Defining Data Migration Strategies for Seamless ERP Transformation- Case Study

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ABSTRACT

This paper delves into the critical realm of data migration within the context of Enterprise Resource Planning (ERP) transformations. With ERP systems serving as linchpins for organizational efficiency, the process of migrating data becomes paramount. This paper explores advanced strategies to address the intricacies of data migration during ERP transformations. It outlines a comprehensive framework encompassing data quality assurance, source identification, mapping strategies, and the selection of tools aligned with the complexities of ERP transformations. Thorough testing and reconciliation plans, coupled with stringent security measures, are integrated into the strategy to ensure the integrity and confidentiality of data. The paper also emphasizes the importance of user training, effective communication, and post-migration support. The paper provides a comprehensive perspective, on optimizing data migration strategies, ensuring a smooth and successful ERP transformation journey.

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Introduction

In the dynamic landscape of modern business, the adoption and evolution of Enterprise Resource Planning (ERP) systems have become instrumental in enhancing organizational efficiency and competitiveness. As businesses strive to keep pace with technological advancements, they often undergo ERP transformations to harness the full potential of integrated and streamlined operations. Amidst this transformative journey, data migration emerges as a critical aspect, representing the complex process of transferring data from legacy systems to a newly implemented or upgraded ERP platform.

Implementing ERP systems can potentially allow a company to manage its business better with potential benefits of improved process flow, better data analysis, higher quality data for decision making, reduced inventories, improved coordination throughout the supply chain, and better customer service [1]. ERP system is a major project requiring a significant level of resources, commitment and changes throughout the organization. Often the ERP implementation project is the single biggest project that an organization has ever launched. As a result, the issues surrounding the implementation process have been one of the major concerns in industry. And it further worsens because of numerous failed cases, including a few fatal disasters, which lead to the demise of some companies

The success of an ERP implementation or upgrade significantly hinges on the effective execution of data migration strategies. Organizations grapple with various types of data migration challenges during this process, necessitating a comprehensive understanding of the intricacies involved.

ERP Critical Success Factors

One of the popular topics in the ERP implementation is to identify or develop 'Critical Success Factors – (CSF)'; According to [2], product life cycle has become very short and technology is changing more rapidly hence new success factors may be arising. The idea is that some important factors determining the success or failure of an ERP implementation can be learned from prior implementation experiences. Implementing an ERP system inevitably involves a large portion of the organization and often accompanies with a major business process reengineering efforts. Therefore, change management becomes a critical topic in the ERP implementation.

One of the sort after and/or mentioned information systems in research, businesses and in industries is the Enterprise Resource Planning (ERP) system. It was estimated that in the past decade about \$500 billion was invested in the ERP systems worldwide [3]. In view of the investment and collective efforts required to implement and run ERP systems, which are very significant to any organization, the fundamental question of the ERP system's value has been a key issue. The high investment that is required and the decision to purchase and implement an ERP system, is one of the most important decision businesses and industrial leaders have to make [4].

The values that ERP systems may create are enormous and versatile: operational benefits, financial benefits, benefits for investors, user satisfaction, etc. Sometimes, the value may be evaluated by

observing market reactions to the mere pronouncement of the ERP project. The value assessment methods can be numerous and sophisticated. For example, the benefits may be evaluated by cost savings, return on investment, asset turnover, return on assets, perceptions by the market forecasts or trends, etc.

1. Define Success KPIs

The ERP Implementation the success should be evaluated using Key Performance Indicators (KPIs) that relied heavily on the seamless and real-time flow of data. Some of the key Performance Indicators are listed below

Finance
• Period Close of xx days compared to benchmark of xx.
• # of invoices processed by AR FTE improved to xx%
• # of AP payments processed per AP efficiency gain by xx%

Order to Cash
• Average Order cycle time improved by xx days
• %Sales order delivered on time of xx %
• Order Fill rate of xx % compared to benchmark of xx %

MFG and Supply Chain Problems
• Total Inventory Turns (DSI) xx compared to benchmark of xx
• Forecast Error of xx % compared to benchmark of xx%
• Supplier on Time Delivery of xx % compared to benchmark of xx %

2. Identify Organization Wide Impact

Identify the any financial, social, environmental or human impact resulting from the ERP Implementation, some of the impacts can be expresses as

Financial Impact
• **Cost Savings:** By streamlining and automating processes, eliminated xx hours/annum of manual work.
• **Increased Efficiency:** Efficient data transfer and processing can lead to quicker decision-making and improved business agility, revenue, and +ve OI impact by $ xx with improved annual growth rates.

Social Impact
• Improved Customer Experience: A well-integrated IT system can lead to better customer service and experiences, strengthening the organization's reputation resulting in xx NPS improvement and social standing.
• Integration Standardization: Develop single master/system of record, and a single master data management system and data integration across organization (end goal).

Business & Technology Impact
• Reduced Platform Footprint: By consolidating various IT systems into an ERP solution, eliminated xx siloed integration platforms (xx % system reduction)
• Reusability: With ERP reusable components, organization was able to build new capabilities xx times faster and at xx lower cost than in prior years.

Resource/Team Impact
• Workforce Training: Helped in centralization of talent, reduction in TCO-Total Cost of Ownership by xx % and xx % of accuracy improvement in demand management.

ERP Data Migration

The intricacies of data migration pose a multifaceted challenge during ERP transformations. Organizations encounter issues such as data inconsistencies, system incompatibilities, and potential disruptions to business operations. The complexity of these challenges is exacerbated by the diverse types of data migration scenarios, each presenting unique hurdles.

There are multiple literatures are available that highlights the significance of successful data migration in ERP transformations, but there is a dearth of in-depth analyses that categorize and address the different types of data migration challenges comprehensively. As organizations increasingly recognize the critical role of data in decision-making and operational efficiency, understanding and mitigating these challenges become imperative for ensuring the success of ERP initiatives. We will go deeper into the below topics
1. Identify challenges associated with data Migration
2. Create an effective data migration strategy
3. List down the various phases data migration
4. Develop risk mitigation strategy for data migration

Addressing these objectives, serves as a valuable resource for organizations, researchers, and practitioners involved in ERP transformations, offering a comprehensive understanding of data migration challenges and strategies tailored to ERP implementations.

A. Data Migration Challenges
• Data Quality Issues- Ensuring the accuracy, completeness, and consistency of data during migration.
• Legacy System Complexity- Navigating challenges posed by the complexity of legacy systems and it's data structures.
• Data Mapping and Transformation- Mapping data from the old system to the new, and handling transformations to align with the new ERP data structure.
• Continuous Changes in Requirements- Adapting to evolving business requirements and modifications in data structure during the transformation process.
• Source Data Identification- Identifying and extracting relevant source data for migration.
• Data Security and Privacy- Ensuring the security and privacy of sensitive data throughout the migration process.
• Data Volume and Scale- Managing large volumes of data efficiently and ensuring scalability.
• Downtime and Business Continuity- Minimizing downtime and ensuring business continuity during the migration process.
• Integration Challenges- Integrating data seamlessly with other systems and applications in the ERP ecosystem.
• Testing Complexities- Conducting comprehensive testing to validate data integrity and system functionality.
• User Adoption and Training- Facilitating smooth user adoption of the new ERP system through effective training and change management.
• Vendor and Tool Selection- Choosing the right migration tools and vendors to align with the specific requirements of the ERP transformation.
• Data Governance and Compliance- Adhering to data governance policies and compliance regulations throughout the migration.
• Budget and Resource Constraints- Managing the costs associated with migration and ensuring adequate resources are allocated.
• Data Archiving and Historical Data- Developing strategies for archiving and handling historical data appropriately.
• Communication and Stakeholder Management- Effectively communicating the migration process and managing stakeholders' expectations.
• Data Reconciliation- Implementing mechanisms for reconciling data to ensure consistency between source and target systems.
• Customization Challenges- Addressing challenges related to customizations and unique configurations in the ERP system.

- Data Ownership and Accountability- Defining clear data ownership and accountability to avoid confusion during migration.
- Post-Migration Support- Providing adequate support and troubleshooting mechanisms post-migration to address any issues that may arise.

B. Data Migration Strategy

The data migration strategy for ERP transformation involves aligning migration goals with overarching objectives, assessing the existing data landscape comprehensively, and creating an inventory categorized by relevance. Clear identification of source systems, categorization of data types, and implementation of quality assurance measures, including cleansing and validation, are imperative. The strategy entails developing a mapping plan for the translation of data to the new ERP structure and selecting tools that suit the transformation's complexity. Thorough testing and reconciliation plans at multiple checkpoints ensure data integrity. Stringent security measures implement a safeguard for sensitive data throughout the migration process, complemented by training programs for end-users and effective communication to ensure a seamless transition. Collaboration with vendors, robust backup plans, and post-migration support contribute to the strategy's overall success. Key considerations and inputs for formulating a data migration strategy include

Define Clear Objectives- Clearly articulate the objectives of the ERP transformation and align data migration goals with overall business goals.

Conduct Data Assessment- Assess the existing data landscape, identifying the volume, quality, and structure of data in the legacy system.

Create a Data Inventory- Develop a comprehensive inventory of data to be migrated, categorizing it based on relevance and importance.

Identify Source Systems- Clearly identify the source systems and understand their data structures to facilitate mapping.

Categorize Data Types- Categorize data into different types (master data, transactional data, etc.) to determine migration priorities and strategies.

Data Quality Assurance- Implement measures to ensure data quality, conducting cleansing and validation processes as needed. Map Data- Develop a mapping strategy to translate data from the old system to the new ERP structure, considering any required transformations.

Choose Migration Tools- Select appropriate migration tools and technologies that align with the complexity and scale of the ERP transformation.

Address Legacy System Challenges- Develop strategies to handle challenges posed by the complexity of legacy systems, ensuring a smooth transition.

Establish Data Governance- Implement robust data governance practices to ensure data consistency, integrity, and compliance with regulations.

Testing and Validation- Conduct thorough testing to validate data integrity and system functionality at various stages of the migration.

Develop Migration Environment- Design an integrated migration environment with checkpoints, controls, and audits to identify and rectify errors during the migration process.

Data Reconciliation Plan- Establish a plan for data reconciliation at multiple checkpoints to ensure completeness and accuracy post-migration.

Consider Agile Principles- Apply agile principles to allow for iterative migration of logical data groups, adapting to changing requirements during the transformation.

Security Measures- Implement stringent security measures to safeguard sensitive data during the migration process.

User Training and Communication- Develop training programs for end-users and communicate effectively about the migration process to ensure smooth adoption.

Vendor Collaboration- Collaborate closely with vendors, ensuring their tools and services align with the specific requirements of the ERP transformation.

Backup and Rollback Plan- Develop a robust backup and rollback plan in case issues arise during the migration, ensuring minimal disruptions to business operations.

Performance Optimization- Optimize data migration processes for performance, considering factors like data volume and system capabilities.

Post-Migration Support- Provide comprehensive post-migration support, addressing any issues promptly and ensuring a seamless transition to the new ERP system.

C. Define Data Migration Phases

The figure 1 shows the various phases that can be used as a guiding principle for data migration.

Phase	What, Who, Outcome		
	Key Activities	**Key Participating groups**	**Deliverable**
Preparation	- Define migration objectives and goals. - Assess existing data landscape and identify source systems. - Create a comprehensive inventory of data.	- Project Managers - Data Analysts	- Migration objectives document. - Data landscape assessment report.
Analysis and Planning	- Categorize data types and prioritize. - Develop mapping strategy. - Choose migration tools and plan data quality assurance.	- Data Analysts - Project Planners	- Data categorization and prioritization plan. - Mapping strategy document.
Design	- Design integrated migration environment. - Develop strategies for handling legacy system complexities. - Establish data governance practices.	- System Architects - Data Governance Team	- Integrated migration environment design. - Data governance and compliance documentation.
Development and Testing	- Implement mapping strategy and migration processes. - Conduct testing for data integrity and system functionality. - Apply Agile principles for iterative migration.	- Development Team - Testing Team	- Implemented migration processes. - Test reports and validation documentation.

Execution	- Extract data from source systems. - Transfer data with clearance or standardization. - Load data into the new ERP system.	- Data Migration Team - System Administrators	- Extracted and transformed data. - Loaded data in the new ERP system.
Reconciliation	- Establish checkpoints for data reconciliation. - Address discrepancies or errors identified.	- Reconciliation Team - Data Analysts	- Reconciliation reports. - Resolved discrepancy documentation.
Post-Migration	- Provide post-migration support for end-users. - Monitor system performance. - Optimize data migration processes.	- Support Team - System Administrators	User Training and Communication User Training and Communication
User Training and Communication	- Develop training programs for end-users. - Communicate effectively about the migration process.	- Training Team - Communication Team	- User training materials. - Communication plans and updates.
Vendor Collaboration	- Collaborate with vendors, ensuring tools align with ERP requirements.	- Vendor Management Team - IT Procurement	- Vendor collaboration documentation.
Security Measures	- Implement stringent security measures.	- Security Team - Compliance Officers	- Security documentation and reports.

Figure 1: Detailed Data Migration Phases

D. Define Risk Mitigation Strategies for Data Migration
The figure 2 shows the various risks that can arise during data migration and associated mitigation guidelines.

Risk	Mitigation
Data Quality Issues	Implement thorough data cleansing, validation, and quality assurance processes.
System Downtime	Plan for off-peak hours, phased migration, and implement backup and rollback strategies.
Mapping and Transformation Challenges	Develop a comprehensive mapping strategy and conduct rigorous testing.
Security and Privacy Concerns	Implement robust security measures, encryption, and compliance with data protection regulations.
Integration Issues	Ensure compatibility and conduct thorough testing for seamless integration.
Data Volume and Scalability	Optimize data migration processes for scalability and performance.

User Adoption Challenges	Provide extensive user training, communication, and change management support.
Vendor or Tool Limitations	Collaborate closely with vendors, conduct due diligence, and choose tools that align with project requirements.
Data Reconciliation Issues	Establish a robust reconciliation plan and address discrepancies promptly.
Budget Overruns	Conduct thorough cost estimation, account for potential hidden costs, and monitor expenses closely.
Loss of Data	Implement reliable backup and rollback procedures to mitigate data loss risks.
Performance Bottlenecks	Optimize data migration processes and conduct performance testing.
Lack of Data Governance	Establish robust data governance practices and adhere to best practices.
Unforeseen Technical Issues	Plan for contingencies, conduct thorough testing, and have a response strategy in place.
Data Archiving Challenges	Develop strategies for data archiving, including categorization and storage.

Figure 2: Data migration Risks and Mitigation

Case Study
ABC Decking, a prominent decking materials provider, embarked on a transformative journey from an outdated AS400 ERP system to Oracle Fusion ERP. The comprehensive data migration involved crucial data elements essential for the company's day-to-day operations and strategic decision-making.

A. Migration Approach
The data migration approach involves seven elements listed below and the it's applicability is shown in figure 3.
- Gathering Information
- Data Cleansing and Consolidation
- Data Extraction
- Data Mapping
- Data Transformation
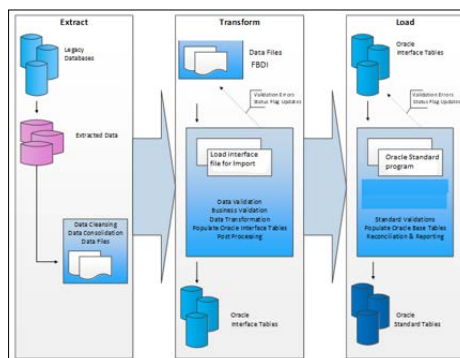- Data Loading
- Data Reconciliation

Figure 3: Data Migration Approach

B. Data Conversion Entities in Scope

1. Payment Terms
2. GL Accounts
3. Inventory Orgs
4. Locations
5. FOB
6. Freight
7. Ship Method
8. CARRIER
9. Mode of Transport
10. Planner
11. Channel
12. Sales Division
13. Sales Geography
14. Service Level
15. Work Areas
16. Work Center
17. Payment Method
18. Resources (equipment, labor, etc.)
19. Sub Inventory (stock rooms)
20. Customers
21. Suppliers
22. Item Catalogues
23. Item Category
24. Items and Item Attributes
25. Item Structures (BOM)
26. Work Definition
27. Standard Operations
28. Buyer
29. Item Cost
30. Partner Network Customer Supplier Relationship
31. Partner Network Supplier Item Relationship
32. Partner Network MOF Schedule
33. Open Blanket Purchase Agreement
34. Price Lists (along with qualifier, modifiers)
35. Discount List
36. Customer Pricing Profile
37. Customer Pricing Segment
38. Customer Pricing Strategy
39. Sourcing Rule
40. Assignment Set
41. Manage Transit Time
42. Item Transaction Default
43. Item X-Ref (with customer, with supplier, with CMS system)
44. Location Code Mapping for EDI
45. Quality and Inspection
46. Historical Shipment/Booking/Adjusted Data
47. Inventory on-hand
48. Open Work Order
49. Open Purchase Order
50. Open Sales Orders
51. Open AR Invoice

C. Key Activities with RACI Matrix

Developing a clearly defined roles and responsibilities in an ERP data migration is important for the successful implementation of the initiative, the fig 4, shows the guideline for defining a RACI – Responsible, Accountable, Consulted, Informed.

Legend:		R: Responsible	A: Accountable	C: Consulted		I: Informed
Migration Phase	Activity	IT	Data Migration Team	Functional Team	Business Users
Legacy Activities	Data Element Identification	CI	CI	R	A
	Data Cleansing	A	CI	CI	R
	Data Extract	R	CI	CI	A
Oracle Cloud Activities	Data Mapping	CI	RA	RA	CI
	Data Transformation	CI	RA	CI	CI
	Data Loading	CI	RA	CI	CI

Figure 4: Data Migration Key Activities and RACI matrix

D. Data Cleansing and Data Consolidation

Some of the data cleansing rules used are

- Discovery of "dirty data" – Duplicate Data, Data having no values in some of the fields which are mandatory, Data having value in a format not consistent with other data etc.
- Eliminating unnecessary data records.
- Fix duplicated data e.g., multiple vendor master records, which will need to be consolidated.
- Reformatting and standardizing data so that it can be converted.
- Gathering information that does not exist in any legacy system but is required in Oracle Cloud.
- Some of the master elements data went through a process of consolidation where data element values from different regions/systems were merged or get inter-related to each other based on the To-Be requirements. For example, merging duplicate customer or Suppliers.

Figure 5 is a template that can be used to track the data cleansing and consolidation.

What to Clean and Consolidate	When to Start the Clean-up and consolidation	When to complete Clean-up and Consolidation	Area	Clean-up and Consolidation Owner	Sign off Owner
- Customer Name and Address - Employees Data	Date	Date	Sales		

Figure 5: Data Cleansing and Consolidation Tracking Template

E. Data Extraction

- Legacy application programming included the implementation of Business Extraction Rules, with a specific emphasis on processing rules for Open Transactions.
- Identified and designated the historical data to undergo conversion.
- Implemented filters to exclude redundant data and eliminate unnecessary information not required for migration.
- Addressed incomplete data by defaulting to specified values.
- Utilized mapping or lookups to derive missing data.
- Handled differently structured data, where a single record in the source system might translate into multiple records in the target system.
- Executed data extraction into extract files adhering to the agreed-upon formats such as XML, CSV, and XLS.
- The Legacy System took the responsibility of creating data files in the predefined format.
- Ensured uniformity across legacy systems, as each one generated file conforming to the same predefined format.
- A consistent and meaningful file name was used with a timestamp <CONV>_<LEGACY>_<MEANINGFUL NAME>_ 2014MMDDHH24MISS
- Where,
- LEGACY – Legacy system from which the file is generated
- MM – Month e.g. 12

- DD – Day e.g. 31
- HH24 – Hours in 24 hour format e.g. 23 for 11 p.m.
- MI – Minutes e.g., 39
- SS – Seconds e.g., 58
- Example – CONV_CPQ_ITEMS_20220405112532
- Once the data file was generated by the legacy system they were placed in a specific server mentioned
- Data files were moved from that Server to Unix path for further loading.

F. Data Loading Options
Data loading options were available in the target system as shown in fig 6 are most suitable option was identified for each data element.

Option	Custom Code Required	Reliability	Speed	Suitable for	Constraints
Manual Entry	No	Low-Medium	Low	Small Volumes e.g. Lookup codes	Manual Errors and Time consuming
Desktop Integration (Data-load & ODI)	No	Medium-High	Medium	Medium Volumes, Data entry enabled by Apps screens e.g. Sourcing rule assignments	Time Consuming
Oracle FBDI	Yes	High	Conversion Specific (Mostly High)	High Volumes & Oracle supported e.g. Items, PO, Invoices, GL Transactions	
REST API	Yes	Medium	High	Entities not supported by FBDI	Effort Intensive and Time Consuming

Figure 6: Available Data Loading Options

G. Data Migration Rounds
The data migration was executed meticulously in four rounds, the fig 7 shows the percentage of the data migrated in each phase of the data migration.

1. **Mock Round:** Conducted a simulated migration to identify potential issues and refine the migration strategy. The goal was to have 60-80 % data ready.
2. **SIT (System Integration Testing) Round:** Executed the migration in a controlled environment, ensuring seamless integration with existing systems. The goal was to have 80-90 % data ready.
3. **UAT (User Acceptance Testing) Round:** Involved end-users in validating the migrated data, collecting feedback, and making necessary adjustments. The goal was to have 95-100 % data ready.
4. **PROD (Production) Round:** The final round involved the live migration of data into the production environment, marking the official transition to Oracle Fusion ERP.
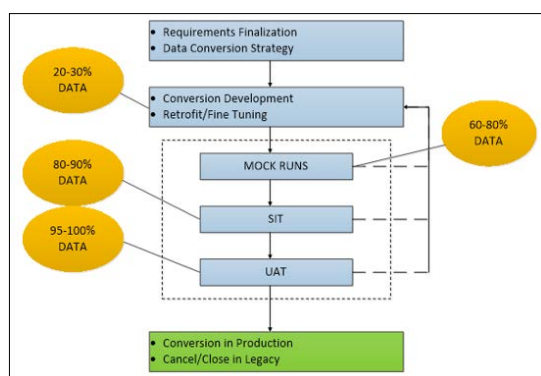

Figure 7: Data Migration Phases and Percent Data Volume

H. Data Reconciliation
This activity was done by the Client Business Team. The Business Team gave a Sign off on that conversion activity.
Record Counts
- Counts on source and target tables/files, including the number of errors records
- This is displayed in the output log of each of the Conversion program and Loader program

Visual Checks
- Select a sample set of data and visually compare the details in both Oracle and the legacy system, this can be done only after the data has been imported into the Oracle Base tables.

Key Fields
- Select the key fields for an Element from Oracle and legacy and compare them programmatically or in excel (for low data volumes), useful for Master data.

Checksum Based
- Compare the amount totals in Oracle and legacy for relevant fields, useful for Transaction data.

Conclusion
In summary, the process of data conversion for ERP transformation plays a pivotal role in the progression of contemporary businesses. We delved into the complexities and challenges associated with migrating data from legacy systems to advanced ERP solutions, emphasizing the crucial need for a well-defined and precisely executed data conversion strategy.

By exploring a diverse array of data elements, ranging from payment terms to inventory organizations, highlighted the intricate and varied nature of challenges that organizations encounter during their transformation journeys. The delineation of data migration phases, spanning from Mock to Production rounds, underscores the importance of a systematic and iterative approach to ensure both data integrity and system functionality.

An in-depth analysis of risks, encompassing issues like data quality, system downtime, and security concerns, has been accompanied by corresponding solutions. This paper advocates for proactive measures, including rigorous testing, robust security implementations, and contingency plans, to effectively mitigate potential risks.

Furthermore, the generic use case provided for an ERP transformation serves as a practical illustration of the principles discussed. It encapsulates the challenges of managing diverse data elements within a specific industry context, showcasing the applicability of the outlined data conversion methodology in real-world scenarios.

In essence, as organizations navigate digital transformations, the success of ERP implementation hinges on the seamless and accurate conversion of data. This paper serves as a comprehensive guide, offering insights, strategies, and practical considerations to navigate the challenges inherent in data conversion for ERP transformation across various industries. By embracing these principles, organizations can ensure the success of their ERP projects and foster enhanced operational efficiency, data-driven decision-making, and sustained growth in the ever-evolving landscape of modern business.

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