Chapter 10
Enterprise Resource Planning System Implementation in Higher Education Institutions: A Theoretical Review

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ABSTRACT

The world over, higher education institutions have resorted to the use of ERP system to automate operations on a standardized platform in line with their strategic plans. This is because ERP system supports a "do-it-all" approach to organizational management in addition to education managers' quest to improve quality of service to their students and the need to meet regional as well as global standards. In most institutions, operational areas such as student admission, finance, procurement, examination management, staffing, and alumni management can now be done through the ERP system. This chapter examines the issues associated with implementation of ERP system in higher education institutions. After studying this chapter, you should be able to: appreciate the various strategies for ERP system implementation, identify the factors leading to successful implementation of ERP system in higher education institutions, distinguish between the different models for successful ERP system implementation, and understand the metrics for measuring success rate of ERP system implementation.

DOI: 10.4018/978-1-5225-7678-5.ch010

CHOICE OF AN ERP SYSTEM FOR HIGHER EDUCATION INSTITUTIONS

The selection of an ERP system might be complicated as it is affected by various factors. These factors influence an ERP implementation success both technical and non-technical. Alanbay (2005) posited that long-term business strategy of the organization will form the basis of the selection criteria of an ERP system. He identified fifteen factors and prioritized them as follows: Customization, Real Time Changes, Implementability, Maintenance, Flexibility, User Friendliness, Cost, Systems, Requirements, After Sales Support & Training, Internet Integration, Reporting & Analysis Features, Vendor Credentials, Integration with Other Software, Back-up System and Financing Options.

Hasibua and Dantes (2012) explained twenty key success factors. These are Team Work, User Involvement, Use of Consultant, Clear Goal and Objective, Top Management Support, Project Budget, Project Time, Organization Maturity Level, Culture Readiness, ERP Implementation Strategy, ERP Implementation Methodology, Project Management, Change Management, Risk Management, Business Process Reengineering, Data analysis and migration, Communication, Training, Technology Infrastructure and Strong ERP product. These factors also have a bearing on the choice of the implementation strategy to be used. The following section discusses the choice of the implementation strategy to be used.

CHOICE OF ERP SYSTEM IMPLEMENTATION STRATEGY

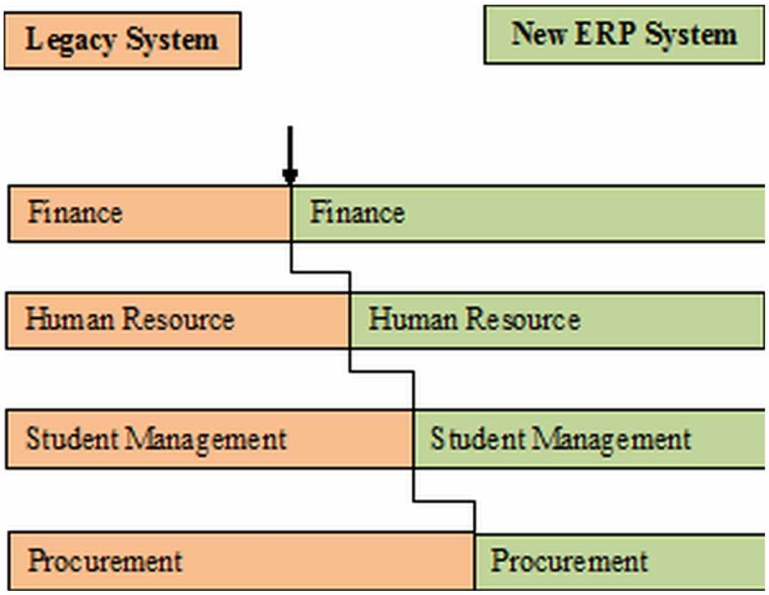
The rising stakeholders' expectations (particularly from students and governments), quality and performance requirements, and competitive education environments, along with decreasing governmental support, have pressured universities to adopt new strategies in order to improve their performance. Consequently, the higher education sector has turned to Enterprise Resource Planning (ERP) systems in the hope of helping them to cope with the changing environment. For these institutions, ERP system implementation can be a daunting task, often taking a number of months to complete and costing more than the price of the hardware and system involved. However, if you are prepared, and the proper resources are applied, ERP system implementation can be completed on time, within budget, and delivering excellent return on investment (ROI). In most cases, the choice of the strategy for the implementation is important. The prospect can be set for the successful implementation of an ERP system by controlling and minimizing the major risks at the initial stage by selecting the appropriate strategy that determines how the ERP system should be deployed. The feasibility of strategy is based on a number of factors, among

them include: the impact on the organization, the complexity of the institution, the duration, risk and the available budget. The following section describes the different strategies, advantages and disadvantages for each of the strategy.

Phased Strategy

A phased approach describes a scenario where elements or modules of the ERP system are introduced in a planned sequence, replacing the old systems gradually as shown in figure 1. The phased approach, implements one practical element at a time, in chronological order as shown in figure 1. Autonomous modules of ERP systems are installed in each unit, while integration of ERP modules is done at later stage of the project. This has been the most commonly used method of ERP implementation. Each business unit may have its own "instances" of ERP and database. Modular (phased) implementation reduces the risk of the installation, customization and operation of ERP systems by reducing the scope of the implementation. The unbeaten implementation of one module can help the overall success of an ERP project. The interface programs that are used in this strategy bridge the gap between the inheritance ERP system and the new ERP system until the new ERP system becomes fully purposeful. This strategy is often used in situations that do not have strong centralized synchronization in the ERP project. Some of the advantages of this

Figure 1. Phased ERP system implementation

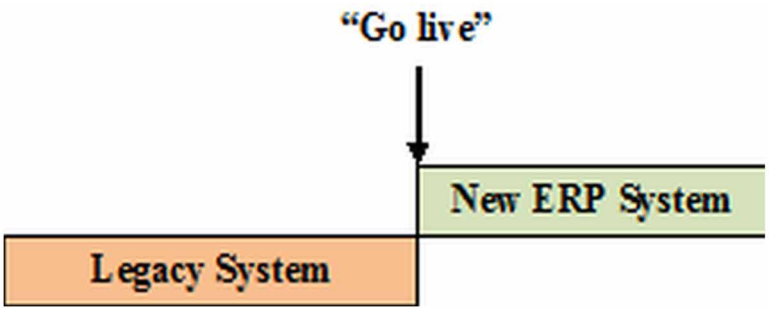


strategy are: the strategy is more user-friendly. Since the new system is implemented in one department at a time, the implementers are able to draw their attention to training one department effectively to using the new system before moving to the next. Again, as the system is tested at every stage, there is very little chance of error. The main drawback of this strategy is that it takes a lot of time to implement the whole new system to the entire organization.

Big Bang Strategy

Big bang strategy is the one where all of the main modules of an ERP system go live at the same time. The big bang approach is also called 'Direct cutover'. In this strategy, the installation of the ERP system of all modules happens across the entire organization at once, with the changeover from the old system to the new system occurring immediately the new system becomes operational as shown in Figure 2. This approach may be used if the operating environment cannot support both the legacy and new systems or they are incompatible. This strategy promised to reduce the integration cost in the condition of thorough and careful execution. It is not very time consuming as once the old system has stopped being used the new system is immediately being set up. The strategy dominated early ERP implementations and it partially contributed to the higher failure rate in ERP implementations. However, in recent years, higher education institutions are hesitant to use big bang approach as it consumes too many resources to support the go-live of the ERP system. It is also very difficult to detect small errors in the new system. In addition, if the system has not been implemented properly the new system may fail to work and this will affect the whole organization. Success in using the big bang approach comes with careful preparation and planning. But many struggle to decide whether the big bang approach is the right selection or not for their endeavor.

Figure 2. Big bang ERP system implementation



Parallel Strategy

In the Parallel implementation strategy, both the legacy system and the new ERP system are kept active for a length of time until everyone is assured that the new system is running smoothly (Vermaat, 2016) as shown in Figure 3.

The amount of time for which both systems are in operation ranges from one day to several months and may even span to several years. In this approach, portions of the same functional areas (including software) such as finance, procurement, examinations, human resource etc. operate at the same time for both the legacy system and the ERP system. One of the advantages of the parallel strategy is that it has good improvement options in case something goes off-center. By using the parallel method, small minor errors can be easily seen. Organizations are able to fix any problems with the new system before ending the previous system. Since both the legacy system and the new ERP system are in function at the same time for a particular module, the institution's business processes will not be broken up if the new ERP system breakdowns. The parallel approach also provides the most reasonable number-to-number comparisons to authenticate that the new ERP system is performing the necessary business process flows. This strategy is ideally suited for mission critical situations that cannot survive a major break down of an ERP system. One of the drawbacks of this strategy is that it is very expensive and requires a huge resource outlay. In addition, operating two systems simultaneously is also very time consuming and stressful as there is more work involved, such as creating more reports.

Pilot Strategy

The pilot strategy is carried out in one isolated part of the institution, for example, a department mainly for testing the new system in different environments. The pilot strategy is very helpful for organizations which have several locations. If the implementation works, then the system may be implemented in the rest of the

Figure 3. Parallel ERP system implementation

organization simultaneously or in stages. Pilot implementation allows an organization to validate its approach for full application deployment. Executing an application pilot can uncover operability issues associated with production-like conditions and provide an opportunity to address these issues before full application roll out. To effectively prepare for a pilot implementation, an organization should develop a detailed pilot approach, identify appropriate participants, plan the pilot environment, and determine how to monitor the pilot. According to O'Brien and Marakas (2006) the pilot strategy help in reducing risks compared to the direct cutover strategy. The strategy also allows the organization to see whether the new system will meet the organization's needs in one department/location before using it throughout the entire organization. One of the drawbacks of this strategy is that too much time is involved while testing the system in one location. There is also increased development and labor costs.

Hybrid Strategy

The Hybrid strategy is the combination of any of the above implementation strategies such as, phasing and parallel implementation strategy. The hybrid strategy tends to evolve into the needed agreement as ERP team members study and consider information. The complexity of a hybrid strategy varies tremendously depending upon the state. Small single-site ERP implementations tend to have simpler hybrid strategies than those used by large institutions with many dissimilar environmental locations. Many implementations use hybrid strategies because they are flexible in adapting to the specific needs of the situation. With the hybrid strategy, industries can exclusively adjust implementations for their needs.

FACTORS IN THE CHOICE OF THE STRATEGY

Migration from one system to another system occurs in almost every organization. In most cases, each of the implementation strategies discussed above may require the organization to alter hardware or operating systems. Therefore, it is important for organizations to identify the best strategy to adopt that matches the organizations purpose. If an unsuitable strategy is chosen, the organization may potentially cause risk to the future of the organization. It is advisable that an organization starts with the use of a costs-benefit analysis determining whether to implement an ERP system before making a decision on which strategy to use while implementing an ERP system. The choice of strategy depends mainly on organizational characteristics

such as its size, structure, complexity and controls within the organization. More often than not, smaller and less complex organizations use the Big Bang approach whereas the larger and more complex organizations often use a phased strategy. A smaller organization using the Big-Bang strategy bears little risk whereas it is more appropriate for a larger organization to use a phased strategy. This is because risks of failure and no fallback are minimal. According to Welti (1999) the implementation strategy should be adopted on the basis of available people, expertise, financing and time which would impact on the objectives of the project and the costs.

The final decision to change to the new system is arrived at by ensuring broad consultations among the various stakeholders and with due regard to the nature of the business and the degree of acceptable risk. While investigating the factors influencing ERP implementation strategies in three countries with over 200 companies Johansson and Sudzina (2008) saw some indication that the factors influencing the choice of implementation strategy include: Chief information officer; Country; IS/IT Strategy; Organization Size and Growth.

SUCCESS FACTORS IN ERP SYSTEM IMPLEMENTATION

Many researchers have identified factors that affect the implementation of ERP systems. In the literature, researchers (Ramaprasad & Williams, 2000; Kuang, Lau, & Nah, 2001; Kumar, Kumar, & Maheshwari, 2003; Garg, 2010; Ziemba & Obłąk, 2013; Alsabaawi, 2015) have talked about Critical Success Factors (CSFs) and Critical Failure Factors (CFFs). They concluded that ERP can be identified when the business organization can achieve its objectives at the most desired duration and according to the most specific budget. Higher education institutions are of different sizes and scales. Whether these institutions have already implemented or are in the process of implementing ERP systems, the aim is to gain the benefit of integration and competitiveness advantages. In markets, reports show that 75% of the ERP projects are classified as failures (Garg, 2010). Among these factors include top management support, team work, communication, project management, change management, education and training, and user involvement. Table 1 presents a Summary of Critical Success Factors in ERP System Implementation as identified from the literature.

The following section discusses these factors and how they affect ERP system implementation in Higher Education Institutions.

Table 1. Summary of critical success factors in ERP system implementation

	Category	Factors
1	**User Factors**	User participation and involvement
		User Attitude
		Computer Self Efficacy
2	**Organizational Factors**	Top Management Support and commitment
		User Education and Training
		Clear Change Management
		Effective Communication
		Business Process Re-engineering
		Effective Project Management
3	**Technological Factors**	Technological Complexity
		Technological Compatibility
		Technical Support
		System Reliability
		Suitability of the software package

User Factors

User Participation and Involvement

End users are the people who have direct contact with the ERP system. User involvement can help increase employees' commitment to their job, as well as help build trust and loyalty to the institution. This participation and involvement of users is encouraged to ensure that user requirements are met, to gain user commitment, and to avoid user resistance. In addition, it helps employees to feel as if they are running their own institution leading them to provide the best of what they have to offer. User involvement is effective because it restores or enhances perceived control through participating the whole project plan. In implementing ERP systems, Zhang et al. (2003) finds that there are two areas for user involvement: (1) user involvement in the stage of definition of the institution's ERP system needs, and (2) during the implementation of ERP systems. Often, institutions do not recognize the impact of choosing the right internal employees with the right skill set. The internal resources should not only be experts in the institutional processes but also knowledgeable of information systems application in the industry. Involving the users in the stage of

defining organizational information system needs can help reduce their resistance to the potential ERP systems, since they feel that they are the ones who choose and made the decision.

User Attitude

The attitude towards ERP system use is the behavioral tendency of users to like or dislike the usage of the implemented information systems (Hwang, 2005). Users with positive attitude and morale towards an ERP system make its implementation a success. Where users of a system are motivated to use the ERP system, they are more likely to try out any new information technology applications. Therefore, user preparedness before the implementation of an ERP system is essential to obtain a positive attitude. Positive attitude towards an ERP system frequently generate positive behavior. When system user does not adopt a positive attitude, he/she tends to follow practices that will ultimately affect their performance in the medium and long term. ERP System users will be willing to use the system to do their work if they feel the system assists them attain their interests and personal goals.

Computer Self Efficacy

Self-efficacy is a measure of a user's confidence in his/her ability to use a technology (Taylor & Todd, 1995). It is not concerned with the skills one has, but with the judgments of what one can do with whatever skills one possesses. In the context of using technology, computer self -efficacy, therefore, can be described as a judgement of one's capability to use a computer and the applications thereof, and is an important precursor of perceived usefulness. In the study by Agarwal and Karahanna (2000), computer self-efficacy was found to play an important role in explaining usage intention through perceived usefulness in a voluntary context. Venkatesh (2003) modelled and empirically tested the determinants of perceived ease of use and found that an individual's computer self-efficacy is a strong determinant of perceived ease of use and behavioral intention. Therefore, users who are computer savvy are more likely to use an ERP system since they feel being more capable of using technology.

Organizational Factors

Top Management Support and Commitment

Many studies have stressed the importance of top management support as a necessary ingredient in successful ERP implementation (Ziemba & Obłąk, 2013; Rajan & Baral, 2015; Yaşar & Gökhan, 2016). The mission of top management is to create

a favorable environment for the implementation of ERP systems and attaining of desired results. Top management is necessary for ERP implementation due to the fact that it is a highly integrated information system that requires the complete cooperation of employees from all departments of the institution. Top management support can play a useful role in settling disputes and in providing clear signals to any doubts. Top management must create an environment for implementing an ERP system and obtained results and must be seen as a participant in the implementation.

According to Zhang, et al. (2003) top management support in ERP system implementation has two main facets: (1) providing leadership; and (2) providing the necessary resources. To implement an ERP system smoothly and successfully, higher education institutions require a steering committee to participate in team meetings and monitor the implementation efforts, spend time with people and provide clear directions of the project. Willingness to provide the necessary resources is another indicator of top management commitment to the ERP project. The implementation could be seriously handicapped if some of the critical resources (e.g., people, funds and equipment) are not available.

User Education and Training

Education and training refers to the process of providing management and employees with the logic and overall concepts of ERP system. ERP education and training increases the level of proficiency since it affects the shared beliefs about the benefits of the ERP system. Training also makes the users comfortable with the system and increases their expertise and knowledge level. At the end of training, users get rid of the worries about the system and they become a part of it. Through education and training; users get a better understanding of how their jobs are related to other functional areas within the institution. The user is the person who produce results and should be held accountable for making the system perform to expectations. The main reason for education and training is to increase the expertise and knowledge level of the people within the institution. According to Zhang, et al. (2003) the three aspects concerning the contents of training are: (1) logic and concepts of ERP; (2) Features of the ERP system software; and (3) hands-on training. Each of these aspects plays a vital role in the implementation of an ERP system such as providing an understanding of the processes as well as decreasing the fear that users might have towards the new systems.

Clear Change Management

Introducing new software such as ERP in an institution changes the way jobs are done. User resistance has been associated with information system change like ERP systems. ERP systems introduce a large-scale change that can cause resistance, confusion, redundancies, and errors that make the change management essential. In most cases, users resist a new system because they are worried that their job might be eliminated or be changed from their usual way of doing things. Managing change within the organization includes creating some balance of the forces that stand behind change against those forces that reject change. The success of ERP implementation can be said to be directly proportionate to an organization's determination to undergo changes. As such, an effective change management strategy can help the organization change and improve its analysis capabilities as well as helping the implementation processes to be carried out smoothly and effectively.

Effective Project Management

Project Management has evolved over the years in order to plan, coordinate and control the complex and diverse activities of modern industrial and commercial projects. Every institution should have an effective project management strategy to control the implementation process, avoiding overrun of budget and ensuring the implementation within schedule. One of the important things that management of higher education institutions should take note of is the project scope. Since ERP systems implementation is very complex, and often involves all business functions as well as requires anywhere between one and two years of effort, a project scope should be clearly defined and should identify the modules selected for implementation Zhang, et al. (2003) suggests that there are five major parts of project management: (1) having a formal implementation plan, (2) a realistic time frame, (3) having periodic project status meetings, (4) having an effective project leader who is also a champion, and (5) having project team members who are stakeholders. The formal project implementation plan defines project activities, commits personnel to those activities, and promotes organizational support by organizing the implementation process (Sum, Ang, & Yeo, 1997). Having a realistic time frame is very important. If the target completion time schedule were unrealistically short, the pressure to rush through would result in the implementation being carried out in a haphazard manner. Conversely, if the implementation is delayed for too long, people would tend to lose faith and/or patience with the system, which also will result in low

morale and resistance. Conducting periodic project status meetings in which each team member reports progress and problems is an invaluable means for evaluating the progress of the ERP implementation. Similarly, selecting the right project leader is also important for the project implementation success.

Effective Communication

Effective communication is an essential factor in implementing ERP systems. In fact, the lack of communication has been linked to many project failures. Communication provides the path through which users from different functional areas share important information that can lead to successful implementation of ERP systems. Since an ERP system is an integrated information system, its design, installation and use require close co-operation of all users. A full and open communication influences success and facilitates the education within the institution. In addition, communication can be a key driver in knowledge management. It helps distribute the knowledge among employees in an institution so that everyone remains knowledgeable about any particular task. Given the benefits mentioned above, communication can be considered the glue that holds the whole institution as well as the teams together. It builds strong social relationships that help system users to cross over the hard time that they face during implementation as well as the development of trust and exchange of information needed.

Business Process Reengineering

The implementation of an ERP system in an organization is often accompanied by substantial changes in organizational structure and ways of working (Kallunki, Laitinen, & Silvola, 2011). This is called Business process re-engineering (BPR). According to Hammer and Champy (2001) business process re-engineering is "the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service and speed". A fairly serious problem of ERP implementation lies in a system's incompatibility with an organization's business processes and its information provision needs. Thus, implementing an ERP system involves reengineering the existing business processes to the best business process standard.

When selecting an ERP system, organizations usually consult specialists, who recommend the systems that best meet their needs. However, irrespective of the suitability of a system, there is no universal ERP system that exists that is suitable for all institutions. In the course of ERP implementation, an institution almost always needs to decide whether to reorganize her business processes according to the logic proposed by a system or to modify the system by adapting it for existing

business processes. An ERP system in itself cannot improve an institution's work until it restructures its business processes. In order to obtain tangible benefits provided by an ERP system, it is necessary to reorganize institution's business processes according to the logic proposed by a system. Therefore, an institution must be prepared to accept the best practice contained in an ERP system and model its business processes accordingly.

Technological Factors

Technological Complexity

The implementation of ERP systems is a complex technological undertaking. Technological complexity is the extent to which a new technology is more complicated for its users than the previous technology used for the same or similar work, and represents an increase in the number of things the user must do at once (Aiman-Smith & Green, 2002). The complex nature of ERP systems limits the amount of knowledge that users can absorb before actual usage. The higher the complexity of the system, the higher mental workload and stress (Rajan & Baral, 2015). The complexity of the ERP system can negatively affect user's attitudes towards using it. This eventually affects its successful implementation in an institution.

Technological Compatibility

Technological compatibility is the compatibility rate between an organization's present technology and systems and new system (Yaşar & Gökhan, 2016). Technological compatibility is considered as one of the technological characteristics that affects the usage of ERP. In technological compatibility, the knowledge gained from past and present experiences with technology are considered (Rajan & Baral, 2015). Common problems in adopting ERP systems are widely recognized to be rooted in the poor fit between ERP systems and business process. If the ERP system is compatible with present business practices and user needs, then an institution can adapt more easily.

In ERP implementation in higher education institutions, systems are developed to support business processes such as, student admissions, examinations processing, fees collection and reconciliation, and so ERP implementation and business process should be closely connected.

According to Soh, Kien, & Tay-Yap (2000) procedural and data compatibility are crucial to the acceptance of the system by the employee. Enterprise resource planning packages are only compatible with the databases and operation systems of some institutions, and procedural and data compatibility are crucial to the acceptance of

the system by the employees (Rajan & Baral, 2015). Technology incompatibility can therefore negatively affect system productivity, efficiency, employees' satisfaction, commitment, and motivation. The greater the compatibility of the ERP system with the existing technical systems, operating practices, and the value and belief systems of the institution, the better for its adoption and use.

Technical Support

Having available and qualified vendor support is a substantial advantage in implementing the ERP system. Zhang, Matthew, Zhang, and Banerjee (2003) identified three dimensions of vendor support as follows: (1) Service response time of the software vendor; (2) Qualified consultants with knowledgeability in both enterprises' business processes and information technology including vendors' ERP systems; and (3) Participation of vendor in ERP implementation. It's important for the vendor's staffs to be knowledgeable in both business processes and ERP system functions to ensure successful implementation. Moreover, the ERP consultants should possess good interpersonal skills and be able to work with people in the institution. ERP software vendors should be carefully selected since they play a crucial part in shaping the ultimate outcome of the implementation.

System Reliability

The reliability of a product can be defined as the probability that the product will not fail throughout a defined operating period and prescribed environment (Rajan & Baral, 2015). ERP systems are made up of a number of components or modules. The reliability of each component or module and the configuration of the system consisting of these components or modules determines the system reliability. System reliability is a major challenge for higher education institutions since unreliable systems can have dual bad effects for them. First, unreliable ERP system can frustrate users because they are the ones who are in direct contact with the ERP system. Secondly, it can be so expensive for the institution. In order to avoid these problems and the system unreliability, institutions must understand what makes a system unreliable and then fix it.

Suitability of a Software Package

The choice of an ERP software package that best matches the institution's information needs is essential to guarantee minimal customization. An erroneous decision in choosing the ERP package may lead to a commitment of architecture and applications that do not fit the institution's business processes. To ensure that this does not happen

Johansson and Sudzina (2008) argues that the decision process should entail the following considerations: (1) budgets, (2) timeframes, (3) goals, and (4) benefits. Institutions differ from each other, so not all ERP software packages are compatible with all institutions. ERP vendors use different hardware platforms, databases, and operation systems and certain ERP packages are only compatible with some databases and operation systems. Thus, institutions should conduct requirements analysis in order to confirm what problems need to be solved and select the appropriate ERP systems. ERP packages are provided as generic off-the-shelf (proprietary) or open source software. Serrano and Sarriegi (2006) posit that the benefits of applying open source software are greater for ERPs than for other kinds of software applications. The authors identify three main reasons:

1. **Increased Adaptability:** ERP software are not plug-and-play. They always need an implementation project to match the business processes and local regulations. Having full access to the ERP source code can facilitate this unavoidable customization.
2. **Decreased Reliance on a Single Supplier:** Institutions that acquire proprietary ERP software are highly dependent on the product builders and distributors – that is, ERP systems and the source code's owners. If one, or even both, of these agents disappears, upgrading and maintaining the ERP can pose significant problems.
3. **Reduced Costs:** Proprietary ERP licenses are expensive. A rule of thumb puts them at between one-sixth and one-third of the implementation project costs. Open source ERPs avoid this cost. Furthermore, they usually do not need expensive hardware to run.

Theoretical Models for Successful ERP System Implementation

A number of theoretical models have been developed to help explain user adoption of new technologies. These models introduce factors that can affect the user acceptance of technology such as Theory of Reasoned Action (Fishbein & Ajzen, 1975), Theory of Planned Behavior (Ajzen, 1985), Technology Acceptance Model (Davis,1989; (Davis, Bagozzi, & Warshaw, 1989), and the Diffusion of Innovation theory (Rogers, 2003). Therefore, an overview on available general adoption models is necessary in determining successful ERP implementation. In this section, we discuss these theoretical models to give an overview for better understanding of successful ERP Systems implementation.

Theory of Reasoned Action

The Theory of Reasoned Action (TRA) as postulated by Fishbein and Ajzen (1975) is one of the most popular theories used. The theory is about one factor that determines behavioral intention of the person's attitudes toward that behavior. The TRA theory proposes that individual beliefs influence attitudes, hence creating intentions that will generate behavior. In this sense, the intention to accept or reject an ERP system is based on a series of tradeoffs between the perceived benefits of the system to the user and the complexity of learning or using the ERP system. Therefore, a person's attitude towards the ERP system together with the subjective norm concerning the behavior, determines the behavioral intention as depicted by figure 4.

Generally, attitudes are affective and are based upon a set of beliefs about the object of behavior. For example, the ERP system makes work easier. The second factor is the person's subjective norms of what he or she perceives the immediate community's attitude to certain behavior. For example, my peers are using the ERP system to are productive in their areas of work).

Theory of Planned Behavior

The Theory of Planned Behavior (TPB) can be comprehended as an extension of the Theory of Reasoned Action. TPB proposes that a combination of attitude toward the behavior, subjective norm may lead to the formation of a behavioral intention to perform the behavior. The TPB postulates intention to act as the best predictor of behavior. The intention is itself an outcome of the combination of attitudes towards a behavior. That is, the positive or negative evaluation of the behavior and its expected outcomes and subjective norms are the social pressures exerted on an individual resulting from their perceptions of what others think they should do and their inclination to comply with these (Al-Mamary, et al., 2016). Figure 5 illustrates a description of Taylor and Todd (1995) combined TAM-TPB Model. The authors suggested that when organizations design and implement an IT system, they should take into account the user's level of experience since less experienced users will

Figure 4. Theory of reasoned action adapted from Madden et al., 1992

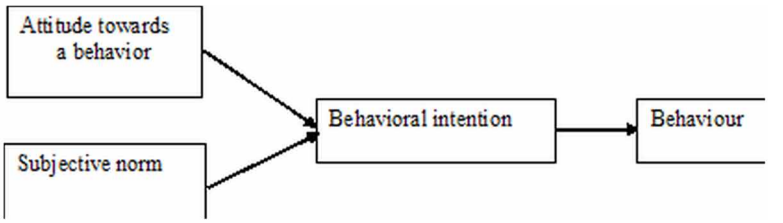
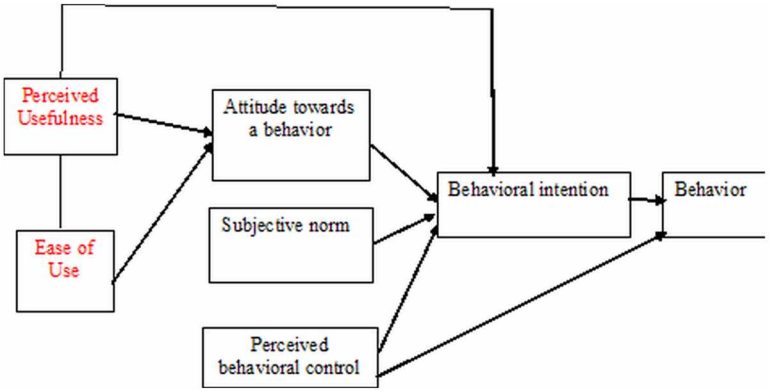


Figure 5. Combined TAM-TPB model
Source, Taylor and Todd (1995)



tend to rely on different factors (e.g. perceived usefulness) than experienced ones in order to start using the system.

The Combined model assumes that individuals are rational in considering their actions and the implications of their actions. That is, individuals will make a rational choice to use the ERP system. But in some cases the use of the ERP system is compulsory. The users don't have options to use the ERP system or not. This theory therefore is more suited as an optional choice only.

Diffusion of Innovations Model

Rogers (1983) proposed the first process model, a five-stage model of the implementation and adoption of innovation in organizations. The Diffusion of Innovations (DOI) model examines a diversity of innovations by introducing four factors (innovation itself, communication channels, time, and a social system) which influence the spread of a new idea. DOI model suggests a number of attributes of innovation that were perceived to assist the diffusion of technological innovation. The DOI model integrates three major components: adopter characteristics, characteristics of an innovation, and innovation decision process. In innovation decision step, five steps namely confirmation, knowledge, implementation, decision, and persuasion have taken place through a series of communication channels among the members of a similar social system over a period of time. In characteristics of an innovation step, five main constructs namely; relative advantage, compatibility, complexity, trialability, and observability have been proposed as effective factors on any innovation acceptance. In adopter characteristics step, five categories; early adopters, innovators, laggards, late majority, and early majority are defined.

Technology Acceptance Model

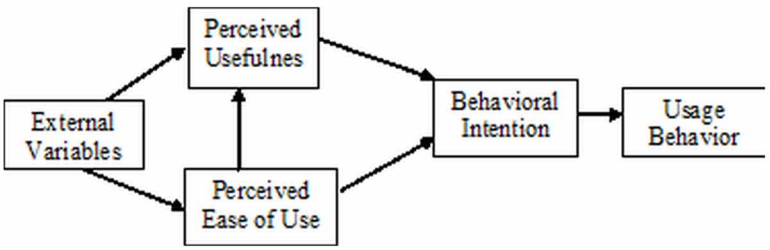
Developed by Davis et al. (1989), Technology Acceptance Model (TAM) is one of the most influential research models to determinate the level of information system adoption. Davis used TAM to explain the general determinants of computer acceptance that lead to explaining users' behavior across a broad range of end-user computing technologies and user populations. TAM uses the Theory of Reasoned Action (TRA) as a theoretical basis for specifying the causal linkages between two key beliefs: perceived usefulness and perceived ease of use, and users' attitudes, intentions and actual computer adoption behavior. The goal of TAM is to explain and predict determinants of computer acceptance in a broad sense, while being a justified and prudent model. The final version of Technology Acceptance Model was formed by Venkatesh and Davis (1996) as shown in Figure 6.

TAM explains the motivation of users by three factors; perceived usefulness, perceived ease of use, and attitude toward use. Therefore, not only behavioral intention would be contained in TAM but also, two chief beliefs like perceived usefulness and ease of use have considerable impact on attitude of the ERP system user. These can be determined as favorableness and unfavorable toward the ERP system. Sometimes, other factors identified as external variables (system characteristics, user training, and user participation in system design) are considered in TAM model.

Information Systems Success Model

DeLone and McLean (1992) presented a model for measuring the "complex dependent variable" in information Systems (IS) research. The authors tried to bring some awareness and structure to this dependent variable, "IS success" in IS research, and proposed taxonomy and an interactive model as frameworks. This model has gone through reviews with the more recent model presented by the authors in the year 2003 inspired by the response they received since the publication of their original

Figure 6. Technology Acceptance Model (TAM)
Source: Venkatesh and Davis, 1996)



paper of 1992. The IS success model has six variables or dimensions: Information quality, System quality, Service quality, (Intention to) use, User satisfaction and the resulting Net benefits (DeLone & McLean, 2016). These variables are proposed to be more interrelated than independent as shown in Figure 7.

Information Quality

According to DeLone and McLean, the information quality dimension refers to the desirable characteristics of the system outputs; for example, management reports. Among them include, relevance, understandability, accuracy, conciseness, completeness, understandability, currency, timeliness, and usability.

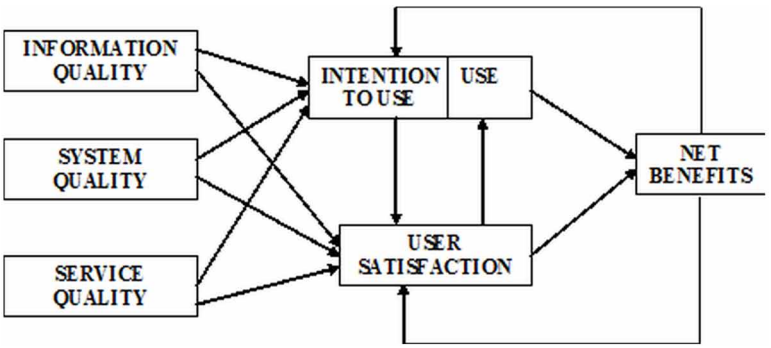
System Quality

The system quality dimension is the desirable characteristics of an information system. For example, ease of use, system flexibility, system reliability, and ease of learning, as well as system features of intuitiveness, sophistication, flexibility, and response times.

Service Quality

The service quality dimension refers to the quality of the support that system users receive from the information systems, organization and IT support personnel. For example, responsiveness, accuracy, reliability, technical competence, and empathy of the IT personnel staff.

Figure 7. Updated IS success model
Source: DeLone & McLean (2003)



Use

The Use dimension refers to the degree and manner in which employees and customers utilize the capabilities of an information system. For example, amount of use, frequency of use, nature of use, appropriateness of use, extent of use, and purpose of use.

User Satisfaction

The User satisfaction attribute refers to users' level of satisfaction with reports, Web sites, and support services.

Net Impacts

The net impacts dimension refers to the extent to which information systems are contributing (or not contributing) to the success of individuals, groups, organizations, industries, and nations. For example: improved decision-making, improved productivity, increased sales, cost reductions, improved profits, market efficiency, consumer welfare, creation of jobs, and economic development.

In summary, DeLone and McLean, argued that the selection of the particular success dimensions are dependent on the nature and purpose of the system(s) being evaluated. For example, an e-commerce application, in contrast to an enterprise resource planning system application, would have some similar success measures and some different success measures. Both systems would measure information accuracy, while the e-commerce system is more likely to measure the personalization of information presentation than an ERP system that uses standard report formats. Similar differences in measures and metrics would be encountered in attempting to measure the success of IS systems in healthcare or government applications.

Metrics for Measuring Success Rate of ERP Systems Implementation

In the recent years, higher education institutions have spent substantial amounts of money in ERP investment with a goal to provide enhanced ability for research and teaching at reasonable or low cost. Successful ERP System implementation is a multidimensional, dynamic and relative concept. Although success is complex and difficult to measure, researchers are making efforts in doing so. Most of the practical measurements focus on delivering a functional information system product

within certain economic and temporal constraints. A system must first be accepted to be used and that should increase the probability of system success. Markus and Tanis (2000) argued that there are different phases characterized by key players, typical activities, characteristic problems, appropriate performance metrics and a range of possible outcomes. Each experience made with ERP system, is unique, and experiences may differ from organization to organization and from the specific point of view. The success measurement model of Markus and Tanis (2000) can be used for multiple success measurement approaches at different stages of an ERP Systems Implementation. Based on their observations of enterprise systems projects, the authors argued that there are three main categories of success metrics. These are:

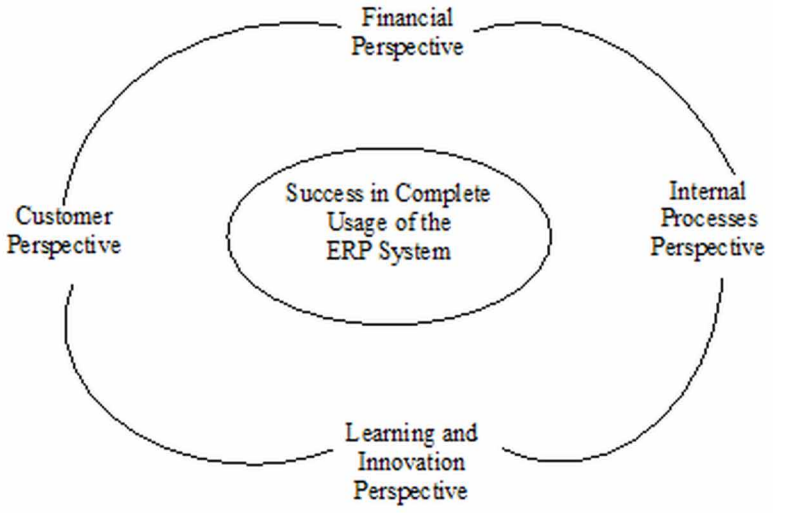
- **Project Metrics:** The project metrics measure the performance of the ERP systems project team against the planned schedule, budget and functional scope
- **Early Operational Metrics:** These metrics measures how the business operations perform in the period after the system becomes operational until "normal operation" is achieved (for example, labor costs, Cycle time, Demand forecast accuracy), and
- **Longer Term Business Results Metrics:** These metrics measures how the organization performs at various times after normal business operation has been achieved. This usually involves attaining the strategic goal behind the system implementation (for example, Rate on Investment (ROI)).

There is a common consensus that ERP systems implementation, given it is managed carefully, provide substantial intangible (nonfinancial) results as well as tangible (financial) results. Bartholomew (1999) claims that in a typical business environment, 80% of the organization's value is in intangible assets. This intangibility of assets has made it difficult for organizations to demonstrate whether they have received the benefits of an ERP system or not. There are other approaches to the measurement of system success rate. However, in this chapter we discuss the balanced score card approach to measuring the success rate of ERP system implementation in higher education institutions.

The Balanced Scorecard Approach

The Balanced Scorecard (BSC) is a technique developed by Kaplan and Norton (1992) that helps organizational decision makers to navigate the organization towards success. Researchers (Bruggeman, 1999; Rosemann & Wiese, 1999; Reo, 1999)

Figure 8. Balanced scorecard for measuring ERP performance



have suggested that the Balanced Scorecard approach may also help to evaluate the performance of an Information System (IS) and to evaluate IS investments in a holistic manner. The intention of the Balanced Scorecard is the supplementation of traditional financial measures with three additional perspectives – the customer perspective, the internal business process perspective and the learning and growth perspective (Kaplan & Norton, 1996).

The BSC approach complements past performance measures (financial measures) with the drivers of future performance indicators (customers, suppliers, processes, employees, technologies and innovation). The fundamental concept of the Balanced Scorecard is to derive the objectives and measures from the overall organization vision and strategy and to use the four perspectives as a "balanced" framework to monitor and achieve these objectives. The following section presents a discussion on the appropriateness of the Balanced Scorecard for measuring success rate of ERP systems implementation.

Measuring ERP Systems Success Rate Using the Balanced Scorecard

A fundamental feature of the Balanced Scorecard approach is that it requires that each measure should relate to the organizational strategies and to each other in a cause and effect relationship. Therefore, identifying the organizational goals and strategies in relation to the core perspectives is a critical preliminary step in a Balanced Scorecard approach. In a nutshell, the balanced scorecard has four perspectives. The

Learning & Growth Perspective looks at what an organization should do to achieve its vision. The Business Process perspective refers to internal business processes and what should be done so as to satisfy customers and stakeholders. The customer perspective shows an increasing realization of the importance of customer focus and customer satisfaction in any business because if customers are not satisfied, they will find other suppliers who will meet their needs, and The financial perspective looks at what should be done for the organization to succeed financially (Kaplan and Norton, 2001).

Rosemann and Wiese (1999) presented two approaches to the Balanced Scorecard that can be used for ERP success measurement. The first BSC approach is measuring the project performance and in addition to the classical perspectives (financial/cost, customer, internal process and innovation and learning). The authors added the project perspective to this BSC, a fifth perspective, which represents the typical project management tasks. The second BSC approach was the operational BSC, which measures the business performance and can be used for (continuous) controlling of the ERP software. In this chapter we consider the second approach, operational BSC.

Financial Perspective

An ERP system represents a capital investment which causes expenses as well as revenues. It is a common practice to measure the performance of any business on a financial scale. The Return on Investment (ROI) and Return on Capital Employed (ROCE) are the most common methods of measuring the financial success of a business (Kaplan & Norton, Translating Strategy in to action: The Balanced Scorecard, 1996). The Return on Investment is a ratio between the net profit and cost of investment resulting from an investment of some resource whereby high ROI means the investment's gains compare favorably to its cost. The return on capital employed is a profitability ratio that measures how efficiently an organization can generate profits from its capital employed by comparing net operating profit to capital employed. ROCE is a long-term profitability ratio because it shows how effectively assets are performing while taking into consideration long-term financing (Kaplan & Norton, 1996). Obviously, a higher ratio would be more favorable because it means that more dollars of profits are generated by each dollar of capital employed. According to Rosemann and Wiese (1999) the results of the financial perspective can help to identify poor performance. For example, negative deviations of actual training costs versus budgeted costs may indicate that the system's functions are not efficiently used by staff members. A continuous increase in external consulting expenses may point to deficiencies in the internal training staff's competence.

Customer Perspective

Higher Education Institutions are realizing the importance of a customer centered approach to survival in the face of increased domestic competition and the globalization of higher education. They have recognized that an unsatisfied customer can easily switch to another supplier that meets the same need with a lower price or a better service. This recognition has led these institutions to set targets like "Customer Satisfaction" and "Customer Retention". As customer expectations are rising, Higher Education Institutions are looking to trim budgets and increase efficiency. In higher education institutions, the direct customers are the employees and students who directly deal with the system and external business partners like suppliers, subcontractors and customers who are indirectly working with the system. For the purpose of measuring performance, concentrating on internal users seems more adequate, since the system's effects on external partners are rather remote and indirect. In light of all this, many institutions have started to use ERP system, to offer programs and courses that students feel their needs and wants are met and get an edge over the competition. In the Balanced Scorecard framework, the measures used to evaluate performance for external users include for example, the Cycle time, which is a measure of how fast the institution is responding to customer needs/ orders. In essence, cycle time measures the length of time it takes to produce a good and deliver it to the customer from the moment the invoice is received. Faster cycle time demonstrates more effective processes and a higher customer satisfaction rate. Similarly, an effective ERP system should be able to accurately predict future demands based on historical numbers. The more accurate the ERP system can monitor the forecast and then keep track of the progress of reaching the predicted numbers, the more successful it is.

Internal Process Perspective

The internal process perspective focuses on the internal conditions for satisfying the customer expectations (Rosemann & Wiese, 1999). These conditions can be grouped into processes needed for operating the system on the one hand and those for improving and enhancing its capabilities on the other hand. Regarding the day-to-day operation of an ERP system, some of the essential measures for evaluating its internal processes are the number and type of trends in user complaints. An analysis of these measures should lead to a ranking of system defects by disutility to users and these are tackled accordingly. ERP systems play an important role in helping managers disaggregate the summary measures. In the Balanced Scorecard Framework, the measures in this perspective are also leading indicators of future performance. For instance, when an unexpected signal appears on the balanced

scorecard, managers can query the ERP system to find the source of the trouble. If the aggregate measure for on-time delivery is poor, for example, managers can quickly look behind the aggregate measure until they can identify late deliveries, day-by-day, by a particular unit to an individual customer.

Innovation and Learning Perspective

In today's rapidly changing and competitive world, Higher Education Institutions cannot catch up with the continuously evolving technological initiatives unless they support continuous learning and improvement and invest considerable amount of resources in new technologies. The innovation and learning perspective is devoted to an assessment of the institution's ability to effectively utilize the ERP system's functions as well as to enhance and improve it. An institution's ability to innovate, improve, and learn ties directly to its value. That is, only through the ability to launch new products, create more value for customers, and improve operating efficiencies continually can an institution penetrate new markets and increase revenues and margins—in short, grow and thereby increase shareholder value. Therefore, in order to ensure long term growth and improvement, an institution should set targets such as "Improved Employee Capabilities", which can be attained by continuous learning and sharing of information among employees. A useful indicator in this case is the level of training courses, measured by the amount of time or expenses spent. Specifically, for system developers, their type of formal qualification can additionally be assessed. In the Balanced Scorecard framework, the measures in this perspective are also leading indicators of future performance since an effectively learning enterprise will easily follow the new technologies and be successful in the future.

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