

A Comprehensive Overview of ERP Systems Integration

(Concept, Advantages, Disadvantages, and Risk Factors)

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Abstract

Enterprise resource planning systems have spread widely in recent times, and the companies that provide them have multiplied, including major companies such as Microsoft, Oracle, and others, despite the similarity of the components of each of them, as they all work on the administrative and financial operations carried out by the organization, and each of them has the advantages that distinguish it from its counterpart provided by the company. Other, which makes us look into the advantages, disadvantages and challenges of these systems. If the companies that use these systems have other systems for managing enterprise resources, what is the concept of integration of enterprise resource management systems and the risk factors of this integration? researchers covered the following: ERP Concepts and Evolution, ERP Existing Software Packages and Their Comparison and in it the following was listed: Comparatives of ERP, Top 10 ERP Software Comparison of list 2020, 2021 and Other Enterprise Software Solution Options. And so, we were

exposed to ERP Technological Infrastructure and in it we got to know: Simplified Structure of ERP Systems, Types of Enterprise Resource Planning Solutions, Housing or Hosting and Hardware Infrastructure and ERP Technologies. We have also covered the risk factors for ERP implementation, we also reviewed the four factors that affect the integration of the ERP system, which are as follows: the organization landscape, the EDN partners, the characteristics of the ERP system, and the domain, we have also reviewed ERP and Business Integration Through the following: definition, the need for integration and integration challenges and in finally advantages, disadvantages and challenges of ERP Systems.

Keywords: ERP- ERP integration - ERP integration risk factors- ERP integration advantages and disadvantages -top ERPs.

1-Introduction

this article introduces ERP concepts, their development phases and their existing and comparable software packages. It also aims at

introducing the ERP infrastructure, clarifying the risk factors implemented, the relationship between ERP and business integration, and a simplified explanation of the advantages and challenges of ERP systems.

2- ERP Concepts and Evolution

2.1- ERP Concepts (Mohammad R. Rashid, Liaquat Hossain, Jon David Patrick, 2002)

The concept of ERP system is illustrated. In back-office, ERP system manages and coordinates the enterprise operations such as financial, manufacturing, inventorying etc., which interacts closely with suppliers. In front-office, it mainly faces to customers, and applications that are related to customer such as sales, distribution, services etc. are administered by ERP system. Corporate reporting and human resource management are throughout. The resulting data are stored in central database, which can be monitored and audited.

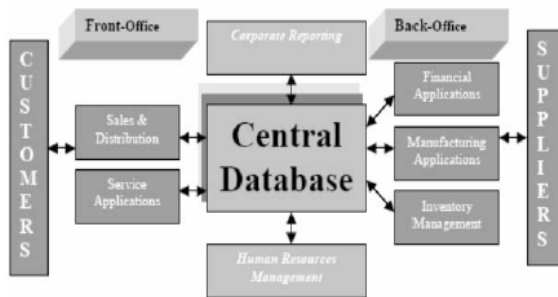


Figure: (2.1) ERP systems concept

Source: (Mohammad, R. Rashid, Hussain, Lialual & Patrick, Jon David, 2002)

Enterprise Resource Planning (ERP) is an important enterprise application that integrates all the individual department functions into a single software application. Despite the success of ERP in many aspects, the practical application in many

institutions, suffered from some negatives in the presence of traditional legacy systems. (Gregor, Bobby, 2012) (Gregor, Bobby, 2011), Enterprise Resource Planning (ERP) systems are integrated, multi-module application software packages designed to serve and support several business functions across an organization. ERP systems are typically commercial software packages that facilitate collection and integration of information related to various areas of an organization. ERP systems enable the organization to standardize and improve its business processes to implement best practices for its industry. (Luvai, F. Motiwalla & Thompson, Jeffery, 2012)

Recently, there has been a remarkable interest in developing models to improve the effectiveness of resource planning for management institutions (SAP, UFIDA, RAMCO, MAXIMO, EPICOR, SYSPRO, PEOPLESOFT, ORACL, ...), Such interest has stimulated many software houses to develop their ERP products, In spite of ERP's significant growth from the late 1990s to the present day, there are a number of challenges that companies may encounter when implementing ERP. (Goeun Seo, 2010) ERP is software that standardizes, streamlines and integrates business processes across finance, human resources, procurement, distribution, and other departments. Typically, ERP systems operate on an integrated software platform using common data definitions operating on a single database. (Perkins Bart, 2019), ERP is a process used by companies to manage and integrate the important parts of their businesses. (Labarre, Olivia, 2020) .

Enterprise resource planning (ERP) is a business process management system that compiles, organizes, aligns, and automates various aspects of a company's workflow. The idea is to have all business functions in one place to increase efficiency and make sure all bases are covered. ERP software is often enlisted by companies to help with the management of a wide variety of back-office functions (Aston, Ben, 2021).

2.2- Goals of ERP

ERP system's goal is to make information flow be both dynamic and immediate, therefore increasing the usefulness and value of the information. In addition, an ERP system acts as a central repository eliminating data redundancy and adding flexibility (Robinson, S., 2004), Another goal of ERP system is to integrate departments and functions across an organization onto a single infrastructure that serves the needs of each department. This is a difficult, if not an impossible.

2.3 ERP Components (Robinson, S., 2004)

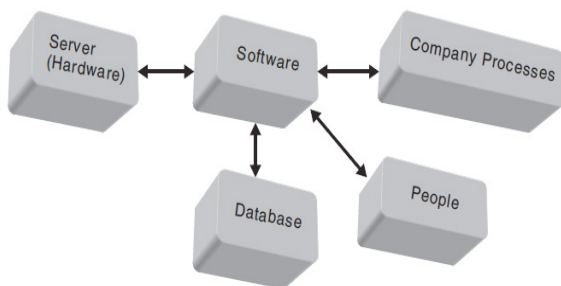


Figure (2.2) ERP Components Source: (Luvai, F. Motiwalla & Thompson, Jeffery, 2012)

As shown in Figure 2.2, an ERP system, like its information system counterpart, has similar components such as hardware, software, database, information, process, and people. These components work together to achieve an

organization's goal of enhanced efficiency and effectiveness in their business processes. An ERP system depends on hardware (i.e., servers and peripherals), software (i.e., operating systems and database), information (i.e., organizational data from internal and external resources), process (i.e., business processes, procedures, and policies), and people (i.e., end users and IT staff) to perform the input, process, and output phases of a system. The basic goal of ERP, like any other information system, is to serve the organization by converting data into useful information for all the organizational stakeholders.

The key components for an ERP implementation are hardware, software, database, processes, and people. These components must work together seamlessly for the implementation to be successful. The implementation team must carefully evaluate each component in relation to the others while developing an implementation plan. Hardware, software, and data play a significant role in an ERP system implementation. Failures are often caused by a lack of attention to the business processes and people components. Both people involvement and process integration will need to be addressed from the very early stages in the implementation plan, Staff must be allowed to play a key role in the project from the beginning.

2.4- Evolution of ERP

During the 1960s and 1970s, most organizations designed silo systems for their departments. As the production department grew bigger, with more complex inventory management and production scheduling, they designed, developed, and implemented centralized production systems

to automate their inventory management and production schedules. These systems were designed on mainframe legacy platforms using such programming languages as COBOL, ALGOL, and FORTRAN. The efficiencies generated with these systems saw their expansion to the manufacturing area to assist plant managers in production planning and control. This gave birth to material requirements planning (MRP) systems in the mid-1970s, which mainly involved planning the product or parts requirements according to the master production schedule. Later, the manufacturing resources planning (MRP II) version was introduced in the 1980s with an emphasis on optimizing manufacturing processes by synchronizing the materials with production requirements. MRP II included such areas as shop floor and distribution management, project management, finance, job-shop scheduling, time management, and engineering. ERP systems first appeared in the early 1990s to provide an integrated solution built on the technological foundations of MRP and MRP II, ERP systems integrated business processes across both the primary and secondary activities of the organization's value chain, including manufacturing, distribution, accounting, finances, human resource management, project management, inventory management, service and maintenance, and transportation. ERP systems' major achievement was to provide accessibility, visibility, and consistency across all functions of the enterprise (Somers, T. M., Nelson, K., & Karimi, J., 2013). ERP II systems today have expanded to integration of inter organizational systems

providing back-end support for such electronic business functions as business-to-business (B2B) and electronic data interchange (EDI). From the technological platform perspective, therefore, ERPs have evolved from mainframe and centralized legacy applications to more flexible, tiered client-server architecture using the Web platform.

Table (2.1): Evolution of ERP from 1960s to 2000s. Source: (Somers, T. M., Nelson, K., & Karimi, J., 2013)

Timeline	System	Platform	Description
1960s	Inventory management and control	Mainframe legacy using third-generation software (e.g., Cobol, Fortran)	With a focus on efficiency, these systems were designed to manage and track inventory of raw materials and guide plant supervisors on purchase orders, alerts, and targets, providing replenishment techniques and options, inventory reconciliation, and inventory reports.
1970s	Material requirements planning (MRP)	Mainframe legacy using third-generation software (e.g., Cobol, Fortran)	With a focus on sales and marketing, these systems were designed for job shop scheduling processes. MRP generates schedules for production planning, operations control, and inventory management.
1980s	Manufacturing requirements planning (MRP II)	Mainframe legacy using fourth-generation database software and manufacturing applications	With a focus on manufacturing strategy and quality control, these systems were designed for helping production managers in designing production supply chain processes—from product planning, parts purchasing, inventory control, and overhead cost management to product distribution.
1990s	Enterprise resource planning (ERP)	Mainframe or client-server using fourth-generation database software and package software application to support most organizational functions	With a focus on application integration and customer service, these systems were designed for improving the performance of the internal business processes across the complete value chain of the organization. They integrate both primary business activities like product planning, purchasing, logistics control, distribution, fulfillment, and sales; additionally, they integrate secondary or support activities like marketing, finance, accounting, and human resources.
2000s	Extended ERP or ERP II	Client-server using Web platform, open source and integrated with fifth-generation applications like SCM, CRM, SFA. Also available on Software as a Service (SaaS) environments	With a focus on agility and customer-centric global environment, these systems extended the first-generation ERP into interorganizational systems ready for e-Business operations. They provide anywhere anytime access to resources of the organization and their partners; additionally, they integrate with newer external business modules such as supply chain management, customer relationship management, sales force automation (SFA), advanced planning and scheduling (APS), etc.

In the 1990s, with the market becoming more competitive, the major players looked for a competitive advantage and began to release applications that integrated the operational portion of the organization with the accounting area of the

firm (Osetskyi, Victor, 2018). Coined ERP by the Gartner Group, this new technological development spurred immense growth with the core six business application vendors (Dillard, Yuthas, 2006). With the fear of the unknown approaching for the year 2000 with Y2K, ERP industry marketing caused firms to scramble to install these applications sparking dramatic growth in ERP vendors and offerings (De Soete, 2016). When the dotcom bubble of 2001 rocked the entire technology industry, the major players in the industry were pressured to downsize (Osetskyi, Victor, 2018). By the end of the 2000s, the ERP landscape changed as J. D. Edwards, and PeopleSoft were acquired by Oracle (Palanisamy, Verville, & Taskin, 2015) and a new entrant in the market, Infor Global Solutions acquired Baan (Osetskyi, Victor, 2018) and IBM's MAPICS product (Labarre, Olivia, 2020), resulting in SAP, Oracle, and Infor becoming the top three ERP vendors in the market respectively (Justin Goldston, 2020).

In reaching the maturity stage of its lifecycle, ERP applications have continued to progress with the gradual introduction of cloud computing. Cloud computing reduces the information technology (IT) overhead for firms by moving all hardware to support its ERP application off premise to a vendor-hosted site (L.Zornada & T.B.Velkavrh, 2005) . In a 2016 ERP Report performed by Panorama Consulting, the survey of 215 organizations deploying ERP applications uncovered a 40% increase in firms implementing cloud versus on-premise Solutions compared to 2015 (SETH, SHOBHIT, 2019). To analyze the dramatic increase, the reduced misconceptions of cloud computing also led to the

dramatic increase (SETH, SHOBHIT, 2019). As ERP providers continue to increase application security to mitigate the risk against security breaches, more organizations are moving from on-premise solutions to cloud-based offerings.

Table (2.2): Evolution of Business Applications from 1960s until now. Source: (Justin G.,2020)

Decade	Applications
1960s	Early computers, Reorder point systems, and early Materials Requirements Planning (MRP)
1970s	MRP
1980s	MRPII and early Enterprise Resource Planning
1990s	ERP
2000s	Introduction to ERP cloud computing, early ERP vendor consolidations, mergers, and acquisitions
The future	Sustainable Enterprise Resource Planning (S-ERP)

In addition to cloud computing, in an effort to reduce waste within operations, the supply chain community instituted Lean initiatives over the past decade which was also integrated into ERP applications (De Soete, 2016). In an effort to develop a tool to track sustainable processes, researchers have begun to call these new applications Sustainable Enterprise Resource Planning (S-ERP) applications.

The enterprise business is a basic prop of the infrastructure in Egypt, and as a result there are many problems associated with the decisions of the senior management there has been the need to connect many of the applications in the network complementary mimic ERP. So it felt researcher and through experience that the research in a Proposed Framework for Enhancing the Integration of ERP (Will be very useful for the holding company

water and wastewater (HCWW).

2.5- Top Tools for ERP (SETH, SHOBHIT, 2019)

ERP is a process-oriented methodology which integrates systems used across different departments of a company, enabling easy and uniform flow of information under defined controls, aided by use of software applications and defined best practices, to gain the best from an ERP, it must have these tools:

- The tools fulfilling the ERP requirements
- Database Management / Data Warehouse / Information Management Tools
- Applications and interfaces with suitable permission control:
- Workflow Management Tool:
- Reporting Tool / Dashboard:
- Communication Tools:
- Analytical Tools:
- Resource Allocation & Task Scheduling Tools:

3- ERP Existing Software Packages and their comparison

ERP Vendor Selection process can be a very complicated and problematic for SMEs if they don't know how to approach it from the very start. This chapter presents a number of quantitative and qualitative analyses to compare major ERP software vendors over a period span of 2005 to 2013. Inherently vendor selection is a multi-criteria problem for small & medium enterprises (SMEs).

In most organizations, purchasing department commands a significant position since purchased raw material and supplies typically represent 40 to 60 percent of the sales of its end products. Even a little reduction in price will have much impact on

profits. Clients can have different needs in terms of budget constraints, technical or functional requirements of the products. These variables influence not only the choice of vendor, but also the choice of specific solution offered by the vendors.

3.1- Comparatives of ERP

This section compares the high-level characteristics of the vendors and details their competing products and technologies. It helps in analyzing one's business requirements, search for prospective vendors, and lead the team in selecting the winning vendor. Consequently, they have a large and direct impact on the cost, quality, technology and time-to-market of new products. It also provides the insight on contract negotiations and avoiding negotiation mistakes. The analysis is summarized based on all solutions offered by these vendors and does not target specific industries. The intent of this study is to provide an independent and balanced comparison of the ERP market's leading software providers like SAP, ORACLE, Microsoft Dynamics or any other software vendor or reseller.

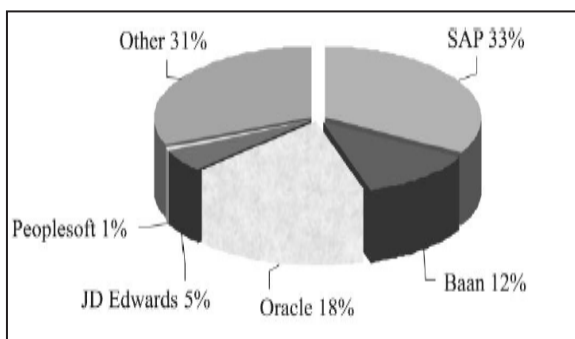


Figure (2.3) Comparison of ERP Vendors

Source: (Mabert et al. (2000); Coffey et al. (2000); Everdingen et al. (2000))

When a company considers acquiring a new ERP system, they often struggle with clearly defining

the evaluation criteria advises clients' to start with five basic criteria:

- 1) Function fit.
- 2) Technology.
- 3) Company.
- 4) Support.
- 5) Cost.

ERP team personnel can inflate the list later on. Most important, get input from the vendor as to the resources required by the organization to make the software implementation a success. Therefore, to get the pin point details related to consideration or selection of ERP vendors, we have made broad quantitative and qualitative analysis to compare major ERP software vendors, over a period span of 2005 to 2013.

3.2- Top 10 ERP Software Comparison List of 2020 (selecthub.com, 2021)

- 1- Oracle JD Edwards EnterpriseOne Software.
- 2- SAP Business ByDesign Software.
- 3- Sage Business Cloud Enterprise Management Software.
- 4- SYSPRO Software.
- 5- Microsoft Dynamics ERP Software.
- 6- Infor SyteLine Software.
- 7- IQMS ERP Software.
- 8- NetSuite OneWorld Software.
- 9- Epicor ERP Software.
- 10- IFS Applications Software.

3.3- Ten Best ERP Software Of 2021 (Aston Ben, 2021)

The appeal of enterprise resource planning systems is easy to fathom. After all, who wouldn't embrace the idea of business processes being

compiled and maintained in a neat, easy-to-scale package? That's probably why 50% of companies are planning to implement ERP system according to a 2019 report. (Quirk, Elizabeth, 2019)

Here's a shortlist of the top ERP systems:

- NetSuite
- Odoo
- ERPNext
- Compiere
- Dolibarr
- webERP
- Delmiaworks
- Microsoft Dynamics 365
- Oracle ERP Cloud
- SAP ERP

3.4- Other Enterprise Software Solution Options

Different types of ERP systems require different tools, so here are a few more that didn't make the top list. If you need additional suggestions for ERP implementation, as: Sage X3, Acumatica, FinancialForce ERP, Visibility ERP, Epicor ERP, Infor ERP, and SYSPRO ERP.

4- ERP Technological Infrastructure (Robinson, S., 2004)

ERP is an integrated system which incorporates an organization's tasks in a uniform way. According to the report by Statistic, more than 94% of the companies claim that their data security centers have improved using ERP technologies, the role of information technology in ERP is immense. Below you will find the list of ERP technologies:

- Databases
 - o PostgreSQL

- o MSSQL
- o ORACLE SQL
- **Programming Technologies**
 - o .NET and ASP.NET
 - o Java
 - o Ruby
 - o Python
 - o PHP
- **Frontend Technologies**
 - o JavaScript
 - o AngularJS
 - o React
 - o Vue.JS

4.1 Simplified Structure of ERP Systems

Before giving you an ERP technologies list, it is very important to understand the typical structure of ERP systems. In a real life, enterprise resource planning solutions consist of dozens of connected applications, databases, modules, APIs, etc. However, as any applications, they can be viewed as a structure built of the database, backend or server part and the frontend or the user interface:

- **Database** - where the data about the assets (like the number of products in the warehouse etc) is stored.
- **Backend** - the engine that performs the operations in the system according to the users' request, for example, making a request for the database to make a list of the products and goods on the particular warehouse and render it to the user.
- **Frontend** - the graphical interface that allows the users to communicate with the backend and to form the requests and then display the received information.

4.2 Types of Enterprise Resource Planning Solutions

1- Client/Server or Desktop ERP

A client/server ERP technology works on a hub of computers which are networked locally or with the cloud server. It enables database hosting in the central location and distribution of reporting services and user interface into all other locations. Client/server ERP technologies help organizations monitor and manage resources in real time, In desktop ERP, the frontend and backend run as an application launched on the user's machine. The data to the desktop ERP is shared via the database located in the intranet (local server) or extranet (database is placed somewhere in the cloud like the Azure). It allows for quick collaboration and easy access to the database even if the team members are located in different countries.

2- Cloud/Web-Based ERP

In cloud/web-based ERP the database and the backend are running in the cloud, typically, a SaaS product. The interface is rendered in the web browser. All you need to access it is a web browser on any device, You can easily access applications including disk storage, memory and processing power which are hosted on the server. The upfront cost of the web-based ERP technology is lower. Installation of software and hardware is not required which is usually a long process, therefore the turnover of cloud-based ERP technology is quick.

3- Hybrid ERP

Hybrid ERP is the combination of the web-based ERPs and desktop based solution. There are two

versions, the one which can be launched as a desktop app and the other which you can access via a browser. They have a unified database to share the same data regardless of how user accesses it whether via the browser or application. The backend for the web app runs on the server and the backend for the desktop app runs on the users' machine. Both versions make the request for the database that is running in the cloud in the same manner irrespective of whether an individual is using the browser or desktop application, Organizations prefer Hybrid ERP over cloud and web ERP due to its rapid implementation, shorter maintenance cycle, and vendor independence. The downside of the hybrid ERP includes installation of the latest technological infrastructure which usually needs a huge amount of investment. These solutions are neither as tested nor mature compared to cloud-based ERP.

4.3 - Housing or Hosting and Hardware Infrastructure

A strong foundation is essential for the durability of a system. Open technology in ERP consultants recommends careful selection of technology. However, choosing the most recommended ERP hardware is what can make you stand out. Performance is also totally dependent upon the hardware you choose. The long-term success of ERP depends upon its infrastructure; therefore, it is essential to properly examine all available options, Today, cloud computing allows businesses and enterprises to host their system on the internet and make it available for all employees wherever they are and on whatever device they are using.

Companies can use any from the available list of ERP technologies. Organizations which are not willing to implement cloud computing can use a hybrid approach which allows them to keep some functions of ERP in-house and host rest of the operations.

- ERP managers need to consider a lot of essentials aspects when reviewing the infrastructure of the hardware. Every time when there is new software introduced in the organization it reflects it is time to update the whole platform. Implementation of the ERP requires thinking out of the box as everything is going to be operated through a virtual server.
- For both organizations big and small, cloud computing has gone from a bleeding-edge technology to the most reliable and efficient technology. Cloud computing has allowed both small and large enterprises to save both money and time. Now information technology departments do not require keeping in-house servers, which are usually expensive and hard to manage.
- As companies both small and large are on a mission to downsize their IT operations, the popularity of cloud computing is increasing among them.
- Choosing the best server for your business is tricky as this is a matter of finance and this can cost huge amounts of money. Also, choosing a bad and inefficient program can be disastrous for your organization. In the section below we have explained the pros and cons of an in-house server and cloud server.

4.4 ERP Technologies

1-Database Systems and DBMS

Developers have a significant list of the ERP-friendly database technologies at their disposal. A DBMS interacts with the users and the database which is the significant part of the framework that holds data which is inquired by the user. The most recommended DBMS is MSSQL. There are several reasons for choosing it, first, because of its open-source nature. Secondly, it has the most authentic consistency, most used databases are PostgreSQL, MSSQL, and Oracle SQL.

2- Backend Programming Technologies

When it comes to back-end programming languages there is no shortage of options, and there is a huge list of ERP technologies. However, the ultimate decision depends upon your long term goal, The most used Programming Technologies are: .NET and ASP.NET, Java, Ruby, Python, and PHP.

3- Frontend Technologies for the ERP

For the last few years, a plenty of frontend ERP technologies are available for creating the beautiful, fast and responsive interfaces, available options may vary for both a desktop interface and web-based versions. Each one of them has their pros and cons, the most used Frontend Technologies for the ERP are: JavaScript, AngularJS, React, and Vue.JS.

5- ERP Implementation Risk Factors (Kähkönen, T., Smolander, K., 2013)

There are four factors affecting ERP system integration

5.1. Organizational Landscape

The ERP Development Network (EDN) forms around adopting organization (AO), which adopts

the ERP system. Organizational landscape, consisting of Enterprise architecture (EA), ERP strategy, supporting practices and Integrative systems' characteristics form the base for ERP system integration. Structural change and Political agendas can introduce additional integration challenges, the following must be considered:

- Enterprise Architecture
- ERP Strategy
- Integrative Systems' Characteristics
- Structural Change
- Political Agendas

5.2 EDN Partners

ERP development is a cooperative effort of the EDN in which AO forms relationships with other members of the EDN. These relationships appear to change during the ERP development. For example, AO ended up in a conflict with a database vendor, which eventually led to the change of the provider of ERP database. Customer-supplier relationship, Supplier's expertise, Software vendors, Consultants' involvement, Supply chain (SC) partners and Standardization partners appeared to have an impact on ERP system integration, the following must be considered:

- Customer-supplier Relationship
- Supplier's Expertise
- Software Vendors
- Consultants' Involvement
- Supply Chain (SC) Partners
- Standardization Partners

5.3 ERP System Characteristics

At the system level, the Amount of customization and System architecture were identified as

important factors affecting ERP system integration, the following must be considered:

- Amount of Customization
- System Architecture

5.4 Domain

Domain was identified to have an indirect impact on integration by defining the suitability of packaged ERPs, defining the environment where AO operates, including Business processes and Economic situation, the following must be considered:

- Business Processes
- Economic Situation

6- ERP and Business Integration

6.1 Definition of Integration

Integration refers to the end result of a process that aims to stitch together different, often disparate, subsystems so that the data contained in each becomes part of a larger, more comprehensive system that, ideally, quickly and easily shares data when needed.

6.2 The Need for Integration

Enterprises are typically comprised of hundreds if not thousands of applications that are custom-built, acquired from a third-party, part of a legacy system, or a combination thereof, operating in multiple tiers of different operating system platforms. (Gregor, Bobby, 2011)

- **First** of all, writing business applications is hard. Creating a single, big application to run a complete business is next to impossible. We can see this easily by the fact that ERP systems are one of the most popular integration points in today's enterprises.

- **Second**, spreading business functions across multiple applications provides the business with the flexibility to select the "best" suits the business' needs. One-stop-shopping for enterprise applications is usually not what IT organizations are interested in, nor is possible given the number individual business requirements, Users such as customers, business partners and internal users do generally not think about system boundaries when they interact with a business. They execute business functions, regardless of the how many internal systems the business function cuts across.

6.3 Integration Challenges

- The true challenges of integration span far across business and technical issues. (Gregor, Bobby, 2011)
- Enterprise integration requires a significant shift in corporate politics.
- Because of their wide scope, integration efforts typically have far-reaching implications on the business.
- Despite the wide-spread need for integration solutions, only few standards have established themselves in this domain.
- Operation and maintenance of the integrated enterprise resource planning major challenge.

7- Advantages, Disadvantages and challenges of ERP System (selecthub.com, 2021).

7.1 Advantages of ERP System

1. Complete visibility into all the important processes, across various departments of an organization (especially for senior management

personnel).

2. Automatic and coherent workflow from one department/function to another, to ensure a smooth transition and quicker completion of processes. This also ensures that all the inter-departmental activities are properly tracked and none of them is 'missed out'.

3. A unified and single reporting system to analyze the statistics/status etc. In real-time, across all functions/departments.

4. Since same (ERP) software is now used across all departments, individual departments having to buy and maintain their own software systems are no longer necessary.

5. Certain ERP vendors can extend their ERP systems to provide Business Intelligence functionalities that can give overall insights on business processes and identify potential areas of problems/improvements.

6. Advanced e-commerce integration is possible with ERP systems - most of them can handle web-based order tracking/ processing.

7. There are various modules in an ERP system like Finance/Accounts, Human Resource Management, Manufacturing, Marketing/Sales, Supply Chain/Warehouse Management, CRM, Project Management, etc.

8. Since ERP is a modular software system, it's possible to implement either a few modules (or) many modules based on the requirements of an organization. If more modules implemented, the integration between various departments may be better.

9. Since a Database system is implemented on the

backend to store all the information required by the ERP system, it enables centralized storage/back-up of all enterprise data.

10. ERP systems are more secure as centralized security policies can be applied to them. All the transactions happening via the ERP systems can be tracked.

11. ERP systems provide better company-wide visibility and hence enable better/faster collaboration across all the departments.

12. It is possible to integrate other systems (like bar-code reader, for example) to the ERP system through an API (Application Programming Interface).

13. ERP systems make it easier for order tracking, inventory tracking, revenue tracking, sales forecasting and related activities.

14. ERP systems are especially helpful for managing globally dispersed enterprise companies, better.

7.2 Disadvantages of ERP Systems

1. The cost of ERP Software, planning, customization, configuration, testing, implementation, etc. is too high.

2. ERP deployments are highly time-consuming - projects may take 13- years (or more) to get completed and fully functional.

3. Too little customization may not integrate the ERP system with the business process & too much customization may slow down the project and make it difficult to upgrade.

4. The cost savings/payback may not be realized immediately after the ERP implementation & it is quite difficult to measure the same.

5. The participation of users is very important for successful implementation of ERP projects -

hence, exhaustive user training and simple user interface might be critical. But ERP systems are generally difficult to learn (and use).

6. There may be additional indirect costs due to ERP implementation - like new IT infrastructure, upgrading the WAN links, etc.

7. Migration of existing data to the new ERP systems is difficult (or impossible) to achieve. Integrating ERP systems with other standalone software systems is equally difficult (if possible). These activities may consume a lot of time, money & resources, if attempted.

8. ERP implementations are difficult to achieve in decentralized organizations with disparate business processes and systems.

9. Once an ERP system is implemented it becomes a single vendor lock-in for further upgrades, customizations etc. Companies are at the discretion of a single vendor and may not be able to negotiate effectively for their services.

10. Evaluation prior to implementation of ERP system is critical. If this step is not done properly and experienced technical/business resources are not available while evaluating, ERP implementations can (and have) become a failure.

7.3 Benefits of ERP implementation

A lot Benefits can be gained from ERP implementation as:

- 1 - Operating costs reduction
- 2 - Facilitation of day-to-day management
- 3 - Strategic planning support

7.4 Challenges of ERP implementation in Business (Goeun Seo, 2013) (Goeun Seo, 2010)

In spite of ERP's significant growth from the late

1990s to the present day, there are a number of challenges that companies may encounter when implementing ERP, (Dillard, Yuthas, 2006) stated that most multinational firms are using ERP and that more small and midsize companies have begun to adopt ERP. Despite ERP's promises to benefit companies and a substantial capital investment, not all ERP implementations have successful outcomes. ERP implementations commonly have delayed an estimated schedule and overrun an initial budget (Ehie L., Madsen M., 2005), Furthermore, the literature indicates that ERP implementations have sometimes failed to achieve the organization's targets and desired outcomes. Much of the research reported that the failure of ERP implementations was not caused by the ERP software itself, but rather by a high degree of complexity from the massive changes ERP causes in organizations (Dimitrios et.al, 2011) (Scott J.E., & Vessey I., 2000).

These failures can be explained by the fact that ERP implementation forced companies to follow the principle of 'best practices' in most successful organizations and form appropriate reference models. (L. Zornada & T.B. Velkavrh, 2005) "Unlike other information systems, the major problems of ERP implementation are not technologically related issues such as technological complexity, compatibility, standardization, etc. but mostly [about] organization and human related issues like resistance to change, organizational culture, incompatible business processes, project mismanagement, top management commitment, etc.". (Huang, Chang, Li and Lin, 2004) presented the top ten risk factors

causing ERP implementation failure

Table (2.3): Top Ten Risk Factors of ERP Risk

Source: (Huang et al., 2004)

Priority	Name
1	Lack of senior manager commitment
2	Ineffective communications with users
3	Insufficient training of end-users
4	Failure to get user support
5	Lack of effective project management methodology
6	Attempts to build bridges to legacy applications
7	Conflicts between user departments
8	Composition of project team members
9	Failure to redesign business process
10	Misunderstanding of change requirements

These risk factors illustrate various organizational considerations: organization fit, skill mix, project management and control, software system design, user involvement and training, and technology planning. Since ERP implementation inevitably causes organizational changes, it requires the engagement of senior management from across the organization that is able to resolve conflicts. Without the commitment of senior management, ERP implementation has a high risk of failure.

In other words, due to changes in business processes across an organization, there can be resistance to adopting the ERP system. ERP connects and integrates all business functions within the organization. Therefore, it is critical that management staff be committed, and particularly that they equip employees who are using business functions influenced by ERP with clear channels of communication. Lack of end-user training increases risks by creating confusion and inaccuracy, thereby decreasing user satisfaction

and the credibility of the system, excellent project management is also needed for successful ERP implementation. Project teams should have clear guidelines to execute ERP implementation from their project objectives and work plan to their resource allocation plan. Without good project management, ERP implementation projects that are large in scale and must take place over longer time periods may end in failure.

Furthermore, the composition of team members plays a crucial role in ERP implementation. ERP integrates diverse business functions across an organization into one single system, necessitating a complex and integrated software package. If a project team does not clearly understand the changes in its organizational structure, strategies, and processes from ERP implementation, it will not be in a position to benefit from ERP's competitive advantage. In order to best implement ERP, project team members should be selected with a balance between members with business experience within the organization and external experts with specialties in ERP (Al - Hadi, M. and Al-Shaibany, N., 2017), from the perspective of project management, the iron triangle can illustrate how important it is to balance the three corners of the triangle - scope, schedule and cost. (Lamers M., 2002)

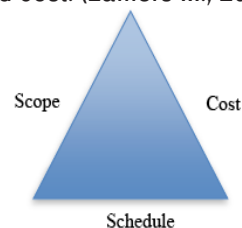


Figure (2.5): The iron triangle of project management Source : (Lamers M., 2002)

However, in ERP implementations, both schedule and cost tend to be underestimated, while scope is overestimated (Aiken, P., 2002). ERP changes the entire organizational environment by reengineering the entire business process; thus, after implementation, it is not easy to revise previous processes. Therefore, ERP implementations need accurate estimation, preparation with a holistic view, and systematic management of the entire implementation process.

Finally, after learning about the importance and evolution of ERP and existing software packages and comparing them to each other as well as their infrastructure. We are aware of the risks of ERP implementation, its relevance to business integration, the advantages and disadvantages of ERP, and the challenges of its implementation especially in the field of water and wastewater sector represented by Holding Company for Water and wastewater in Egypt.

Both the literature and the survey suggest that organizations eliminate their efforts when parameterizing ERP packages, as enterprise systems cause customization problems. The minority of companies attempting to customize their ERP packages face serious integration problems, as ERP systems are not designed to tie up other applications (Goeun Seo, 2013). The survey has reported that 82 per cent of companies face integration problems during implementation. Furthermore, 38 per cent of companies do not replace their legacy systems when adopting ERP solutions, with this observation also supported by Zahavi (1999). Based on the survey, organizations

struggle to cope with integration as only two companies successfully incorporated their legacy systems with ERP solutions.

the integration of ERP systems with other inter organizational applications can be done with XML, Javabeans and Middleware technologies. It indicates that CORBA, XML and Screen Wrappers can be used for the integration of ERP systems with other applications. Hasselbring (2000) supports that AI issued to integrate ERP systems, and reports that AI includes a number of other technologies (e.g. XML, Middleware, CORBA, etc).

8- Summay

In this article we covered the following: ERP Concepts and Evolution, ERP Existing Software Packages and Their Comparison and in it the following was listed: Comparatives of ERP, Top 10 ERP Software Comparison of list 2020, 2021 and Other Enterprise Software Solution Options. And so we were exposed to ERP Technological Infrastructure and in it we got to know: Simplified Structure of ERP Systems, Types of Enterprise Resource Planning Solutions, Housing or Hosting and Hardware Infrastructure and ERP Technologies. We have also covered the risk factors for ERP implementation.

We also reviewed the four factors that affect the integration of the ERP system, which are as follows: the organization landscape, the EDN partners, the characteristics of the ERP system, and the domain. We have also reviewed ERP and Business Integration Through the following: Definition, The Need for Integration and Integration challenges and in Finally Advantages, Disadvantages and

challenges of ERP Systems.

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