ASEE 2014 Zone I Conference, April 3-5, 2014, University of Bridgeport, Bridgeport, CT, USA.

ERP Systems and their Effects on Organizations: A Proposed Scheme for ERP Success

Khaled Almgren
Computer Science and Engineering Department
University of Bridgeport
Bridgeport, United States
Kalmgren@mail.bridgeport.edu

Cristian Bach
Technology Management Department
University of Bridgeport
Bridgeport, United States
Cbach@bridgeport.edu

Abstract— **The world has become more digitized. Businesses are depending on technology to help them enhance their business processes. Companies are looking for an information system that can handle massive workloads. This is where Enterprise Resource Planning (ERP) systems come into play. An ERP integrates different subsystems into one huge system that shares one database. It enhances productivity and brings more profit to companies (Hasselbring, 2000). The purpose of this paper is to address the effects of ERP systems on organizations. The paper will discuss these issues and present a scheme to overcome them. Research was carried out with articles, as well as books, to gather the suitable resources that will help us in discussing the factors that contribute to ERP systems. Many of the articles are from IEEE journals. A large volume of data was collected that represents millions of users. Analyzing the collected data will give researchers insight into the effects brought about by ERP systems. In addition, the paper will explore these issues and their impacts on organizations.**

Keywords—Enterprise Resource Planning. Customization. Information System.

I. INTRODUCTION

Since the beginning of organizations, methods were researched to improve business processes. This is when computer systems and databases were introduced to the business world. Creating an information system helps the organization to maintain its data and use its processes. At first, it was a great idea to have a computer perform a process much faster than a human can do. It was also unbelievable to store millions of papers into a drive that is smaller than a human's head. However, when businesses started growing more, the need for computer systems has increased. Then, different systems were introduced. But many problems have arisen (Irani, 2002).

It was in the beginning of the 1990s when the enterprise resource planning (ERP) system was first introduced. From the perspective of the business field, it was a great product. But from the perspective of system developers, it was a challenge to implement. The ERP system is not only about integrating different subsystems into one massive system; it is much more than that. It is a system whereby you have an entire electronic organization. However, everything new brings new challenges. ERP has not only brought obstacles to system developers, but to organizations, as well (McGaughey & Gunasekaran, 2007).

The ERP system stands for enterprise resource planning. It is basically an information system that combines different subsystems into one system. This operation is called integration, whereby subsystems are integrated into one system. For example, an organization has three main information systems. The first system handles human resources; the second system handles finance; and the third system handles manufacturing. ERP integrates these three subsystems into one system that shares data among these subsystems. The ERP system should improve efficiency for organizations (McGaughey & Gunasekaran, 2007).

The traditional ERP system is called a back-office system. It is used exclusively by employees and is not for the public or customers. It involves only the core business processes of organizations without involving customers. The main goal of the traditional ERP system is only to improve efficiency (McGaughey & Gunasekaran, 2007).

However, the modern ERP system has broken the boundaries of the back office (Robert Jacobs, 2007) to also include the front office, such as customers. It includes the usage of customers to make it a greater system that handles massive operations (Robert Jacobs, 2007).

The history of ERP systems actually dates back to 1970, with the need for the integration of business processes. But it was not implemented until the beginning of the 1990s. The name itself came about in 1990 by Gartner Group. Software companies started to implement ERP systems in the early 1990s, such as Baan software and SAP (Robert Jacobs, 2007).

SAP released SAP's R/3 in 1992. The system added new features, such as the addition of client-server hardware architecture. The addition of client-server hardware architecture enabled the software to be run on many platforms. Moreover, the system was implemented using an open architecture approach that made it possible for third-party companies to integrate their systems with SAP's R/3.

In 1999, the ERP system made companies, except for IBM, grow much more and control the software market, such as Oracle, SAP, PeopleSoft, and BAAN (Robert Jacobs, 2007).

The year 2000 is one reason why ERP systems have spread around the world. ERP system vendors have addressed the issue of Y2K. These companies and other major ERP systems have implemented packages, such as a system package for universities. Third-party companies customize these packages (Robert Jacobs, 2007). The ERP system brings many benefits to organizations. It brings operations benefits, managerial benefits, strategic benefits, IT infrastructure benefits, and organization benefits. But there are many obstacles to moving to an ERP system (Shang & Seddon).

I. Related work

In order to make an ERP implementation a success, we need a good scheme. Limited studies were conducted in ERP implementation plans. Two of these implementation schemes will be discussed in this section. Most of the studies focus on the critical success factors of ERP success.

There are many factors involved in making the ERP project a success. There are critical factors (Velcu, 2007). These factors will be discussed in this section. According to Umble, there are nine success critical factors.

The first one is a clear understanding of strategic goals. This is the first factor because you need to understand why you want to change to ERP. This factor means that the organization needs to understand what they want to achieve and how they can achieve it. In order to do that, they need to understand the strategic goals (Umble, Haft, & Umble, 2003).

The second factor is commitment by top management. This is very important. The members of top management in any organization are the decision makers. And in order to make the ERP project work, it needs full support from top management (Umble, et al., 2003).

The third factor is excellent project management. A great project management strategy needs to be followed in order to reach success. This involves a clear understanding and definition of objectives. They need to have good work and resource plans. In conclusion, the management needs to track the project progression (Umble, et al., 2003).

The fourth factor is organizational change management. As discussed earlier, the change management is very important because organizations always face resistance from employees and users (Umble, et al., 2003).

The fifth factor is having a great implementation team. As we have seen in some of the previous cases, it is very important to have a great consulting partner. For example, PharmaCo lost money and time because of a poor implementation team that had no experience with Oracle products.

The sixth factor is data accuracy. An organization that implements an ERP system will need to move its data from the old system to the ERP system. This means that the data that is entered into the ERP system has to be correct and accurate; otherwise, it will cause many problems. As we have seen in the CosmeticCo case, the company was put in a bad place because the data format reports were causing problems (Umble, et al., 2003).

The seventh factor is extensive education and training. It is very important to reduce user resistance, and we can achieve that by having training sessions. Educating and training employees is very critical to the success of the ERP project (Umble, et al., 2003).

The eighth factor is focused performance measures. The ERP system performance must be evaluated by the organization to keep track of how the system is meeting the organization's goals.

The ninth and last factor is multi-site issues. It is fundamental to the ERP system, and it is very difficult to implement, so it has to be taken care of by a top implementation team (Umble, et al., 2003).

Another paper also mentioned similar critical factors. They also gave a scheme to lead the project ERP to success. They divided their scheme into four phases: chartering phase, project phase, shakedown phase, and onward and upward phase. Each phase has many tasks, and they are illustrated in the next figure (Nah, Lau, & Kuang, 2001).

II. Problem statement

The ERP system affects organizations. It should improve operations efficiency, simplify business processes, and make life easier for employees. As mentioned previously, there are several factors that motivate organizations to choose an ERP product. However, there are even more factors that lead organizations to not consider going with an ERP product.

Moreover, when implemented, it could majorly affect organizations negatively and move organizations backward.

The purpose of this paper is to address these issues facing organizations, explore how to deal with them, and propose a scheme to overcome these problems.

III. Case study

According to Issues in implementing ERP: A case study, the Water Corporation decided to change their old system because of many failures. After a long search for a solution, the ERP solution was introduced in late 1997. They decided to go with the SAP vendor.

They followed the ERP implementation life cycle; they started in 1997 and finished in 1999. During that time, many training sessions were set up for more than 1000 employees. These training sessions are really good for change control. Everything was going just fine, so they decided to use a sequential deployment whereby each part of the system is brought to life in a sequence.

After the first system was deployed, the problems started to appear. Moreover, they still had to launch the other subsystems because it was a sequential deployment. The system was shutting down a lot. This small problem of transferring data from the old system to the ERP system has caused many problems for the Water Corporation.

First, they had to pay a lot more money to fix these problems. The data was not available, many solutions were proposed, and by the end, the problem was eventually solved, but only after a long time of suffering.
The company paid a lot of money to contractors to fix this problem. The employees were suffering because they could not do their jobs. Management was affected badly because the company was in financial crisis. The whole company was facing a disaster, and some employees were laid off.

In conclusion, there are many people who have proposed strategies for a successful ERP implementation, but only a few who have written about handling these effects after the ERP disaster occurs.

IV. ERP ISSUES

According to Issues in implementing ERP: A case study, the ERP system could improve organizations immensely, but only when implemented correctly. When the system is not implemented correctly, it could affect organizations very badly. It could destroy companies.

These effects will be listed under its category. According to The Impact of Enterprise Resource Planning (ERP) System Implementation on Organization: Case Study ERP Implementation in Indonesia, there are three types of implementation impacts: individual, workgroup, and organizational impacts (Yoon, 2009).

These effects are operational and managerial. Each of these effects could damage organizations severely. These effects bring many issues to organizations. They will be discussed individually under these three categories.
These two effects are shown in Figure 1. The figure shows the two main categories of effects that the ERP system could bring.

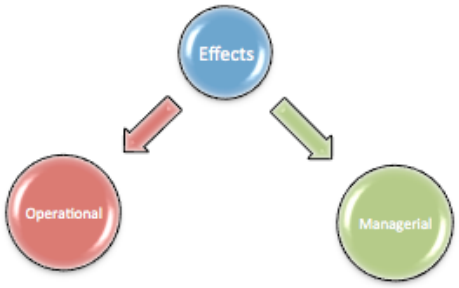

Figure 1 ERP EFFECTS

A. Managerial effects

There are many problems that affect an organization's management. Management is always working to maintain or increase profit. The ERP system could require a lot of money after deployment when problems start to appear. It should reduce costs, which will in turn increase profit (Poston & Grabski, 2001).

But sometimes, as with the case study presented, a company suffers and money is an issue. The money is actually a big issue, because when a company is in financial crisis, it cannot function efficiently. A company starts to cut costs and suddenly it loses its place in the market; usually, it takes a very long time to recover (Mandal & Gunasekaran, 2003).
PharmaCo is a Chinese company that works in medicine. They decided to implement an ERP system in 2000. They purchased an Oracle product and chose a local customization vendor to do the implementation. The management chose the wrong vendor; the vendor had no experience with Oracle products. Eight months later, the implementation was stopped and a new vendor was selected. They lost their money that they paid to the local vendor (Xue, et al., 2005).
These problems are affecting the organizations in general, but also the management department in particular and to a greater extent, because they are the ones who are the decision makers. When you make a decision, you have to deal with the consequences. For example, if the management would have taken more time with exploring consultant vendors, they could have avoided these problems. But they were rushing in making the decision.

B. Operational effects

In order for a system to operate effectively, it has to be implemented very well. The most important factor in the success of the project is the implementation phase (Xue, et al., 2005).
As we have seen in the case study, a technical problem in transferring the data from the old system to the new system has put the Water Corporation in a disastrous situation; the data was simply not available (De Loo, et al.).
Another technical problem that can put an organization in a bad place is what happened with CosmeticCo. It is one of the biggest Chinese companies that works in cosmetics. They decided to immigrate to an ERP system in 1998. They selected AB as their package vendor. The first problem they encountered was that the system was not fully translated into the Chinese language; it still had English words. In addition, the reporting format was not the government-required format, and it also was not compatible with Chinese finance standards. For example, the negative sign is located after the numbers. Moreover, the numbers were overlapped and difficult to read. As a result, they had to fix the reports after they were generated, so the process took much longer than it used to on the old system. The company lost their money on the purchase of the system and suffered because of that. Eventually, they sued the vendor and got their money back after almost two years and had to replace the whole system (Xue, et al., 2005). Although these technical effects impact the organization from an operational perspective more so than from a managerial perspective because operations are stopped, operational and managerial effects overlap, and one affects the other (Law & Ngai, 2007).

I. PROPOSED SOLUTION

As we have seen, there are many effects of the ERP system that have repercussions on an organization. These effects are seen in the case of an ERP disaster. Many schemes have been proposed to prevent these problems from happening, but they continue to occur. In this paper, a scheme will be proposed to overcome these issues. The scheme is called Solve Scheme:

1) First: Managerial effects

As we have seen, the effects of managerial problems are wastes of:

- Time
- Money

The causes can be grouped into three main categories:

- Poor management skills
- Hasty management acts
- Poor decision-making skills

2) Second: Operational effects

As we have seen, the effects of operational problems are:

- Business process shutdown
- Technical problems

The causes are under three main categories:

- Poor consultant vendor
- Poor transfer of data
- Do not apply government standards

A. SUCCESS SCHEME

The figure below is the proposed scheme for overcoming the managerial and operational effects. In order to overcome this disaster, we need to have a good start.

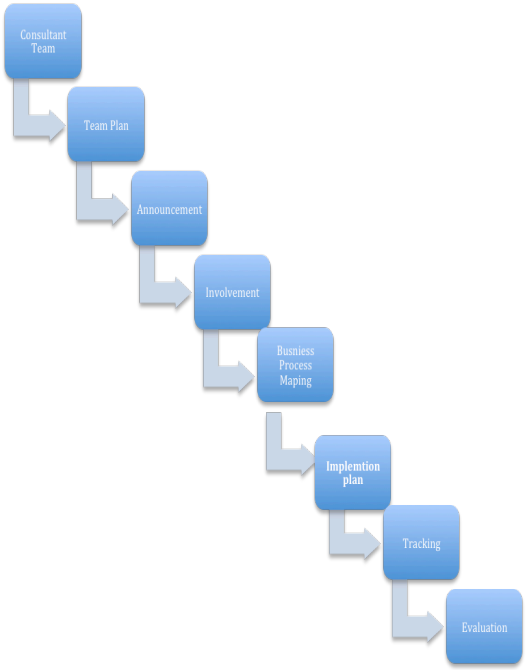

Figure 2 THE SUCCESS SCHEME

First Phase: Consultant Team

In this phase, the top management will form a consultant team from the organization. This team should include experts in three areas: ERP system, business process, and information system. The team should also include consultants from outside of the organization who are experts in ERP products.

Second Phase: Team Plan

In this phase, the team should design a main plan. This plan should specify the phases that they should go through in the project. They are of the following: Specify issues in the current information system; Set up goals; Review proposals; Choose ERP product; Choose integration partner; Implementation; Training; and System Testing.

Third Phase: Announcement

In this phase, the scheme should be announced to all of the employees in the organization. This phase is critical because the involvement of the employees is very important.

Fourth Phase: Involvement

In this phase, the employees will be told how they will be involved in this project. The involvement of the employees will reduce the user resistance. They will also have higher self-esteem toward this project.

Fifth Phase: Business Process Mapping

In this phase, the integration partner will first meet with the consultant team to discuss the main processes of the system. Then they have to go to each department and understand how each business process is carried out.

Sixth Phase: Implementation Plan

In this phase, the integration partner will build the implementation plan. Moreover, they need to discuss this plan with the consultant team and get their approval.

Seventh Phase: Tracking

In this phase, the consultant team will need to track the progress of the implementation with the implementation team. They should track the progress every week and evaluate the progress.

Eighth Phase: Evaluation

In this phase, the consultant team should evaluate the project after it has been done. They should see if it has met the goals that they set.

II. RESULT AND EXPERIMENT

A questionnaire was spread out to a graduate class at the University of Bridgeport, where a presentation was conducted to explain the topic and present the Success Scheme (SS). The class has students from different fields. There were PhD- and master's-level students.

The survey was conducted among 15 people who hold at least a master's degree in an engineering or management major. The table below represents how many people choose a particular choice for questions. For example, when people agree with a choice, it means that they strongly agree with the statement. We use the efficiency equation (Efficiency= Estimated points *100 / Total points) to determine the most important statement. Total points=1500. After analyzing the

data, the fifth statement came out to be the most important phase. The figure below shows the analysis.

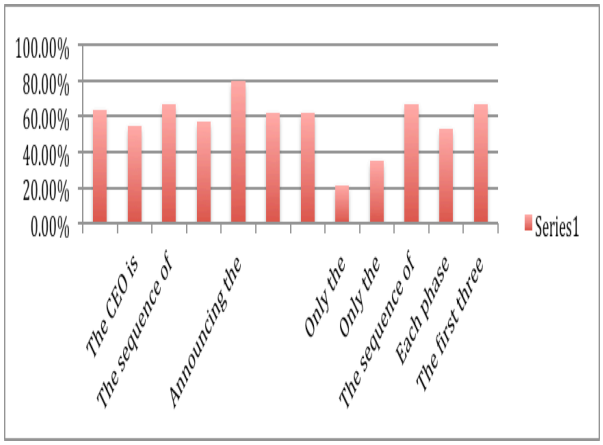

Figure 3 DATA ANALYSIS

IV. CONCLUSION

In conclusion, the paper has discussed several effects of the ERP system. The effects are managerial and operational. The paper has proposed the Success Scheme (SS). The SS consists of eight phases. The scheme was presented and discussed in a graduate-level class, and a questionnaire was conducted. After the analysis of the survey, some modifications on the scheme were made.

The work can be further enhanced. Implementing the scheme in an actual project to test its effectiveness can enhance the scheme, as well as improving the Success Scheme to involve more certain aspects of the ERP project, such as customization.

REFERENCES

[1] Aladwani, A. M. (2001). Change management strategies for successful ERP implementation. *Business Process management journal*, *7*(3), 266-275

[2] De Loo, I., Bots, J., Louwrink, E., Meeuwsen, D., van Moorsel, P., & Rozel, C. The effects of ERP-implementations on organizational benefits in small and medium-sized enterprises in the Netherlands.

[3] Dyer, G. W. J., & Wilkins, A. L. (1991). Better stories, not better constructs, to generate better theory: A rejoinder to Eisenhardt. *Academy of Management Review, 16*(3), 613-619

[4] Gable, G. (1994). Integrating Case Study and Survey Research Methods: An Example in Information Systems. *European Journal of Information Systems, 3*(2), 112-126

[5] Hasselbring, W. (2000). Information system integration. Communications of the ACM, 43(6), 32-38. Holland, C. R., & Light, B. (1999). A critical success factors model for ERP implementation. *Software, IEEE, 16*(3), 30-36

[6] Irani, Z. (2002). Information systems evaluation: navigating through the problem domain. *Information & Management, 40*(1), 11-24.

[7] Kremers, M., & Van Dissel, H. (2000). Enterprise resource planning: ERP system migrations. *Communications of the ACM, 43*(4), 53-56.

[8] Law, C. C. H., & Ngai, E. W. T. (2007). ERP systems adoption: An exploratory study of the organizational factors and impacts of ERP success. *Information & Management, 44*(4), 418-432. theory and research. *Academy of Management Review, 35*(4), 506-509.

[9] Mandal, P., & Gunasekaran, A. (2003). Issues in implementing ERP: a case study. *European Journal of Operational Research, 146*(2), 274-283.

[10] McGaughey, R. E., & Gunasekaran, A. (2007). Enterprise Resource Planning (ERP): Past, Present and Future (pp. 23-35): IGI Global.

[11] Nah, F. F.-H., Lau, J. L.-S., & Kuang, J. (2001). Critical factors for successful implementation of enterprise systems. *Business Process management journal, 7*(3), 285-296.

[12] Poston, R., & Grabski, S. (2001). Financial impacts of enterprise resource planning implementations. *International Journal of Accounting Information Systems, 2*(4), 271-294.

[13] Robert Jacobs, F. (2007). Enterprise resource planning (ERP),ÄîA brief history. *Journal of Operations Management, 25*(2), 357-363.

[14] Shang, S., & Seddon, P. B. (2000). *A comprehensive framework for classifying the benefits of ERP systems*.

[15] Umble, E. J., Haft, R. R., & Umble, M. M. (2003). Enterprise resource planning: Implementation procedures and critical success factors. *European Journal of Operational Research, 146*(2), 241-257.

[16] Velcu, O. (2007). Exploring the effects of ERP systems on organizational performance: evidence from Finnish companies. *Industrial Management & Data Systems, 107*(9), 1316-1334.

[17] Xue, Y., Liang, H., Boulton, W. R., & Snyder, C. A. (2005). ERP implementation failures in China: case studies with implications for ERP vendors. *International journal of production economics, 97*(3), 279-295.

[18] Yoon, C. (2009). The effects of organizational citizenship behaviors on ERP system success. *Computers in Human Behavior, 25*(2), 421-428.