JOURNAL OF APPLIED INTELLIGENT SYSTEMS & INFORMATION SCIENCES
VOL. 1, ISSUE 2, PP. 108-117, DECEMBER 2020.
Available at: www.journal.research.fanap.com
DOI: 10.22034/JAISIS.2021.269964.1019

AN EMPIRICAL RESEARCH ON DEPLOYMENT OF ENTERPRISE RESOURCE PLANNING SYSTEMS: A CASE STUDY

Ramin Amrbar [1], Hojatollah Bardlou [2], Mansour Shiani Kalhori [2, *]
[1] *MIDHCO Company, Tehran, Iran*
[2] *Research Center, FANAP Co., Tehran, Iran.*

ABSTRACT

Implementing enterprise resource planning (ERP) systems is one of the most challenging decisions in any organization. In an attempt to prevent the failure of such an ambitious project, a proper implementation methodology for this solution should be selected and customized according to the conditions of the organization. Therefore, the ERP solution providers apply different approaches and tools to successfully implement ERP solutions. This paper tries to introduce a comprehensive approach to implement and deploy an ERP system. The introduced approach proposes all the necessary measures which need to be adopted in the deployment of enterprise solutions and it can help companies in a structured way to have a successful implementation. This approach has been implemented in a large steel-making company considered as the case study in the present research. The obstacles and challenges of this implementation are fully expressed. The promising results of deployment with such an approach will be described. A key finding in this research is that the integrity and comprehensiveness of deployment could affect the proper performance of ERP implementation.

***KEYWORDS*:** Enterprise resource planning, Deployment, Post-Implementation, Change management.

1. INTRODUCTION

With the inception of information technology in organizations, the first goal of this type of systems was expected to increase the ease, accuracy and speed of activities. With the development of these types of systems and proving the profound impact of using information technology in organizational activities, expectations rose and users of these systems thought of using information technology to make managerial decisions. Thus, the need for integrated systems design and integrated database was felt. Because of increasing the IT usage capacity in this field and increasing the executive experience, it became possible to achieve a set of integrated systems with a centralized database. One of the important tools of information and communication technology that plays an important role in the integration of information and operations in organizations is the enterprise resource planning systems or ERPs, which is currently known as one of the latest planning and management tools in the world.

Enterprise resource planning (ERP), is a modular software system designed to integrate core business processes into a single system for a specific business (O'Leary, 2000). One of the main questions that managers ask when preparing an ERP is how long does it take to implement this system? In fact, they need to know when they can start using this system and the end of the implementation project. As a matter of fact, ERP is not just a software program whose cycle of use would stop just after its purchase and customization. In fact, managers

* *Corresponding Author, email: m.shiani@fanap.ir*

RECEIVED: 26 NOVEMBER, 2020; **ACCEPTED**: 27 DECEMBER, 2020; **PUBLISHED ONLINE:** 28 DECEMBER, 2020

should consider a long-term strategy for implementing and using such systems in order to facilitate its acceptance in the organization and strengthen the functional characteristics of this system.

Chang (2004) divides the ERP life cycle into three phases; 1) *Pre-implementation phase* (denoted as Project chartering phase) comprising selection of vendor and system, and signing a contract. 2) *Implementation phase* (denoted as a Project phase), including the installation and configuration of the ERP system. 3) *Post-implementation phase* (denoted as the Shakedown phase and Onward and Upward phase) which involves fixing the bugs, stabilization, further adaption, training, support and maintenance after the system is rolled out.

One of the most important reasons for the failure of ERP projects is related to the issues arising from the post-implementation stage and during the deployment of these systems in the target organization (Amid et al., 2012). Lack of proper planning for Go-live, lack of user acceptance, lack of proper training, inefficient use of the capabilities of this technology are the main obstacles in this stage of the project. In addition, the users' resistance against the new system is the main reason for the failure of ERP projects. As long as system users do not have the necessary knowledge to make the best use of the new system, because they want to continue working in the same old way, they avoid to give up their old habits and gain new knowledge and experience. The most important factors which play a significant role in the system acceptance include: prioritizing training as well as receiving feedbacks from staff. If they do not use a particular feature in the new system, you need to determine why and how this feature will help them.

In this paper, an attempt has been made to introduce a practical and efficient framework for deployment by examining the best practices in the field of ERP systems. A case study of the deployment of such a system is also presented below, which contains valuable experiences of implementation with the proposed approach. In the next section, we will review the ERP implementation literature in organizations. Then, in the third section, the proposed approach for the implementation of ERP systems is introduced and also the case study is reviewed. In the last part, we will describe the results obtained from the research.

2. LITERATURE REVIEW

There are several failure experiences in ERP implementation projects like Nike (Wong et al., 2003), Harshley (Barker & Frolick, 2003) and HP (Peci & Važan, 2014). A case study of a failed attempt to implement ERP at a big company is described by Al-Mashari & Al-Mudimigh (2003). The main reasons for this failure include scope creep in project, lack of ownership and transference of knowledge, lack of change management, lack of communication, lack of performance measurement and tendency to segregate IT from business affairs. A comprehensive review in the field of ERP post-implementation and its challenges, especially in multinational environments, has been carried out by Osnes et al. (2018). According this study, the conflicts between parent and subsidiaries are one of the most important challenges. Due to the different structure and culture of these entities, each one has different goals which is the source of conflict. Some critical success factors (CSF) such as managerial support and excellent user training for post-implementation stage in ERPs are explained.

ASAP, which stands for Accelerated SAP, has been used for many years as a methodology for deploying SAP projects (Hiquet & Kelly, 1998). ASAP methodology is a set of techniques, methods, instructions and rules for efficient and effective project management. The main purpose of this methodology is to reduce implementation risk, shorten the deployment time and proper use of resources and manpower, and ensure the accuracy of the project outputs. According to ASAP methodology, each project is divided into 6 main phases of Preparation, Blueprint, Realization, Final Preparation, Go-live & Support and RUN.

In 2014, with the introduction of the SAP HANA product, which was based on cloud technology, SAP launched methodology was introduced, which was dedicated to deploying SAP systems in the cloud environment. Then in 2015, SAP introduced its new methodology called SAP Activate, which is used for both cloud and non-cloud systems (On-Promise). SAP has updated this methodology by using its new features in the field of system development in SAP/4 HANA version and with the project agile approach. The steps of implementing this methodology are as follows:

1. **Preparing:** The purpose of this phase is to prepare the organization to start the project. One of the most important steps in this phase is to prepare a pre-configured system that should be the basis for the proposed validation sessions in the next phase. The more comprehensive the pre-prepared system and the more it fit in with the range of customer requirements, the better the next phase will be.
2. **Exploring:** In this phase, SAP standards and process validation are provided to identify and analyze gaps. In this phase, the customer is assured that the business needs can be satisfied. Once the gaps are identified and prioritized, they are scheduled to be filled in the next phase.
3. **Realizing (Training & Integration Test):** Here the system required by the customer is prepared and, it is time for the customer to make sure that the system works properly.
4. **Deploying:** After the test phase and insuring against the operational error of the system, it is time to transfer the data prepared based on the templates provided in the Exploring phase in the system and make a decision about the system execution time.
5. **Running the system:** After the implementation, the support of the system and the end users is very important and, and this phase is aimed at accomplishing system operation in this phase and there is a need for daily control by key users to establish the correct way of system operation after two to three months.

The implementation methodology provided by Oracle is called Application Implementation Method or AIM (Lutovac & Manojlov, 2012). The scope of AIM is very wide and many companies use it. In the first phase (*Defining*), the project is designed and its purpose is to know the goals of the organization and understand the business processes. In this phase, the project team is built and tasks are assigned to the team members. In the second phase (*Operation analysis*), the project team generates business requirements scenarios and the weaknesses of the current system and the proposed solution for the new system. A model for system architecture and customization is formed at this stage. The third phase (*Designing*) deals with the detailed design of new solutions for the business needs of the organization. Also, according to the organization requirements and if it is cost-effective, other selected features can be added to the solution. In the fourth phase (*Production*), development and testing of all the customized parts of the software are conducted, and data conversion and user interface design is formed. In the fifth phase (*Migration*), the project team extends the designed system to the entire organization level. That is, all the components that have been implemented so far are put together. The project team also trains the staff and tests the new system to determine their satisfaction. In the last phase (*Go-live*), ERP is implemented in the real environment. At this stage, standard work processes replace the existing work processes of the organization and all old systems are removed from the workplace.

Another method as a comprehensive approach is called ERP institutionalization. ERP institutionalization expresses the approach in which the ERP system evolves and is institutionalized within an organization. The institutionalization model is based on the analysis of multiple case studies, including three stages and four important events that start from go-live (Maheshwari et al., 2010). These events include the following:

- **First go live**: This step refers to the first time that the ERP system is actually implemented on the site and the beginning of the system deployment process. Depending on the ERP project, users will start using the system. Of course, they have been taught how to use the system, but their main learning takes place here.

- **Technical stability**: Due to insufficient initial training to users and inadequate product maturity, at this stage, some issues that have not been reviewed, identified or resolved since the implementation stage, appear. As a result, the support team is actively involved in resolving these types of issues to prevent future system problems, and user frustration and dissatisfaction. The purpose of this step is to achieve "technical stability" of the system, which can be achieved successfully when the support team is able to solve all problems and reduce the remaining issues to an acceptable and low risk.

- **Semantic stability**: Due to the lack of proper understanding of the system and the constant occurrence of problems, some disorders still persist. Therefore, this step has been developed with the aim of developing a perfect system and will continue until all the problems are solved by the relevant teams. This is where the effectiveness of the system is determined.

• **Decline/Replacement**: This stage is related to the future status of the ERP solution within the organization and whether ERP is stable and effective in meeting the new needs of the organization or not. Otherwise, it may be gradually replaced by a new system.

Despite the variety of approaches that can be adopted in the deployment phase, there is only one approach for each organization. Therefore, the project team should find the right approach, taking into account the various aspects of the specific ERP project of the target organization that are underway. Aspects such as organizational structure, resources, attitudes toward change, or even the distance between different production facilities influence the team's decision about the ERP system (Hasan et al, 2019).

According to this review, having a comprehensive approach that takes into account all aspects of a successful deployment in the organization and then successfully delivers it to the employer is an essential need. In this article, based on this need, a comprehensive and step-by-step approach to deploy organizational solutions has been presented. The challenges of implementing such a product through this deployment in a specific industry will also be presented in the next section.

3. A COMPREHENSIVE METHODOLOGY

Experimental research is a research that focuses on studying and evaluating conditions, as explicitly observed by a researcher. The data thus collected may be compared to a theoretical model, but the findings are still inspired by real life experience. The approach used in this article is also based on this viewpoint. In fact, by examining all the methods and lessons learned from the systems in the articles and the real systems, a comprehensive framework has been provided.

In this section, we present a comprehensive and new approach to establish comprehensive organizational solution. The steps of this deployment model are shown in Fig.1.

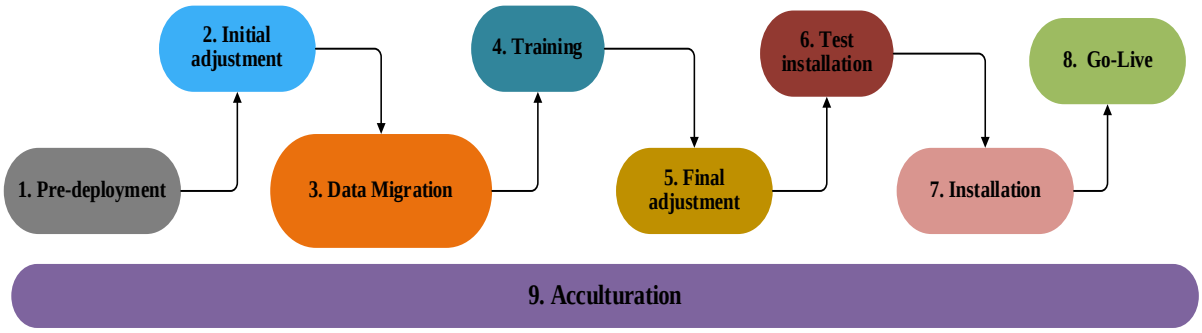

Fig.1 - Proposed Deployment Methodology

Table 1 introduces the steps used in the proposed methodology. As it is shown, some steps have been introduced and emphasized by other references. On the other hand, some steps such as trial installation and acculturation are not mentioned in any reference, and this shows the contribution of the proposed approach.

i. Pre-deployment

One of the most important measures is the management and planning of the deployment process, wherein the delivery schedule of products that can be installed at different sites is determined. In fact, this step includes everything that needs to be conducted before running the system. For example, the first step in training is the standardization of terms which are used in the pre-deployment phase so that everyone involved in the project can use a common language to implement the solution. In addition, the preliminary steps of data migration are also performed during this step:

- Checking the deployment requirements
- Identifying the hardware and physical requirements
- Identifying the type of connections to the hardware as well as their prerequisites

Table 1- Compare the steps provided in the proposed methodology and other references

Step	References
Pre-deployment	Hiquet & Kelly (1998), Lutovac & Manojlov (2012), Shanks (2000)
Initial adjustment	Hiquet & Kelly (1998), Shanks (2000), Al-Mashari, M., & Al-Mudimigh, A. (2003).
Data gathering and migration	Lutovac & Manojlov (2012), Sastry et al., (2013)
Training	Maheshwari et al. (2010), Shanks (2000)
Secondary adjustment	Lutovac & Manojlov (2012), Sastry et al., (2013), Al-Mashari, M., & Al-Mudimigh, A. (2003).
Trial installation	
Installation	Hiquet & Kelly (1998), Lutovac & Manojlov (2012),
Go-live	Hiquet & Kelly (1998), Lutovac & Manojlov (2012), Maheshwari et al. (2010), Sastry et al., (2013), Shanks (2000)
Acculturation	

- Receiving the configuration data and data cleaning
- Identifying solutions available in target factories and companies

ii. Initial adjustment

In this part, it is expected that the new solution will not only meet all the needs of the user covered by the previous processes, but it is also assumed that they optimize the way these processes work. Therefore, it can be concluded that the processes designed in the new solution must be adjusted with the actual processes in the target site. For this purpose, the following measures are taken:

- Identifying the current software solutions
- Identifying the existing software and hardware
- Identifying the non-systematic activities and adding them to the product integration document
- Documentation of each process in each BU
- Drawing a systematic role relationship on formal and informal organizational units
- Determining users and access levels for roles
- Designing alternative processes for the next steps according to the process integration form
- Collecting configuration and original data
- Determining the plan of work centers
- Preparing the installation scenario document

iii. Data gathering and migration

In this phase, the initial information is updated and the latest information used in the work processes of the organization is collected and entered into the system. Data migration is conducted with the goal of configuring the product for work, which includes basic data and configuration. Data migration in experimental deployment takes place in three stages. First, part of the data is transferred with the aim of working the system in an experimental environment and training is achieved based on this data. Then the second stage is done before the initial operation with the aim of running the system, parallel with the previous solution. The third stage is conducted before go-live and with the aim of final exploitation of the product. While considering all business principles and validation in the stage of data collection and implementation of Business processes (BPs), data transfer is achieved automatically and without user intervention and in the shortest time.

iv. Training

Here, all users are taught how to use the solution properly and efficiently. After that, the training is evaluated and a certificate is issued to the hired employees. Acculturation can also be achieved simultaneously with learning. Training is done with the aim of increasing productivity through the growth of knowledge and skills of individuals. At this stage, by identifying the target users, careful planning of system training during the project

stages is conducted. It should be noted that the training program includes specialized and general training for managers, end users and system administrators. There are three types of training at this stage:

- Basic: Including a theoretical discussion about project introduction
- Professional: Including business rules
- General: Including application forms

Also, to make it more useful and user-friendly, a learning system or platform can be designed in which, in addition to downloadable booklets, everyone can also access instructional videos.

v. Secondary adjustment

Essential actions are taken to prepare the system for launch and start using it at this stage. As users become more familiar with system performance, secondary adjustment is provided to fix potential problems. It is noteworthy that this familiarity is the result of the training process mentioned the previous step. At this stage, final tests on performance, security and integration are performed and problems with the required changes are sent to the management team. If a change is required, the implementation team will re-produce the package and apply the change, and this process will continue until the final approval.

vi. Trial installation

Here, the solution needs to be installed on the test server so that the end users can work with the system in real time (in real conditions with real data) in a test interval and provide their feedback. To install the packages, the servers should be transferred to the client site and the required operating systems and databases must be installed on them and then each product will be installed on the server. Since the hardware requirements have been reviewed in the previous steps, the hardware installation should also be followed at this stage. Test installation of each product is performed to achieve the necessary stability of the system. If changes are needed, the executive team will consider the change cycle and this process will continue until the final approval. During the trial period, tasks are gradually transferred to users to ensure the capabilities of the system before the go-live phase.

vii. Installation

At this stage, the developed system is launched on the main server for the operational use of the users. One of the most important measures at this stage is weighing the maneuver. In fact, some time before Go Live, all the settings of the purchasing, sale, warehousing and weighing systems must be entered in the main server. In a systematic process, the test server is synchronized with the main server. After that, all input and output weights of the site(s) must be executed in the test server without any problems.

viii. Go-live

After the test period and the confirmation of the system performance, the system goes live. At this stage, if the servers are separate, it may be necessary to retransmit information and transactions and be approved by the customer. Go-live is not an event but a long-term trend. In fact, this process continues until the target organization is approved, and then the project enters the support phase. Notably, the Go-live event is a key period in which initial feedback from users and deployment officers can be obtained and appropriate improvements can be made.

ix. Acculturation

Each ERP system must be customized based on its specific cultural context to be more user-friendly. In fact, in the deployment phase, cultural measures are crucial to reduce users' resistance to change. Acculturation continues throughout the deployment phase and all the necessary steps are taken to prepare target company in the field of working culture for the successful launch of the system. Some of the goals of acculturation are:

- Introducing the project
- Expressing the benefits of the project
- Having the impact of the project on individual employment (change management)
- Developing the individual and professional skills by acquiring project knowledge
- Accompanying and participating in project implementation
- Accompany with systemic thinking

Various actions can be taken in this regard. For example, system users who earn high scores in system training courses will be rewarded. Managers should also emphasize the importance of setting up such a system.

4. A CASE STUDY AND ITS CHALLENGES

FANAP Company was established as an IT company in 2005 with the support of Pasargad Bank. The initial mission of this company was to design and prepare a core banking solution. Then, FANAP expanded its activities in IT industry by providing financial solutions, insurance solutions, stock exchanges, and financial transaction management and processing. The main areas of activity of this company are financial and payment technology, infrastructure and communication technology, content and value-added services, venture capitalization, and enterprise solutions and e-government. On the other hand, MIDHCO Holding has started to invest in the mines and mining industries. This holding includes several subsidiaries that work together to achieve the ultimate goal of the company. The management of this holding and its subsidiaries requires a great deal of coordination. Therefore, the company needs an efficient and integrated product to integrate its processes.

MIDRP solution, as a total enterprise solution which is produced in FANAP IT company, has been successfully implemented in one of the largest steel-making holdings called MIDHCO. This solution, which consists of 13 product groups, includes a set of process-oriented modules that comprehensively integrated and all the affairs and processes of companies and organizations in all areas, including financial systems, human resources, administrative affairs, and supply chain. In fact, this comprehensive product is designed to meet all the needs of a particular industry, such as the steel-making industry.

The deployment of the MIDRP system at MIDHCO, as a large steel-making company, was a successful implementation after an unpleasant experience. In fact, in the deployment phase, all the previous steps regarding the design and implementation of the MIDRP solution will be showcased and its strengths and weaknesses will be revealed. By testing the product in one of the factories, it can be concluded whether this solution can be implemented in the whole holding or not. Creating a culture and changing the mindset of users to abandon the old system and get used to the new system was one of the major problems facing this deployment. Below we describe the basic challenges of setting up a deployment framework and related strategies.

The post-implementation phase refers to the fact that although the ERP implementation is over, the final solution presented brings with it a whole new work environment. This naturally affects the way people work and as a result causes them to resist. In addition, MIDRP was designed and developed to meet all the needs of system users, both basic and complex, such as real-time analytics and advanced reporting. The essential point is that the system setup is a stage in which the first perception of the system users of the product is formed. This initial insight definitely influences their thinking about the product, which leads to acceptance, resistance or rejection of the product. As a result, the demand for a new product will require a coherent change management program that is more in control of the product deployment requirements. Needless to say, there is a great deal of demand here for a comprehensive change management plan to begin preparing the target environment for future change.

A pilot plant is required to start the deployment phase, and MIDHCO, the largest subsidiary with different products, has been selected for this phase. The reason for choosing this subsidiary was that it has the most complex procedures and processes available and can play a vital role in assessing the MIDRP solution to these complexities. Regardless of the amount of money invested in this phase of the project, a lot of time and energy have been spent on deployment. However, the unique inherent nature of the project and the immaturity led to a disappointing result.

As a result of the MIDRP deployment, it has been observed that the system does not work properly and does not meet the needs of the users. In fact, in addition to the problem of users coping with the package, there were other major issues such as system slowdowns and in many cases the problems the users encountered while performing their tasks. In fact, the nature of their job requires a real-time operating system with the expected speed to which MIDRP may not be very responsive at this point.

The first problem identified was that, as mentioned earlier, the MIDRP package could only handle some parts of the operation. It actually provides users with output that should be used as input to systems other than MIDRP, systems that worked in the company before MIDRP. For instance, MIDRP output of the weighing

system was used as input to another financial solution that was unacceptable to the user. This means that either the deployment model is not sufficiently met or the users are not patient and cooperative enough.

According to the deployment project manager, the second problem was that although the large pilot site was useful for optimizing and maturing the system, for many reasons choosing it as a pilot was not the best decision. First, as the term "pilot" implies the scope of the pilot site should be tested only to ensure the success of the system or product. Another fact was that many MIDRP expert users were not qualified and sometimes could not fully understand business processes. Therefore, FANAP professionals need to be taught the business process and the way it works through the MIDRP system.

Third and most importantly, the primary products to be used did not fully cover all stages of the steel production chain. The chain that includes MIDHCO core activities, from the moment of weighing to the last step when creating an accounting coupon. FANAP experts somehow knew that their MIDRP package might not fully cover the entire process in the chain, so they preferred to have other solutions in addition to MIDRP so that if MIDRP did not work well, there was a risk of data loss. This may indicate the role of the system test in this project. Although the system test was conducted formally in the system development stages, the results of these system tests were not taken seriously by the project team.

Another major problem identified was the lack of integration between work processes and systems. As mentioned earlier, as the comprehensiveness and integration of a software package increases, so does the complexity of its analysis and development. At the beginning of the project, when the scope was reviewed, the processes were analyzed and designed to take into account all the connections they needed. But in a large-scale project like MIDRP, it may be impossible to identify all the potential connections in advance. For this reason, in the first deployment, many of the problems were appeared due to this lack of integration and incomplete communication between processes. Naturally, when one process fails to obtain the data from another process needed to perform an operation, its performance is disrupted. Therefore, it is a great lesson for those involved in this project that deployment will not be successful until the products are fully mature.

Regardless of the reasons, the failure of the first deployment led to a turning point in the whole project and a new approach and mindset was formed. FANAP was given another chance to prove the performance of the MIDRP system. Aware of the functional weaknesses of this solution, FANAP decided to change its model to a new one. Now, FANAP team is focused on designing a model that can achieve the integrated performance of all modules, including accounting, purchasing, sales, treasury, and more. The adoption of this new approach led the project team to make fundamental changes in the project management framework. The project team, taking into account previous unsuccessful attempts and maturity, this time decided to choose a smaller subsidiary that has almost less challenges in trying to successfully deploy MIDRP processes.

So, based on the new model, integration is the most important concern that needs to be addressed. In fact, this was a point that was not taken into account in the first deployment. For this purpose, all processes and their connections with other systems were identified. For each process, a diagram of the relationship between that particular process and other systems processes was drawn, which provides a map for the project team to develop these connections. Although the second pilot deployment was successful, it had its own problems and challenges. While system integration was achieved this time, system performance was the most challenging issue. In order to manage the challenges the project team encountered, this time FANAP project management developed a method for tracking the issues. In addition to system integration, having a way to track issues that affect system performance for whatever reason was the most important approach used to remove deployment barriers. Therefore, this was a point that was not taken into account in the initial deployment.

This deployment model could be an important achievement for both the solution provider, FANAP, and MIDHCO as the employer. On the one hand, in the employer organization, there was a guarantee that all aspects of the deployment, including the necessary adjustments and tests, were performed. As a result, the deployment proceeded with a pre-planned model, and the common problems in such deployments were reduced as much as possible. This approach also led to user acceptance and managerial support and this made it easier and faster to deploy the system inside the organization. On the other hand, the solution provider, FANAP, also came up with

a holistic approach to a new deployment methodology after a failed deployment experience. This model is the result of examining the best practices as well as FANAP's experiences in previous deployments. Acculturation from the beginning to the end of the deployment process was one of the most important achievements that is emphasized in this approach.

5. CONCLUSION

This article presents a comprehensive and practical approach to deploy an ERP system. Implementing the ERP solution has always been one of the major challenges for manufacturers of these products, which can lead to the failure of such projects. Large companies have gained extensive experience by implementing various implementation projects and deploying ERP systems, and each of them has provided a deploying methodology according to the characteristics of their products.

The approach studied in this paper is used in MIDRP solution, which is an organizational solution designed by FANAP company, and various aspects of its implementation were described in detail. The challenges and experiences gained from this implementation were also described. But using the results of the implementation of such products can be a way forward for many companies producing enterprise solutions. For example, the first deployment, or pilot, is very crucial. The question that must be answered is concerned with the level of product readiness adequate for the experimental deployment phase? Or is the environment in which the system is expected to be deployed ready for a change? On the other hand, since implementing ERP systems is a challenging issue for all companies, having a holistic approach can be a useful guide for all of them. For example, which tests should be conducted before go-live is very vital.

Naturally, the solution provider and the customer sites should evince adequate readiness for the deployment and specially Go-live date. Adequate maturity of developed products is one of the key points. Deploying products can be problematic until the products are efficient enough to be implemented in the customer site. Numerous pre-deployment tests can ensure a successful implementation. Also, the support of the senior managers of the employing organization for the institutionalization of this product can be a very effective stimulus in accelerating the deployment process. Numerous factors can contribute to the successful implementation of deploying enterprise products, but the use of approaches that have been the result of successful experiences can show the right path to organizations.

As suggested pathways for future research, the use of this approach and its analysis can be examined by implementation in different environments or compared with other methods. Providing suggestions for improving the current framework can also be an effective step in completing this methodology.

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