than buying a $25,000 package to support 100 users. In addition, the SAP project enabled the pharmaceutical company to reduce its information systems development staff from 500 to 50 people.

Some of the "business drivers" for the SAP implementation at the pharmaceutical manufacturer included: data integration, standardization, access to timely and complete information, leverage gained in purchasing, and globalization. SAP cut the costs of operational systems, improved the reliability of customer service, and assured timely delivery and follow-up.

	Nature of business	1998 sales	No. of employees worldwide	No. IT (info (technology) employees	No. of project employees
Beverage manufacturer	Manufactures food and beverage products	$12,832,000,000	25,123	1,100	50 internal, 25 external*
Military aircraft manufacturer	Manufactures military aircraft	$15,000,000,000	60,000	850	80-100 internal, 20 external*
Electrical manufacturer	Manufacturer of electrical and electronic products and systems	$12,298,600,000	100,700	90 (one division)	25 internal, 50-60 external* (one division)
Investment brokerage firm	National investment brokerage firm	$1,135,000,000	13,690	725	25 internal
Pharmaceutical manufacturer	Manufactures and markets high-value agricultural products, pharmaceuticals, and food ingredients	$7,514,000,000	24,700	600	25 internal, 10 external*
Consumer product manufacturer	Manufactures dog/cat foods and dry cell battery products	$4,653,000,000	23,000	750	100 internal, 20 external*
Chemical manufacturer	Manufactures and distributes biochemicals, organic chromatography products, and diagnostic reagents	$1,127,000,000	6,000	200	20 internal, 10 external*

*external consultants

Table 2: Company Profiles

The original project justification for the SAP project at the beverage manufacturer was similar. There were extensive economies of scale associated with consolidating four MIS projects into one, and SAP offered an integrated, corporate-wide solution. The business justification entailed major cost savings from reducing the costs of operational level information systems. SAP provided hard-dollar savings, based upon integration of data and processes, a common database, and increased leverage in purchasing and buying.

The major sources of justification for the SAP project at the chemical manufacturer were the need to integrate a number of different order processing systems, the need to improve and integrate financial systems, and the ability to reduce the workforce through systems integration. The major motivation behind the project was to gain a "competitive advantage" by providing "seamless" order processing to customers in a global marketplace. This meant that any customer in the world could place orders using one integrated order processing system, as opposed to using many different systems for different product lines.

The Peoplesoft Project at the military aircraft manufacturer was justified in terms of better information, cost-reduction, and data integration. Between 70 and 80 systems were replaced by a single, integrated system. While the original intent was to implement an integrated human resources/payroll system using Peoplesoft, the first phase of the project involved completing the human resources (HR) component and creating an interface to the existing payroll system. After the completion of the firm's merger with a commercial aircraft manufacturer, the plan was to integrate both HR and payroll, using the Peoplesoft software. As you will learn later, this "phased-in" approach created significant problems in system implementation.

The major justification for the Peoplesoft Project at the investment brokerage firm was data integration, a common systems approach, and hard dollar savings through integration. The Oracle project at the consumer products manufacturer was also justified in terms of data integration and cost-reduction through the re-engineering of business processes.

	System	Justification	Project Initiation
Beverage manufacturer	SAP	Cost-reduction of operational systems	1996
Military aircraft manufacturer	Peoplesoft	Cost-reduction; data integration	1994
Electrical products manufacturer	Oracle (financials, inventory, et. al)	Cost-reduction; inventory reduction; headcount savings	1996
Investment brokerage firm	Peoplesoft	Data integration; common systems	1996
Pharmaceutical manufacturer	SAP	Cost-reduction of core operational systems	1996
Consumer products manufacturer	Oracle (financials, inventory)	Cost-reduction; data integration	1996
Chemical manufacturer	SAP	Cost-reduction; systems integration	1996

Table 3: Project Type and Justification

The major purpose of the Oracle project at the electrical products manufacturer was to implement Oracle financial, distribution, and manufacturing systems. The business justification included: inventory reduction, headcount savings, and reduced lead times through on-time delivery.

Table 3 summarizes the basis for project justification for the various SAP, Peoplesoft, and Oracle projects. Since all of the projects are still in the process of implementation, the implementation dates are not noted here.

7. RISK FACTORS

7.1 Lack Of A Proper Management Structure.

Without central project leadership, there is excessive duplication of effort. Monsanto put someone "in charge" and centralized the management structure of the project in order to avoid duplication of effort. Another, more complex issue is related to the problem of having too many "chief's." At Boeing, three different vice-presidents (including the HR head, the IT head, and the Finance VP) all had the same authority and conflicts arose in establishing common requirements. In implementing a "centralized" system, centralized authority must "call the shots." (Monsanto, Boeing)

7.2 Failure To Re-Design Business Processes To Fit The Software.

Avoid customization. Many companies "go to war" with the package and try to make it meet their business process requirements, only to lead the way to huge cost overruns and project failure in some cases. Rather than attempting to modify the software, Monsanto re-engineered their business processes to be consistent with the software, and this has proved to be critical to the project's success. It is important to re-design business processes to be consistent with system specifications (Monsanto, Anheuser Busch, Sigma, Boeing, Edward Jones, Ralston, Emerson Electric). First and foremost is the importance of using a "vanilla" implementation, e.g. "not changing the original software." In the Boeing case, a number of pieces of the Peoplesoft software were customized. In its implementation, for example, the HR piece was 70% vanilla, 30% custom. The payroll piece was 60% vanilla, and 40% custom; and the benefits piece was 50% vanilla, 50% custom. One of the most difficult and time-consuming aspects of the project was the creation of a "bridge" between the HR and legacy payroll application, and this resulted in extensive time and cost delays. If modifications are necessary, establish an up-front agreement between IT and user managers with respect to what is to be modified.

7.3 Insufficient Training and Re-Skilling

Monsanto invested heavily in training and re-skilling their developers in SAP software design and methodology. Most firms emphasized the investment in the training, re-skilling, and professional development of the IT workforce. In the experience of four companies, training costs were higher than expected (Monsanto, A/B, Sigma, Boeing).

7.4 Insufficient Internal Expertise

When they didn't have needed expertise internally, Monsanto brought in the consultants they needed. Most firms made investments in training and support required to overcome technical and procedural challenges in design and implementation. It was important to maximize the use of consultants (Monsanto, Emerson).

7.5 Lack Of Senior Management Support

Without question, top management support is critical to the success of a project. It is important to achieve the support of senior management for accomplishing project goals and objectives and aligning these with strategic business goals. (Monsanto, Anheuser Busch, Sigma, Boeing, Edward Jones, Emerson Electric).

7.6 Lack Of A Champion

The project leader for the SAP project was clearly a "champion" for the project, and that role was critical to marketing the project throughout the organization. (Monsanto, A/B).

7.7 Insufficient Discipline and Standardization

Another "risk factor" which is closely associated with the software itself is insufficient adherence with the standardized specifications that the software supports. It is important to avoid compromising the system and its specifications. In terms of

"lessons learned," Monsanto's experience demonstrated the importance of using SAP's built-in "best practices," its systems development methodology. Standardization is key to success, and can create greater flexibility and changeability down the line. (Monsanto).

7.8 Ineffective Communications

It is critical to communicate what is happening, including the scope, objectives, and activities of the project. (Monsanto)

7.9 Lack Of "Business" Analysts

One of the critical workforce requirements for the project was the ability to obtain analysts with both "business" and technology knowledge. Instead of 200 "programmers" with average skills, the SAP project demanded and could be accomplished with 20 of the "best and brightest" analysts. However, retaining these professionals was a significant problem because of their market value. (Monsanto, A/B).

7.10 Lack of Integration

In terms of factors conducive to project failure, one of the main factors associated with failure is lack of integration. The project needs to be based on an enterprise-wide design. You can't start with "pieces," and then try to integrate the software component's later on. It is important to use a "federal" approach; define what is needed at the enterprise-level, and then apply it to the business unit level. A phased-in approach is superior to the "big-bang," all-at-once approach. (Monsanto, Boeing, Emerson).

7.11 Failure to Mix Internal and External Personnel

Use a mix of consultants and internal staff to work on the project team, so that internal staff members can "grow" the necessary technical skills for SAP design and implementation. Maintain excellent staffing, both by developing internal personnel and by using external consultants. (A/B, Sigma)

7.12 Failure To Place a "Business" Leader In Charge, So That Project Leadership Comes From The Business Perspective. (A/B)

7.13 Failure to Empower the "Team"

Manage team expectations effectively. (A/B, Boeing)

7.14 Lack of Ability to Recruiting and Retain Qualified ERP Systems Developers

It is difficult to recruit and retain good technical people because market rates for these people are much higher. Management must understand and appreciate the criticality of high-tech worker turnover, recruitment, and retention issues (Ralston, Boeing, A/B, Edward Jones).

7.14 Insufficient Training of End-Users

Most firms emphasized making a major commitment to training end-users in system uses. This meant re-skilling the end-users in new technologies and applications and supplementing "generalized" user training with training in the use of specific application modules (Sigma, Boeing, Ralston. Emerson).

7.15 Lack Of Data Integration and Data Standardization

Use a common data model and common data definitions to drive common business processes (Monsanto, Boeing).

7.16 Inability to Obtain A Full-Time Commitment of "Customers" To Project Management and Project Activities

It may be difficult to get managers to commit to project management roles, because they may be uncertain about what responsibilities will still be open to them once they are transferred back to their functional areas. Getting the "business" areas to dedicate people to the management of the project is a key priority. (Boeing, Edward Jones).

7.17 Avoid Technological Bottlenecks

It is important to prepare for client-server implementation well in advance. (Boeing).

7.18 Lack of Disciplined, Flexible Program Management

Once data input was decentralized to the shop floor at McDonnell Douglas/Boeing as part of the Peoplesoft HR system implementation, there was major resistance by end-users. This reinforces the critical importance of training. (Boeing).

7.19 Lack Of An Integrated Technology Strategy To Support Client-Server Implementation

The different "technology" environments at Boeing and MDC created delays in establishing consistency and coordination in platforms, database management systems, and operating system environments for the Peoplesoft application. For example, the choice of whether to implement Peoplesoft using Unix/Oracle as an operating system/database environment or MVS/DB2 became an issue. While Unix/Oracle is the "standard" environment at MDC, MVS/DB2 is the system standard at Boeing (Boeing).

7.20 Avoid Building Bridges to Legacy Applications

The Boeing/McDonnell Douglas merger complicated the project and necessitated the creation of a "bridge" between the Peoplesoft HR software and the MDC legacy system, resulting in extensive time and cost delays. It is important to implement a total integrated package at one time, rather than in pieces. The building of a bridge between a Peoplesoft module and a legacy application was problematic and illustrated the complexity of building a bridge to a legacy system (Boeing).

7.21 Failure to Recognize the Risk of "Scope Expansion"

It is important to address "scope expansion" requests with information on the time, cost, and business impacts of these changes (Ralston).

7.22 Failure To Recognize The Importance Of Application-Specific Knowledge

It is important to obtain consultants who are specialists in specific application modules (Ralston).

7.23 Failure to Emphasize Reporting, Including Custom Report Development

The use of report generators, and user training in reporting applications is critical to project implementation success (Boeing, Ralston).

7.24 Failure to Integrate Add-On Modules with the ERP System

When software does not meet requirements, most firms used bolt-on's, or add-on packages which are offered by third-party vendors (Emerson). Several project managers emphasized the need to limit the number of "bolt-on's," or "add-on's," to those which are absolutely critical to accomplishing project activities (Emerson).

A summary of the risk factors affecting enterprise-wide information management systems projects is shown in Table 4.

Organizational fit	Failure to re-design business processes Failure to follow an enterprise-wide design which supports data integration Lack of data integration and lack of data standardization
Skill mix	Insufficient training and re-skilling Insufficient internal expertise Lack of business analysts with business and technology knowledge Failure to effectively mix internal and external expertise Lack of ability to recruit and retain qualified ERP systems developers
Management structure and strategy	Lack of senior management support Lack of proper management control structure Lack of a champion Ineffective communications Lack of a change management strategy
Software systems design	Failure to adhere to standardized specifications which the software supports Failure to effectively integrate "add-on" modules Failure to recognize the importance of application-specific knowledge
User involvement and training	Insufficient training of end-users Ineffective communications Lack of full-time commitment of customers to project management and project activities Lack of sensitivity to user resistance Failure to emphasize reporting
Technology planning	Inability to avoid technological bottlenecks Lack of an integrated technology strategy to support client-server implementation Attempting to build bridges to legacy applications
Project management	Lack of disciplined, flexible project management Failure to recognize the risk of scope expansion (time, cost)

Table 4: Summary of Risk Factors in Enterprise-Wide Projects

8. WHAT ARE SOME OF THE RISKS IN ERP PROJECTS THAT ARE NOT FACTORS IN MIS PROJECTS?

When the risk factors affecting MIS projects are compared with the risk factors affecting ERP systems projects, some of the uniquely important factors affecting the ERP projects include:

- The danger of customization.
- The new investment in recruiting, re-skilling, training in state-of-the-art technology.
- The new challenge of using external consultants and integrating their application-specific knowledge and technical expertise with existing teams.
- The new project management risk, resulting from extensive size/scope and data integration.
- The risk of technological newness and technological bottlenecks in a client-server environment.

- The management of change, including organizational change because of systems integration.
- The emerging role of the business analyst, combining technology and business skills.

9. SUMMARY

Enterprise-wide information management systems projects pose new opportunities and significant challenges. Some of the "summary" ideas which are re-iterated throughout the case studies are:

- Justify the enterprise-wide projects based upon cost-justification and economies of scale.
- Re-engineer business processes to "fit" the package, rather than trying to modify the software to "fit" the organization's current business processes.
- Identify and implement strategies to re-skill the existing IT workforce and acquire external expertise through vendors and consultants when needed.
- Utilize "business analysts," with both business knowledge and technology knowledge.
- Obtain top management support for the project and establish strong project leadership.
- Make a commitment to training end-users in custom report development.
- Manage change through leadership, effective communications, and the role of a champion.

Without question, the effective management of these huge projects is a new and unique challenge which requires the use of project management and control methods that have not been used extensively in the past. The sheer size of these projects requires centralized control, strict discipline, and extensive monitoring of project outcomes. Compared with traditional MIS projects, less emphasis is placed upon customizing the system to support unique business process requirements. Using a large-scale package such as SAP to support the business creates a more centrally controlled, consistent organizational structure and and extensive data integration.

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