# Reasons for Failure of ERP Systems' Enterprise Application Integration

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**Abstract**— *Enterprise Resource Planning (ERP) projects spending at organizations worldwide has absorbed the attention, budgets, and energy of information technology professionals. Therefore, many organizations around the world attempt to increase their ERP functionality by integrating their enterprise packages with legacy systems and other applications via Enterprise Application Integration (EAI). EAI technologies provide the means to integrate strategic business solutions within and across the component parts of organizational information systems infrastructures. The adoption of EAI with ERP still suffers from frequent failure which affects the overall integration project success. This paper presents the most common reasons behind the failure in integration between ERP and other enterprise applications.*

***Keywords*— Enterprise Application Integration (EAI), Enterprise Resource Planning (ERP), failure factors, EAI issues, integration problems.**

## I. Introduction

Over the past 10 years, there has been a significant trend towards the use the packaged applications; among the main popular packages are Enterprise Resource Planning (ERP) solutions.

ERP is a software infrastructure with the aim of improving the interaction and cooperation between all the departments in the organization such as finance, human resource, purchasing, manufacturing, sales, and inventory. In the era of globalization, it basically helps an organization in addressing needs like reduced cycle time, customer focus, sharing information seamlessly across the enterprise, real-time data access, and just-in-time (JIT) management. Deployment of an ERP system typically involves considerable business process analysis, employee retraining, and new work procedures, and hence, the cost of ERP implementation is high [12].

ERP packages have transformed the way organizations go about the process of implementing information systems. Organizations are now able to install well-integrated, internationally sourced packages that seek to provide best practice from IT systems worldwide rather than crafting each new information system locally. ERP systems help to manage company-wide business processes, using a common database and shared management reporting tools. ERP systems support the efficient operation of business processes by integrating business activities within the same organization [4].

Traditionally, although ERP packages offer advantages to enterprises, they are focused on optimization (planning, controlling and monitoring) of the enterprise-internal processes, and not supporting interaction possibilities with external autonomous and heterogeneous applications [12]. Therefore, ERP systems won't demonstrate their full potential unless they are properly integrated with other enterprise software application (such as legacy systems, e-business solutions, etc.) [2].

Furthermore, the failures of most ERP solutions to provide a complete functional replacement for legacy systems increased the need for EAI. Companies that attempted that approach largely determined that the cost and time involved in totally replacing legacy systems was far too high to be tenable. So, in other words, Instead of implementing new e-business applications, many companies have recognized that for the foreseeable future, ERP systems will co-exist with legacy systems. The emerging technology of EAI provides a robust structure to preserve the functionality of legacy systems while addressing critical connectivity and communications needs with leading-edge technology [10]. Some ERP vendors have tried to reduce the burden by developing their own integration technologies such as SAP Netweaver [13].

EAI "is a set of technologies that allows the transfer and exchange of data between different applications and business processes within and between organizations" [12]. The goal of enterprise application integration is to provide accurate and timely exchange of consistent information between business functions to support strategic and tactical business goals in a manner that appears to be seamless [16].

Many Companies and organizations are seeing the benefits of EAI; for instance, healthcare organizations linking systems to provide good administrators, caregivers, and payers the information they need to deliver care more effectively; manufacturing companies integrating their supply chain for

more accurate inventory replenishment and better anticipation of consumer demand; and, government organizations web-enabling citizens and businesses with self-services such as permitting, tax collection, licensing, payments, and polling or voting [3].

Although the integration is a way to exchange information in one organization automatically, it still suffers from problems and failures. Unfortunately, most developers and mangers consider EAI as a big challenge for the success of synchronizes all applications within the organization.

### *A.* Problem of the Study

In an enterprise system, it is a critical that ERP systems and other critical application systems operate seamlessly. Getting applications to work with each other remains a big challenge. Problems related to integration cause great delays in enterprise operations. A lot of work has to be done manually, for instance, data from one system has to be printed out and then re-entered in a different format to a target system.

Furthermore, the cost of integration is high and growing as it is not limited to installing new applications only. There are many other expenses related to time and human resources associated with the huge responsibility of maintaining and controlling the integrated systems. Thus, the implementation of an integration project is critical investment for any organization or company.

According to Information Management [1] "enterprise application integration (EAI) remains one of the top priorities" for organizations. What may surprise many, however, it that more than 70 percent of these EAI projects fail in some way, where failure is rated as missing deadlines, blowing budgets or failing to deliver the service that the business was expecting."

Moreover, the research of Dr. Bernard Wong and David Tein [4] identified integration of systems as one of the Critical Success Factors in ERP implementation. The $110 Million SAP ERP implementation project of the Hershey Foods Corporation's had failed as a result of the improper testing of the integrated systems [4].

IS evaluation group [14] from Brunel university, publishes the result of an empirical survey involving ERP problems and application integration as follows "Integration is another important problem of ERP Solutions, the most serious problems focus on the integration of the ERP solution with existing applications such as legacy systems (82%), or with new business software (e.g. supply chain management, e-commerce applications etc) (46%). Therefore, integration is extremely difficult to be achieved through these integrated suites."

From the previous studies and research we can realize the integration of ERP requires significantly more than a simple data exchange focus. The application integration projects with ERP draw upon technical skills, business process, reengineering skills, and business acumen to discover rich opportunities and avoid the failures.

### *B.* Purpose of the study

In order to help companies succeed with their business integration, the study's main objective is to identify the most common causes of ERP integration failures from the different literature on ERP and systems integration and to present it to the reader in an ordered and organized manner. This should help managers of such implementation projects to avoid such problems and the potential causes for failure

## II. Enterprise Application Integration

### *A.* What is EAI?

Different definitions of EAI were found during the literature review: "Enterprise application integration (EAI) is the process of linking such applications within a single organization together in order to simplify and automate business processes to the greatest extent possible, while at the same time avoiding having to make sweeping changes to the existing applications or data structures" [6]. EAI is also defined as "unrestricted sharing of information between two or more enterprise applications. A set of technologies that allow the movement and exchange of information between different applications and business processes within and between organizations" [10].

In general, systems integration in an enterprise can take place on different levels in an IT system. Many technologies and tools fit into one of these levels. Currently, the new trend in the industry towards IT applications achieving multiple integration levels [7]. In the data integration level, the integration takes place between data stores. Data is extracted from one site's database and used to update another system's database after suitable data formatting modifications. The application interface integration level is an interface that gives access to three types of services including business, data, and objects provided by a custom system or a standard package. In the method (business process) integration level, the applications are integrated through the enablement of the sharing of a set of common methods. In user interface integration levels, also known as "screen scraping," applications are integrated through the user interfaces, i.e. information are accessed from user screens by programmatic mechanisms [7, 10].

The infrastructure of Application integration is based on a set of technologies that allows information to be exchanged between different systems and business processes within and between organizations like remote procedure calls (RPCs), message oriented middleware (MOM), distributed objects, database oriented middleware, XML, and, enterprise service bus (ESB), etc.

### *B.* ERP Integration Options

The integration between different systems such as legacy, e-commerce and other applications with ERP suites from vendors like SAP AG, PeopleSoft, Oracle, J.D Edwards, and Microsoft Dynamic can be performed in different ways. Each integration approach has its own challenges and limitations.

The options vary from off-the-shelf data-sharing products such as middleware, EAI tools and ERP connectors to develop home-grown connector components, or application programming interfaces (APIs) available within the ERP system. Depending on what the systems we are working to integrate and the level of integration, developers can use one of the following options[15]:

1) *ERP APIs today*: ERP vendors are providing their software with low-level APIs that support simple data access. If the data is going to be shared between two or three ERP modules, this approach can work very well. The drawback of this option is that APIs in general work well in providing data access but not in providing integration of business processes such as workflow.

2) *Data-Sharing Tools*: A Number of tools are available in the market for facilitating simple data sharing between ERP packages and other applications, such as manufacturing applications.

3) *Transactional Integration Tools:* Due to the increasing need for corporate ERP systems to work with different ERP, e-commerce and e-procurement application platforms outside a company, transactional infrastructure is important in this kind of integration. The drawback of this option is that firewalls will not be adequate.

4) *Sticking with Standards:* The developer must select an approach and a product that fits with the current standards used in the enterprise. A few popular standards are available like Enterprise JavaBeans (EJB) and Microsoft's Common Object Model (COM). Staying with common standards such as EJB, COM, CORBA and XML also helps ensure that future integration projects will be somewhat easier to accomplish.

## III. Causes of Failure

The failure of enterprise application integration is not a small problem; it is a critical factor for the success of the entire organization. In general, it is important to know what does failure mean? from the previous studies we can answer this question as follow: If the EAI solution runs less efficiently than the old systems it replaced (end to end transaction), it will be deemed a failure, or EAI project goes over budget, or produces less-than-hoped-for results, or any combination of these cases, the EAI solution will be considered to have failed [10, 11].

In this paper we have summarized the reasons for failure discussed in related works and categorized them, based on their potential for occurrence during the EAI project life cycle, into four major types: organizational problems, implementation problems, architecture & design problems, and, operational problems.

Organizational problems include issues related to management and cost, planning, scope, communication, business prospective, and user resistance (Table 1).

TABLE I
ORGANIZATIONAL PROBLEMS

| Reason Category | Ref. | Details |
|---|---|---|
| Management and Cost Issue | [5] | - The implementation of EAI is expensive and more complex than expected. |
| | [11] | - The nature of EAI is dynamic and requires dynamic project managers to manage these changes. |
| | [8] | - The cost of EAI project could be 5 to 7 times higher than other IS projects.<br>- Top management often does not understand what exactly the cost of integration is. |
| | [16] | - Management by magazine where the decisions are made without performing an appropriate analysis.<br>- The need to obtain and maintain sponsorship and financial commitment at all levels of the organization for the duration of a potentially lengthy project. |
| Planning Issue | [5] | - At the initial implementation of Integration Project, the entitlements are often not considered. EAI integrate multiple existing applications, each of which supports its own security, a suitable entitlements system must be in place in the beginning of implantation. |
| | [11] | - Change is constant; the frequent change requires changes in different components that spread across different companies. |
| | [8] | - Inflexible plan for changing within the implantation.<br>- Management usually does not understand that integration is not a one-time activity or a singular success.<br>- The lack of appropriate change plan repeatedly leads to rejection of the EAI strategies. |
| Scope Definition | [8] | - Scope creep. |
| | [16] | - The scope for the integration effort is not adequately defined. |
| Communication | [5]& [16] | - Bad communication between Business units in drafting /documenting the end-to-end Business Processes. |
| | [8] | -Some departments do not wish to share their information which leads to conflicting redundancy of data. |

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| Conflicting of Business Perspective | [11] | ▪ Sometimes departments have conflicting requirements; there should be clear accountability for the system's final structure. |
| | [8] | ▪ Different departments can have different, often conflicting, views of the same business processes. |
| | [16] | ▪ Lack of business case or drivers. |
| Resistance of User | [11] | ▪ In general, IT staffers tend toward analysing the requirements to build an appropriate interface design from the scientific view. This approach could lead problems because the proposed solution may not be acceptable for users. |
| | [8] | ▪ The biggest challenges are employees who continually refuse any change, for better or for worse, and obstruct the process. |

Architecture & Design problems include issues as shown in Table 2 that are related to integration architecture, data sense, and, the infrastructure of integrated application.

TABLE 2
ARCHITECTURE & DESIGN PROBLEMS

| Reason Category | Ref. | Details |
|---|---|---|
| Integration Architecture | [5] | ▪ EAI involves considerable research and design activity against little development work but using regular conventional application implementation approaches and techniques that do not usually work for EAI implementation. |
| | [11] | ▪ EAI is not a tool, but rather a system and should be implemented as such. |
| | [16] | ▪ Organizations focus on the wrong sets of issues in developing enterprise architecture, where the enterprise architecture is essentially a planning activity, rather than a development activity. But in practice, there is no distinction between planning and development. |
| Data Sense | [5] | ▪ Data Models mismatches between applications complicate communications and data mapping. |
| | [11] | ▪ Information that seemed unimportant at an earlier stage may become crucial later. |
| | [9] | ▪ Lack of visibility into the data and metadata within the organization. |
| ucture of Integrated Applica | [5] | ▪ It is difficult to align data models between two applications that will communicate via integration |
| | [8] | ▪ Almost 70% of critical business data is still stored in complex, cumbersome, legacy applications written in third generation programming languages and the maintenance and support of legacy applications is expensive. |
| | [16] | ▪ The legacy systems designed from unplanned, stovepipe development or were developed as batch or Single Tier.<br>▪ The legacy systems were not initially designed for new quality-attribute requirements and are being affected by needs for interoperability, performance, security, and usability.<br>▪ Poor Design: some systems create their data which is specific to the applications, and data was not designed for sharing. |

Implementing the plans for EAI projects requires methodology different than other IS projects and resources. Problems associated with this phase include issues related to integration methodology, necessary expertise of integration, inappropriate technologies, and testing (Table 3).

TABLE 3
IMPLEMENTATION PROBLEMS

| Reason Category | Ref. | Details |
|---|---|---|
| Integration Methodology | [5] | ▪ There are no standardized methodologies when defining topologies including security, fail-over, and load balancing. |
| | [11] | ▪ Within the EAI field, the paradox is that EAI standards themselves are competing. Therefore, companies should budget for testing and validation because standards can't guarantee interoperability. |
| Expertise of Integration | [5] | ▪ Some organizations ignore the need for a different skill set for integration projects than what is needed for application design. |
| | [11] | ▪ EAI requires knowledge of business and technical aspects both. |
| | [8] | ▪ Due to the difficulty of integration that requires a lot of technical and business decisions, expert are only capable of making tough decisions.<br>▪ Most enterprises try to do integration projects depending on their own people with no experience. |
| Inappropriate Technologies | [8] & [9] | ▪ Selecting the wrong technology as a result of bad consideration for real limitations, drawbacks, and overall suitability of selected technology for current situation.<br>▪ In the planning phase of EAI projects there is no planned time for technology evaluations. |
| Testing | [5] | ▪ There are few tools that support integration testing.<br>▪ No specialized tools for stress testing EAI exist. |

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|---|---|---|
| | [4] | ▪ Lack of adequate testing. |

After the EAI project has been completed several operational problems may arise. These include the issues of knowledge transfer and documentation, maintenance and up-front contingency plans, and performance (Table 4).

TABLE 4
OPERATION PROBLEMS

| Reason Category | Ref. | Details |
|---|---|---|
| Knowledge transfer and Documentation | [16] | ▪ Providing inadequate training. |
| | [8] | ▪ The documentation is often neglected which leads to unnecessary dependence on outsourced IT consultants.<br>▪ Writing documentation is a time-consuming and expensive process. |
| Maintenance and Up-front Contingency Plan | [5] | ▪ Poor end-to-end system management and monitoring. |
| | [8] | ▪ Most failed integration projects did not have an up-front contingency plan from hardware and software vendors in case of disaster. |
| Performance | [5] | ▪ There is a problem because the lower granularity communications means an increased amount of messages is required to achieve overall functionality that negatively affect the performance. |

# IV. Conclusion and future work

This paper introduced the necessary background to understand EAI and the reasons of failure of projects involving ERP systems.

As a future work, we plan to conduct a field study involving real situations of integration projects at some selected companies that are facing troubles with integration which can be useful to augment our current study and the possible discovery of additional causes of failure and difficulties with ERP EAI. We then hope to develop a best practice model which can be considered as a useful decision-making integration solution that could help produce significant benefits in the area of enterprise application integration.

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