

ERP: framework based implementation - a case study

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Abstract

ERP implementation projects are some of the most critical and complex project implementations. Most of the fortune organizations and institutions will adopt the large scale ERP to standardize their business needs and upgrade their IT systems on par with the current technologies. ERP is one of the solutions for managing Enterprises; Most of the ERPs are suitable for Manufacturing and IT industries. This research paper discusses the framework which helps to minimize the implementation of data conversion processes. Most of the organizations use the migration manually and involve a significant duration of time of many functional users; thus the work proposes the creation of data model templates and Smart Data Load Accelerator. The proposed work also helps to reduce the development time.

Keywords: ERP; Frameworks; Data Migration; Conversion; SDLA.

1. Introduction

Helmut Klaus et-al [10] described the Enterprise Resource Planning [ERP] system evolution which was started in the early 90s. The name was derived from the MRP materials requirement planning and manufacturing resource planning. With the success of MRP products over time, ERP evolves in to other parts of business like customer relations, financials, higher education, etc. In the past, there were very few niche ERP players in the market. The industry adoption and need for ERP has grown. So, there are major ERP providers like SAP, Oracle (Fusion, PeopleSoft, JD Edwards, Siebel, and BAAN), Microsoft, Ramco, workday, etc. in the present market. Initially, the architecture of ERP was built around the three tier client and server architecture. Later, the invention of the World Wide Web made the vendors to adopt the internet technology. Now cloud computing and cloud services are becoming the norms for many organizations. Therefore, it is evident that ERP systems should move towards cloud architecture. Even though the technology adoption by the vendors has grown rapidly, the ERP system has been developed in a generic way to suit multiple lines of business processes. Similar to industries, higher education institutions like universities and colleges are also adopting ERP for standardizing their business needs and it takes a major amount of their IT spending.

The ERP implementation strategy and approach need to be carefully designed and documented to provide the enough detail on various aspects of the proposed strategy, scope and activities related to data migration. There are challenges and constraints for the data migration process in terms of freezing the data requirements, gaining and providing access to the data required by ERP systems, legacy and third party systems. Most importantly the strategy must address the validation of the data once it has been migrated. The primary objective of the proposed data migration methodology is to ensure that the required and related academic and supporting data for higher learning institutions is available in the target ERP systems. The secondary objective is to ensure that the target data

has been cleansed and validated prior and post data load. The objective can be achieved by the use of appropriate resources, process, controls and tools to ensure that the data is reconciled and validated at agreed intervals. So it is evident that ERP migration is complex in nature and consists of multiple factors and sub factors. This work adopts the KMS multi-dimensional model proposed by Venkata et al [12] for ERP data migration.

The following are some of the key challenges to data migration:

- Establishment of ownership of data.
- Defining and confirming the key roles and responsibilities for Data Migration.
- Gaining access to legacy and third party supported systems and associated data.
- Understanding and contextualizing source data, particularly in the case of Multiple Country implementation.
- Cleansing the data in readiness for final migration.
- Validation and verification of migrated data.
- Customizations.
- Management failure.
- Customer support.
- Administration.
- Change & release management.
- User interfaces & reporting.
- Processing errors.
- User Synchronization & security.
- Advance Dynamic Printing options.
- Backup to Cloud.
- Limitations for Choice Based Credit System.
- Limitations for Outcome Based Education.

ERP Systems are the largest software programs which are being adopted by fortune organizations and leading global institutions, and highly integrated with organization and business processes which create a large number of transactional data during every day business activities. The ERP system features multiple products such Human Capital Management [HCM], Financial and Supply Chain Management [FSCM], Customer Relationship Management

[CRM], Campus Management Solutions [CS] for Higher Education institutions etc. This provides a complete suite of functionality suitable for different types of organizations such as Manufacturing, Insurance, Retail and Higher Educational institutions etc.

The ERP implementation project is the most complex since it requires a lot of effort in planning and execution. The system plays a very crucial role in the decision making process of the business. It transforms the business with new dimensions of information to complete the business operations intelligently and efficiently. The implementation of ERP will provide tangible benefits to the customers, employees, students and suppliers. Therefore, ERP implementations should be thoroughly planned to improve the customer service, Supply Chain, Student administration and employee management [1].

Data conversion is the main process in any ERP implementation project. Generally, the decision makers will use the computer system generated data for the analyses, and the computer data will be a credible reference to support their decision [2], Garbage in – Garbage out [GIGO] approach is very much required to ensure that the data loaded in to the system is cleaned, so that the output of the system will have valuable information. During the ERP implementation, if the data conversion failed to load the correct data, it will create the wrong transactional data which leads to major data issues in the system. Often ERP implementation projects will have less time for data conversion. The organizations will have their data residing in several legacy systems which are built using different technologies and different platforms. It is more important to analyse and profile the data for the implementations.

2. Literature survey

The concept of ERP systems emerged in 1990. Researchers have shown interest in developing combined software packages for standardizing the business processes to the industry's best practices. Davenport et-al [4] claim, "ERP systems are like the dream come true. The system promises the complete integration of the business process of all the information in the organization which includes finance, HRMS, CRM etc." The ERP system sales are increasing in the current market. The next generation ERP clouds are already available and competing with the traditional ERP players.

Gable et-al [5] [10] define "A new class of packaged application software has emerged over the past decade, ostensibly consolidating under a single banner, a multi-billion dollar industry that includes the world's fourth largest software vendor, several other of the largest software firms and the world's largest management consulting organizations".

A. Min Tjoa et-al [11] describe ERP systems as comprehensive software packages which integrate with the full set of business process functions to represent the high level single view of business through the data and its IT capabilities. Rizwan et-al [6] explain the two major factors for the success or failure of an ERP implementation. The two major factors are data quality and user participation. In addition, there is a need to increase these factors to further enrich the quality of the ERP system.

The author illustrates the strategies needed for increasing the user participation and loading the quality data from legacy to new ERP systems.

Shruti Nagpal Et-al [7] discuss the methodologies to increase the ERP implementations effectively and faster. The author also talks about the usefulness of agile applications and frameworks for ERP implementation benefits. Ashish Et-al [8] examines the various issues that impact the ERP implementations such as vendor, right hardware, user friendly approach, Change management, Implementation strategy, Data conversion and effective communications. Dianne Arneberg Et-al [9] highlight the challenges with data conversion which cause the ERP projects to delay in going live., The Authors provided the information about how the US navy ERP project was delayed for two years and cost more than the

budget. They insist on the fact that the right time to implement the data quality process is the beginning of the ERP solution implementation. It is always good to improve the quality of data and frameworks for loading it which helps in reducing the risk of project delays and project costing.

3. Data conversion

The data conversion process in the ERP project involves major features, such as configuration, Process, Functional and Technical resources. There is a lot of configuration data and transactional data that needs to be loaded into the newly implemented system to attain the optimum results. Considering the ERP implementation for leading higher education institutions, there could be hundreds of existing legacy systems which store data for different business operations; but, when it comes to ERP all the data has to be loaded in to a single system. The university might have the Academic Plan, Academic Program, Course Catalogues, Organization Structure, Department, Campus, Staff, Student, Grades, Course structure and fees information etc.

a) Processes

The implementation team will consist of different groups of people, such as Higher Management (Project Approval Board), Business Analysts, Functional Resources, Technical Resources, Project Administrators, Legacy Data Migration group, Data Conversion Team, Project Managers etc. The core implementation configuration, customization and data loading are responsible for the functional and technical groups

b) Functional Resources

Functional resources are experts who know the in and out of the ERP systems and also possess the domain knowledge of the functional area. Especially their time is more valuable, as they will be spending most of their time in understanding the business processes of the organization and conducting meetings with business analysts providing the functionality and features of ERP systems. The main purpose is configuring the ERP system to fit the business process. From the data conversion perspective, they will be identifying the functional areas which require data to be loaded from the legacy system. They will create the functional specification document and data conversion template. Creating a data conversion template is tedious, as it will take most of the functional users' time, since the functional user has to identify the components required to be loaded on each and every page, its transformation values etc.

c) Technical Resources

Technical resources are mainly required for an ERP implementation project. Their technical capabilities will be required to convert the functional document into technical work products. They are software implementation consultants the organization possesses. These resources consist of a highly skilled expert group that builds and maintains the business system and the quality of hardware, network and software Implemented (Jennex, 2007). Thus, they are highly important for an organization, making decisions based on the available technical experts and the technology. In the process of data conversion, the technical developers will be developing batch programs for each and every component which requires data conversion based on the functional document recommendations. The development procedure will consume a huge amount of time, even though the processing concept may be similar for each component. It is more unlikely to directly load the conversion data on to tables, since the ERP system components will have a business logic for each of their functionalities. There is a need to develop interfaces for the components and load the data using the component interface, to execute the business logic of the ERP systems.

4. SDLA framework implementation

The Smart Data Load Accelerator framework [SDLA] based approach is highly in need for the ERP implementation project in various parts. The proposed data conversion framework is tightly

coupled with ERP functionality. This framework is developed using Oracle People Tools and technologies and will help to standardize or accelerate the delivery of conversion objects across the projects in the organization, by creating highly valuable and re-usable conversion objects for later use. Due to a project uncertainty, some of the legacy systems and their requirements for data transformation may be found only at later stages, in which the development team is required to develop, customize and debug the conversion routine programs based on the system functions for some business processes[3]. The SDLA framework contains the following features.

- Info-Bus – which will enable the developers to access the legacy data by owning the copy of the legacy production system, thus accelerating the legacy data export phase by eliminating the client resource dependencies.
- Data Conversion Functional Mapping Template Generation.
- Streamlines the standard Conversion Approach.
- Developer efforts will be reduced.
- Allows functional to configure.
- Dashboard Reporting of success & Error records.
- Creating/Building the Staging record based on the configuration

Ability to perform parallel processing in simple configurational steps.

This conversion framework will streamline the entire process; it reduces the development effort and functional resources by creating data mapping templates and also eases the process of validation after the conversion process successfully.

a) Agent – Process Flow

Step 1: Read the configuration

Step 2: Load the file data to staging based on the layout information.

Step 3: Perform the validation edits Such as Yes/No, Translate values, Base table, Date format, Number etc.

Step 4: Mark each row of data with the fit qualifier for processing. The pass/fail rows will be marked by a flag.

Step 5: Generate the report for invalid data for correction.

Step 6: Read the valid data and load to the temporary table for processing.

Step 7: Creating the session and object instance for target component.

Step 8: Perform the cross walk mapping transformation at run time based on the configurations.

Step 9: Assign the temporary record field values to the component interface collection fields.

Step 10: Execute the component interface save method.

Step 11: Catch exceptions and perform error handling.

Step 12: Flag the success/error records in the staging table flag field.

Step 13: Generate the dashboard report with the data conversion processing results.

Step 14: Process complete.

5. Data collection

The data was collected in the large scale ERP implementations in the higher education sector from the projects managed for UK and US markets. The traditional data conversion program efforts are taken from previous project implementations. The SDLA framework conversion program efforts are taken from the recently completed project. The comparative analysis based on both types of implementation are analysed carefully for various aspects of benefits to the project development and QA team. There is a significant amount of bugs reduced while using the framework based implementations than the traditional approach. The following figure shows the effort comparison between the traditional development and the implementation SDLA benefits for each and every conversion program. The chart shows the effort difference in development.

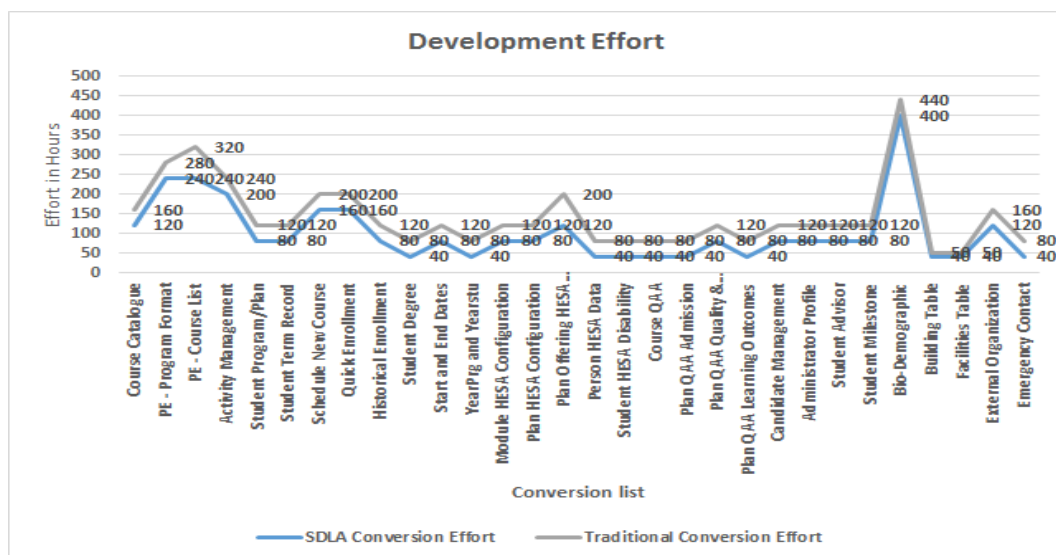


Fig. 1: Experiment Results Framework vs. Traditional Development.

There is effort saving in the code review process too, since the framework provides the predefined code commonly for any type of conversion, and developers need to add transformation mapping and interface code on top of the framework software code, which provides the code reviewer to review in less time and efficiently. This increases the strict code format enforcement and style of all conversion programs in the same format, which makes debugging much easier. For any changes there won't be any need to fix in each and every program. The bug fixes can be done globally in the framework. The experiment is carried out in higher education ERP implementation project conversion.

The following table shows the list of conversion programs taken for the experiment. This shows the advantage of framework based implementations that increase the resource utilizations.

The framework based approach has the total hour's development of 3040 hours for 30 conversions with different complexity levels, while the traditional approach has 4260 hours which is approx. 33% of the development effort. The advantage of implementing the framework is reusability and configurability. The program has to be implemented once for any client; going forward, you can reuse the entire package without additional development effort. Only the configuration mapping based on legacy is required. This approach will make the programs readily available for future im-

plementations and create a code repository to share among multiple implementations and save the cost.

Table 1: Conversion Program Development Effort Comparison

S.No	Effort (Hrs) Traditional vs Framework Conversion Name	Complexity	Framework	Traditional
1.	Activity Management	High	200	240
2.	Schedule New Course	High	160	200
3.	Quick Enrollment	High	160	200
4.	Building Table	Low	40	50
5.	Course Catalogue	Medium	120	160
6.	Student Program/Plan	Medium	80	120
7.	Student Term Record	Medium	80	120
8.	Historical Enrollment	Medium	80	120
9.	Student Degree	Medium	40	80
10.	Start and End Dates	Medium	80	120
11.	Yearprg and Yearstu	Medium	40	80
12.	Module HESA Configuration	Medium	80	120
13.	Plan HESA Configuration	Medium	120	200
14.	Plan Offering HESA configuration	Medium	120	200
15.	Person HESA Disability	Medium	40	80
16.	Student HESA Disability	Medium	40	80
17.	Course QAA	Medium	40	80
18.	Plan QAA Admission	Medium	40	80
19.	Plan QAA Quality & Regulation	Medium	80	120
20.	Plan QAA Learning Outcomes	Medium	40	80
21.	Candidate Management	Medium	80	120
22.	Administrator Profile	Medium	80	120
23.	Student Advisor	Medium	80	120
24.	Student Milestone	Medium	80	120
25.	Facilities Table	Medium	40	50
26.	External Organization	Medium	120	160
27.	Emergency Contact	Medium	40	80
28.	PE – Program Format	Very High	240	280
29.	PE – Course List	Very High	240	320
30.	Bio-Demographic	Very High	400	440
	Total Effort		3040	4260

Calculate percentage difference between $V_1 = 3040$ and $V_2 = 4260$

$$\begin{aligned}
 & \frac{|V_1 - V_2|}{\frac{(V_1 + V_2)}{2}} \times 100 \\
 = & \frac{|3040 - 4260|}{\frac{(3040 + 4260)}{2}} \times 100 \\
 = & \frac{|-1220|}{\frac{7300}{2}} \times 100 \\
 = & \frac{1220}{3650} \times 100 \\
 = & 0.334247 \times 100 \\
 = & 33.4247\% \text{ difference}
 \end{aligned}$$

Fig. 2: The Effort Difference Percentage Calculation.

6. Conclusion

ERP implementation is large in nature, and will be done with huge spending. The global ERP implementation survey says many of the ERP projects are not finished by the deadline. In this situation, the project gets delayed by various factors. There is a need for frameworks and accelerators which could save the time and effort in the implementation project. This research work provides a framework methodology to implement and accelerate the data loading process in a shorter span of time. It increases the productivity of functional experts and developer efforts by reducing the manual task of loading routine functional template creation and also provides a standard mechanism to build the conversion pro-

gram using the framework delivered objects, which reduces the time and effort spent by each developer to 33.4247%. The proposed architecture provides efficient dashboard reports for load routine results. Currently the interface code and stage data map is a developer effort. The future scope of the work is to enhance this framework with new additional features to generate a component interfacing code dynamically.

References

- [1] Liping Ge a, StefanVoß b, "ERP application in China: An overview,"Int. Journal of Production Economics, Vol 122, PP 501–507, June 2009. (References).
- [2] Daniel T. Brooks, Brandon Becker and Jerry R. Marlatt, "Computer Applications in Particular Industries: Securities appearing in Bige-

- low, Computers & The Law", American Bar Association, Section of Science and Technology, Third Edition 1981 at 250, 253.
- [3] Thomas, D. (2005), "Agile programming: design to accommodate change. Software", IEEE, V.22 (3), pp.14-16. <https://doi.org/10.1109/MS.2005.54>.
- [4] Davenport, "Putting Enterprise in the Enterprise system", 1998, Harvard Business Review.
- [5] Gable, G. G., Chan, T. and Tan, W.-G. (2001), "Large packaged application software maintenance: a research framework", J. Softw. Maint. Evol. Res. Pract., 13: 351-371. doi: 10.1002/smr.237. <https://doi.org/10.1002/smr.237>.
- [6] M. Rizwan Jameel Qureshi, Alnamer M. Abdulkhalaq, "Increasing ERP Implementation Success Ratio by Focusing on Data Quality & User Participation", I.J. Information Engineering and Electronic Business, 2015, 3, 20-25 <https://doi.org/10.5815/ijieeb.2015.03.03>.
- [7] Shruti Nagpal, Sunil Kumar Khatri, Ashok Kumar, "Comparative Study of ERP Implementation Strategies", Systems, Applications and Technology Conference (LISAT), 2015 IEEE Long Island. <https://doi.org/10.1109/LISAT.2015.7160177>.
- [8] Ashish Kr. Dixit, Om Prakash, "A Study Of Issues Affecting Erp Implementation In SMEs", Journal of Arts, Science & Commerce, 2011, E-ISSN 2229-4686, ISSN 2231-4172.
- [9] Dianne Arneberg, "ERP data conversions are a major reasons for implementation delays", Available at:<http://bitidy.com/we-think/data-conversion-erp-delay-success-factors.html> [Accessed: 01January 2016].
- [10] Helmut Klaus, Michael Rosemann and Guy G. Gable, "What is ERP?" Information Systems Frontiers 2:2, 141±162, 2000.
- [11] A. Min Tjoa, Li Xu, Sohail S. Chaudhry, "Research and Practical Issues of Enterprise Information Systems", IFIP TC 8 International Conference on Research and Practical Issues of Enterprise Information Systems (CONFENIS 2006) April 24-26, 2006, Vienna, Austria. <https://doi.org/10.1007/0-387-34456-X>.
- [12] Venkata Subramanian D, Angelina Geetha and Mohammed Hussain, "Measurement Process and Multi-dimensional Model For Evaluating Knowledge Management Systems", IEEE International Conference on Research and Innovation in Information Systems, 2011, pp 128-133, 2011.