

Design and Implementation of a Web-Based Enterprise Resource Planning (ERP) System

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Abstract

Rapid increase in the use of the Internet has influenced various aspects of job technique in modern business. Contemporary enterprises require restructuring the operational model successively to maintain an economic edge in this global business era. A web-based Enterprise Resource Planning (ERP) became crucial for the continuous development of business enterprises. The researchers reacted to this crucial need and developed a Web-based Enterprise Resource Planning System for a Company. These new innovations (SMS and email notification), are not obtainable in existing ERP's. Ultimately, the system was able to generate strategic and operational intelligence that enables effective management of the organization.

Keywords: *Application Layer, Database, Data Mining, Enterprise Resource Planning, Resources, Short Message Service (SMS), Web-Based ERP.*

1. Introduction

The era of globalization has affected business sectors in Nigeria since many of the production facilities are located in other countries and the logistics function spreads across various countries in different physical locations. Enterprises participating in these global markets will increasingly be at a serious strategic disadvantage if they are unable to handle their world-wide operations and manage them in a globally co-ordinated manner. Therefore, they must look at the issues and opportunities of using a far-reaching information system on a distributive basis.

Enterprise Resource Planning (ERP) is a strategic use of computing and communications hardware and software to leverage technology in order to gain competitive advantage and increase productivity.

ERP systems are software systems for business management, encompassing modules supporting functional areas such as planning, manufacturing, sales, marketing, distribution, accounting, financial, human resource management, project management, inventory management, service and maintenance, transportation and e-business [5].

The architecture of the software facilitates a transparent integration of modules, providing the flow of information between all functions within the enterprise.

ERP system is a method for the effective planning and controlling of all the resources needed to take, make, ship and account for customer orders in a manufacturing, distribution or service company. ERP is an enterprise-wide computer management system. Reference [3] described ERP as a commercial software package that promises the seamless integration of all the information flowing through the company—financial, human resources, supply chain, and customer information. It represents the application of the latest Information Technology (IT) to the Manufacturing Resources Planning (MRP/MRP II) system. In addition to the new business functions, it has included many technology innovations including the move to Relational Database Management Systems (RDBMSs), the use of a Graphical User Interface (GUI), open systems and Client/Server architecture [7]. In the new generation of ERP, one will see many more enhancements including the Internet-based applications, the development of component technology using object-oriented models for quicker, faster implementation and customization.

The main aims of an ERP application are to accelerate, integrate and maintain the standardization of business workflows; provide the coordination, cooperation, and integration among the functional units; obstruct the repetitive data entry within the organization, and generate various reports for management with a finger tip.

ERP has a distinction from other software systems because modules (application domains) in ERP packages are free from the implemented organizations. Thus, customizations are inevitable through the implementation. For example, an important step in implementation is to compare business processes embedded in the ERP package with organization's business processes. In order to manage this change, by bringing business processes to the same

platform, an organization should become aware of the organizational change and needs.

As ERP systems have evolved and made businesses more and more efficient, a new set of demands sprang up. The main objective was the automation of the basic business functions; today the companies want in addition automate processes that are unique to their operations.

However, the main reason justifying the migration of ERP systems into the Web is that to improve their competitiveness, companies need to drive collaborative business. Implementing this collaborative business requires integrating their existing heterogeneous Information Technology (IT) landscapes and extending this integration to their business partners, customers, and suppliers. The Internet appears as the solution for integrating different applications belonging to different Information Systems.

The fundamental advantage of Internet is that it is a standards-based environment with no owner, so nobody can claim to have new and improved Internet [4]. Any company can access to a web-based ERP as long as it has an Internet connection and the right authorization. The Web allows the creation of an open platform that will permit different applications to communicate easily through the standards offered by the Internet. Internet-based ERP allows companies added flexibility and increases the flow of information for better decisions at all levels of the business. Factories can be located in different zones according to the availability of raw materials and still be coordinated and monitored from one point. The company can share data through a single unified database and streamline data flow within and between factories. Web access helps the entire enterprise customize its core business processes to the customers and suppliers in developing a competitive advantage. The Web is an asset to any company when properly integrated into the ERP applications. Web-based ERP system provides for online data storage.

Web-based ERP systems lean on the Web Services but also on Service-Oriented Architectures (SOA) for building enterprise business blocks in order to aggregate the benefits of multiple Web Services and to simplify interoperability between them. The company can rationalize operations due to the fact that the information is easily reached by a wide-variety of people anytime, anywhere, which includes mobile equipment such as personal digital assistants (PDAs) and mobile phones.

Web-based ERP solution improves business among customers, suppliers, and partners through self-service portals, providing for lead management, shipment tracking, bill payment and more. There is no software to install, no

hardware to purchase and maintain, and no upgrading requiring complex re-implementation over time.

2. Enterprise Resource Planning Systems

An Enterprise Resource Planning system can be seen as a software solution that helps the management of all processes and data of an enterprise by integrating the business functions into a single system. ERP systems are composed of different modules related to different departments of a company that shares data through a single and unified database. These modules are in fact, software applications that concern the business activities such as finance, logistics, human resources, supply chain, manufacturing, and warehouse management. ERP systems were named differently by different authors, some of them are enterprise systems, enterprise-wide systems, enterprise business systems, integrated vendor software, and enterprise application systems, but however with no significantly different definitions [2]. ERP systems are customizable, standard application software which includes integrated business solutions for the core processes (e.g. production planning and control, warehouse management) and the main administrative functions (e.g., accounting, human resource management) of an enterprise. They are comprehensive package software solutions that seek to integrate the complete range of business processes and functions in order to present a holistic view of the business from a single information and IT architecture.

ERP systems are integrated modules for materials management, finance, accounting, sales and distribution, human resources and other business functions on the same architecture domain linking the enterprise to customers and suppliers. ERP systems are designed to streamline data flow within and between organizations, providing management and other organizational members with direct access to real-time operating information. Ref. [8] defined ERP as a process in which an organization commits to using an integrated set of software packages for key information systems to improve the effectiveness and efficiency of the enterprise. An ERP application is also a software system that manages successfully the relations between various functional departments, the infrastructure of business intelligence and different reporting needs as well as the backbone of business processes and workflows in a corporation.

ERP system stores all company data in a single, relational database. Employees input the data and access it via modules designed specifically for each functional area. Storing all of a company's data in a single, relational database makes it possible to write queries and generate reports that give business leaders a sense of how the

company is doing and where they can make business process improvements to save money and increase profits. A single database makes a complete set of data available to everyone for a holistic view of a company's performance.

ERP software is used by companies in many different industries. However, manufacturing companies are particularly well-suited to ERP systems because the various pieces of the order fulfilment process are connected, making it easier to track orders and coordinate manufacturing, warehouse and shipping functions, especially among different locations. The idea is to help businesses operate more smoothly and provide better customer service than they can with individual systems that are isolated from the rest of the organization.

Enterprise Resource Planning is one of the most useful and effective systems that assists the large as well as a small organization in running their business frequently and also allows the control the overall business process in a systematic way. However, in reality, the majority of an organization in corporate sector fails to implement ERP system successfully due to lack of management engagement and proper selection of ERP vendors as well as software packages [1]. However, cloud-based ERP system is the current technology that developed by the ERP vendors in terms of monitoring the organization activities from any locations.

An ERP system actually maintains a flow within an organization to maintain the basic functions of an organization like purchasing, manufacturing, marketing, business, human resource, sales, customer service etc. The marketers in retail business environment faced lots of issues with the implementation of ERP system within their business operations.

A company doesn't need ERP software to be successful; however, it will force an organization to improve its business processes which can lead to cost savings and increased profit margins. To successfully implement an ERP system, a company must understand why it needs one in the first place and how it will use such a system to improve its operations. An ERP project can take on a life of its own without thoughtful consideration and careful planning. Usually, ERP systems track and automate business functions of the departments of a company. It keeps tracks of monetary transactions of the organization. Traditional ERP software has to be installed and maintained on the site of work whereas cloud ERPS is purely a web-based software. In the web-based ERP model, the software buyers have to pay for the service on an annual or monthly basis. This service helps the organization in removing extra effort of maintenance. In

this case, organization records can be accessed via the Internet, enabling to remotely access their business data through any appliance with internet access.

3. The Benefits Of ERP Software

- It helps businesses improve internal processes.
- It integrates systems from different functional areas, making business operations more efficient.
- Some ERP systems can automate parts of the manufacturing process, which allows organizations to introduce standards that increase productivity, save time and reduce staffing requirements.
- Increased visibility of the order fulfilment process from beginning to end helps reduce work-in-progress inventory and finished goods inventory.
- ERP software can be used to manage employee information across multiple business units, making it easier to track years of service and eligibility for benefits and services.
- Many businesses can purchase ERP software packages tailored to the specific needs of their industry.

4. Review Of Related Works

Web-based ERP s have become popular in areas such as customer relationship management, human resources, and accounting. ERP software is slow as compared to the web-based system. So the ERP vendors started to offer their system in the software as a service, cloud, Model etc [1]. There are only a few options of web-based ERPs in the current market, all ERP vendors offer various types of web services to their system.

Some of the existing ERP systems are Systems Applications and Products (SAP), Oracle, PeopleSoft Inc., J.D. Edwards & Co. There are also a few more newly emerging smaller and midsize ERP vendors including third-party developers competing for the ERP market. The result is stiff competition and feature-overlapping products difficult to differentiate. Due to keen competition for control of the lucrative ERP market share, the vendors are continuously updating their products and adding new technology-based features [6].

5. Statement Of The Problem

Developing an ERP system is ideal for keeping efficient records of customers and suppliers, etc. It is necessary to address the militating problems of tracking down records. The manual system presently being practiced by our present Company involves the use of people, papers, and

pens in record keeping. This method of data processing causes a number of problems which include:

- i. Record maintenance and operations required on a daily basis are broad.
- ii. Lack of timely and reliable information, causing duplication of functions.
- iii. A range of services carried out by different departments calls for substantial efforts to ensure that all business dealings are taken into proper account.
- iv. Records to be kept by the company are often too large, diversified and complex to be processed manually.
- v. A lot of files are kept in office that tracing a particular record at times takes a long time.
- vi. Clients have to visit the company before they can get useful information.
- vii. Information can be lost when records are stolen, misplaced or vandalized.

6. Aim and Objectives of the study

The aim of this work is to develop web-based ERP Information Management System. The system developed will be able to:-

- i. Provide online registration processing for new clients (customers and suppliers).
- ii. Enable confirmed clients to place order/supply goods from anywhere.
- iii. Enhance Security of the system using Short Message Service (SMS) coding.
- iv. Develop a real-time system that has batch processing capabilities.
- v. Build a database of all clients and staff so that clients know exactly who they are dealing with.
- vi. Generate sales, supply and registration reports.

The problems and weaknesses of the present system:

1. Labour intensive: Like many manual systems, the human resource department of the Company requires a lot of human energy for the purpose of its operations. The process of record keeping of list of employee, customers and suppliers records are tedious. It is characterized by low productivity and incompetency.
2. Accessibility: The manual methods of keeping clients records are stored in a way not easily accessible. It involves having to wade through series of files for each client.
3. Error-prone: The process of calculation, compilation, and storage of pay slip, receipts and orders with the use of a manual system is susceptible to a lot of errors.

4. Insecurity: The system is not well secured with manual operations, records can easily be stolen, misplaced or changed without the knowledge of the Administrator, and records could also slip out of files in which they are stored.

7. Analysis of the Proposed System

The new system is web-based Enterprise Resource Planning System for a Company which allows:

- Provides online registration processing for new clients (customers and suppliers).
- Enables confirmed clients to place order/supply goods from anywhere.

With Enhanced Security of the system using Short Message Service (SMS) coding and modules that work in real time with online and batch processing capabilities. It also builds a database of all clients and staff so that clients know exactly who they are dealing with.

8. Advantages of the Proposed System

- Promote good management in the Company. A managerial approach to information will be completely web-based, making information processing an easy job.
- Online processing of the activities being carried out by the company, thereby generating various reports for management with a finger tip (timely information).
- Provide online security for logging in by the introduction of SMS coding.
- Provide online registration/processing for new clients

9. High Level Model

The system design made use of top-down design in processing data. Access to information is made through the homepage. All the subsystems in the program perform a specific task. Below is the top-down design of the new system.

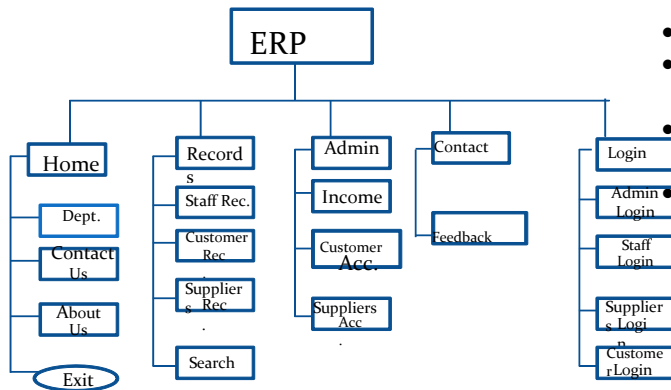


Fig. 1. High Level Model of the New System

With the growing need for data management, an online collection of information, storage, and retrieval has been made possible through new technologies. Enterprise Resource Planning can now be carried out through an online system. Depending on the intended use, there are a number of database architectures in use. Many databases use a combination of strategies but On-line Transaction Processing systems often use row-oriented data store architecture, while data-warehouse and other retrieval-focused applications like Google's BigTable, or bibliographic database (library catalog) systems may use Column-oriented DBMS architecture.

Databases are used in many applications, spanning virtually the entire range of computer software. Databases are the preferred method of storage for large multiuser applications, where coordination between many users is needed. Even individual users find them convenient, and many electronic mail programs and personal organizers are based on standard database technology. Software database divers are available for most database platforms so that application software can use a common Application Programming Interface to retrieve the information stored in a database. So, the web-based information system developed will enable the company to manage their database safely.

10. Review of Achievements

Web-based information management system for the Company has been tested and found to achieve the following:

- Online processing of the activities being carried out by the company, thereby generating various reports for management with a finger tip (timely information).

- Provided online security for logging in by the introduction of SMS coding.
- Provided online registration/processing for new clients.
- Provided Database security.
- Accelerated, integrated and maintained the standardization of business workflows.
- Provided the coordination, cooperation, and integration among the functional units.
- Obstructed the repetitive data entry within the organization, thereby improving accountability and resource management.

11. Areas of Application of Work

The best environment for this software will be our case study Company for registration of its clients (staff, suppliers, and customers), order status, and all other ERP modules implemented. Other corporate bodies that perform similar functions like our case study company can equally use the software. For example, companies can use the modules which suit their daily activities, the Government also inclusive.

12. Contribution to the Body of Knowledge

Web-based information management system for the company will create sanity and objectivity in their activities, and it will expand the use of internet which is not necessarily limited to only Google search, Emails, WhatsApp etc., but software can be developed and integrated into the internet system as in the case of web-based information system for our company which can be accessed through the internet to reduce travelling to the company offices for any update.

13. Recommendations

In order to give the growing trends of Information and Communication Technology (ICT) which involves e-business in the company a vision in the right direction, the following strategies are recommended:

- The Company must be focused in terms of its needs and use of the right technology to achieve the desired goal.
- The Federal Government should assist the company to implement the software developed in terms of finances and logistics to avoid setbacks and as a way of encouraging indigenous companies to do more and grow the economy.
- The participation of government in ensuring focused telecommunication industry must be

visible to reduce the avoidable cost of implementing web-based applications.

- The necessary legal codes backing the company must be established, to counter the legal threat and security posed to online registration.
- Training and Manpower development is another major problem militating against the growth of online business in the country. The Government must make right IT policy by ensuring that Computer, Communication equipment, and other IT infrastructure are manufactured in the country so that people can acquire first-hand necessary skills.

14. Conclusion

The implementation of an online information system for the company will be a big relief for clients can now register with the company, supply raw materials, order goods etc. The hassle and inconveniences involved in travelling to the company's offices to do registration and transact other business with it will be removed. There will be online processing of the activities being carried out by the company, thereby generating various reports for management faster and accurately than a manual system. The system provides online security for logging in by the introduction of SMS coding. It also provides the coordination, cooperation, and integration among the functional units. And also block the repetitive data entry within the organization, thereby improving accountability and resource management.

References

- [1] Al-Johani, .A. and Youssef, .A. (2013). "A Framework for ERP Systems in SME Based on Cloud Computing Technology", IJCCSA, 3(3), pp.1-14.
- [2] Al-Mashari, M., Al-Mudimigh, A., Zairi, M. (2003). "Enterprise resource planning: A taxonomy of critical factors", European Journal of Operational Research, Volume 146, Issue 2, 16 April 2003, ISSN 0377-2217.
- [3] Davenport, .T. (1998). "Living with ERP", CIO Magazine 12, pp 30–32.
- [4] Peter, .S. (2002). "The Process of Migrating ERP to the Web", Bizware Online Applications, Inc. – APICS.
- [5] Rashid, M., Hossain, L., & Patrick, D. (2002). "Enterprise Resource Planning: Global Opportunities & Challenges", Idea Group Publishing. (2002).
- [6] Rashid, M., Hossain, L., & Patrick, D. (2002). "The Evolution of ERP Systems: A Historical Perspective", Idea Group Publishing.
- [7] Robert, G., (1996). "Beyond ERP and MRP II", IIE Sol. 9, 32–35.
- [8] Satzinger, Jackson, .R., and Burd, .S. (2000). "System Analysis and Design", Course Technology Inc.

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