



Enterprise Resource Planning (ERP) Considerations¹

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Executive Summary

ERP implementations are more likely to:

- Fail;
- Be delayed;
- Cost more than forecast; or
- Fail to deliver full functionality

than they are to succeed. It is important to be aware of how ERP as a technology evolved, what its strengths and weaknesses are, the nature of important implementation challenges. Further, understanding of how ERP and legacy system metadata can be used to simplify implementation and help organizations best plan for this exciting new challenge.

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¹ This paper was prepared in the Fall of 2002 when the author was a Visiting Scientist as part of an Internal Research and Development (IRAD) project for the Software Engineering Institute (SEI) at Carnegie Mellon University.

The Institute for Data Research (IDR) is a research and development center located in Richmond, Virginia and affiliated with Virginia Commonwealth University. The Institute is an interdisciplinary research organization founded to further the study of data and metadata as valuable organizational assets. The key to IDR's successful practice of creating business value is the application of innovative data engineering and management techniques for recovering, understanding, improving and re-using organizational metadata assets.

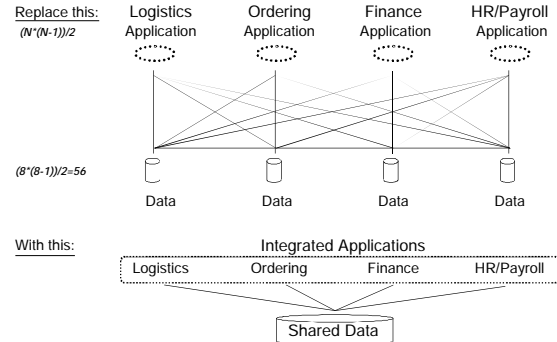


Enterprise Resource Planning (ERP) Considerations

Introduction: ERP Defined

The term "ERP" stands for Enterprise Resource Planning. As illustrated, ERPs are popularly considered to be modern, integrative, technology-based solutions that permit organizations to replace:

- Disparate, legacy applications and stove-piped data; and the



- Associated organizational inefficiencies that arise from the use of the disparate data and applications.

Because legacy systems were typically not designed to easily share information with other systems – they don't. This leads to confusing situations where the organization doesn't know the answer to questions such as how many customers it has!



Each disparate legacy application/data combination typically supports an individual functional-area such as finance, ordering, or logistics, etc. Only recently have organizations become aware of that the magnitude of these disintegration costs – **ranging from 20-40% of organizational IT budgets!**

ERP solutions provide integrated applications that access standardized enterprise data – replacing the hodgepodge of legacy systems. Major ERP vendors attempting to help organizations reduce their organizational disintegration costs include: PeopleSoft (www.peoplesoft.com), SAP (www.sap.com), Baan (www.baan.com), Oracle (www.oracle.com), Lawson (www.lawson.com), J D Edwards (www.jdedwards.com).

When considering enterprise resource planning as a potential solution to specific organizational challenges, major considerations include:

- Understanding ERP's complex MRP II origins;
- ERP capabilities;
- Five ERP implementation challenges as –
 - Inaccurate ERP expectations,



- Customization challenges,
- Long payback periods; and
- Data quality costs;
- "Hidden" implementation costs
- ERP metadata value in support for ERP implementation.

ERPs Complex MRP II Roots

ERP's roots emanate from the same engineering-based solutions developed as "MRP" (or Manufacturing Resources Planning). MRP solutions integrated the data used to produce bill of materials, inventory, and production material requirements. Functional area coverage included areas such as business planning, sales and operations planning, production planning, master production scheduling, material requirements planning, capacity requirements planning, and the execution support systems for capacity and material. Additional MRP capabilities included the ability to forecast the quantity and timing of raw material deliveries; simulation capabilities to answer "what if" questions; and integrated financial reporting such as the business plans, purchase commitments, shipping budgets, and inventory projections. ERP's MRP roots provide an engineering-focused solution development perspective that it can be perceived as technically detailed and complex. As we shall see, these complexities lead to implementation difficulties more often than not.

ERP Capabilities

Generally ERPs are considered to possess better technology/integration capabilities, and increased functional area coverage (for example adding human resource functionality, maintenance, project planning and document management capabilities) than MRP II solutions. According to one vendor's website ERPs are commercial-off-the-shelf (COTS) enterprise software applications that are marketed as "global, enterprise-wide software solutions ... (consolidating) fragmented resources formally devoted to supporting functional stand-alone systems. (By investing in ERPs) ... resources formerly devoted to the tedious process of converting and integrating data among individual applications are freed to apply to analysis. Increased access to better quality and more integrated information can be powerful tools with which to run an organization."² In short, ERPs are software systems that permit coordinated exchange of data using common data structures and coordinated procedures among a wide-variety of functional organizational areas.

In spite of the size of the investment, ERPs are popular with management especially those with complex and/or costly legacy environments. ERPs can be purchased by functional area module permitting organizations a degree of flexibility when determining the scope of the package. For example, an organization might typically implement a

² <http://www.peoplesoft.com> – accessed 10/98.

combination of pay and personnel management modules to replace two or more legacy payroll and HR systems. Other popular ERP solutions: integrate financial information; integrate customer order information; standardize and speed up manufacturing processes; reduce inventory; or standardize HR information.

ERPs make sound arguments for data-centric enterprise software development. They shield the enterprise from the complexities of having to develop standard data structures for sharing and operating procedures for coordinating activities among organizational components. PeopleSoft and SAP (for example) each contain thousands of data tables and individual procedures for interacting with the enterprise software. Because ERPs attempt to permit organizations to capitalize on planned information sharing cost avoidance, they make sense when existing organization procedures and data structures can be successfully adopted to match those implemented by the ERP – the process of ERP customization or tailoring.

Over-arching ERP Challenge: Achieving Organizational Understanding:

The biggest ERP challenge faced by organizations is recognizing the implemented that the integration of previously un-integrated job functions requires that knowledge workers supporting different organizational functions will now be using the same software and they will both be entering information that affects the other. To do this accurately, these knowledge workers must have a much broader understanding of how others in the organization perform their functions than they did before the ERP solution.



Understanding has a specific definition in an ERP context: "Understanding an architecture" indicates that the organizational legacy systems and the ERP are documented and articulated as a digital blueprint illustrating the commonalities and interconnections among the component metadata. Understanding in EAI Understanding is a shorthand reference for use of a data centric technique to represent, manage, and develop manipulable system component models within a formally defined common metadata model.

Common metadata model components are represented using standardized notation and are sufficiently detailed to permit both business analysts and technical personnel to separately read the same model, and come away with a common understanding and yet they are developed effectively.

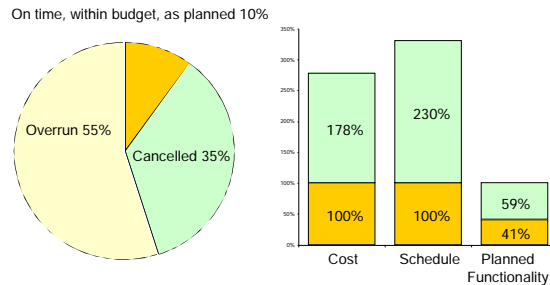
Other ERP Challenges

ERP implementation suffers from two common problems: inaccurate expectations and customization/tailoring challenges.

Inaccurate Expectations

The first thing to realize when considering ERPs is that inaccurate expectations are the norm. Most ERP implementations today result in cost and schedule overruns. Consider the following statistics:³

- 10% of ERP implementations succeed with full functionality, within forecast cost and time frames.
- Cost overruns average 178%;
- Schedule overruns average 230%;
- Implemented functionality averages 41% of what was desired.



Other recent ERP related findings include⁴:

- A 2001 Robins-Gioia Survey of ERP implementers found that 51% viewed their ERP implementation as unsuccessful and 46% characterizing their organizations as not understanding how to use the system to improve the way they conducted business.
- 2001 Conference Board Survey participants indicated only 34% of respondents were very "satisfied" with what they got and that 40% of the projects failed to achieve their business case within one year of going live.

These outcomes indicate a lack understanding of ERP implementation complexities. Routinely, the cost of implementing and the time required to implement are underestimated while the scope of what organizations are able to implement are routinely overestimated.

Customization Challenges

Because ERPs attempt to permit organizations to capitalize on planned information sharing cost avoidance, they make sense when existing organization procedures and data structures can be successfully adopted to match those implemented by the ERP. Most organizations discover how compatible the new ERP is with their existing systems

³ Standish Group web site – <http://www.standishgroup.com> – accessed 10/98.

⁴ IT Cortex web site – <http://www.it-cortex.com> – accessed 10/02.



and processes when the turn on the new system. When it is discovered that the ERP differs from the system it is replacing the organization is faced with possibility of customization or tailoring the ERP. There are four basic choices to

1. Modify the ERP to match the organizational processes and/or data structures;
2. Modify the organizational processes and/or data structures to match the ERP (Note: that 1 & 2 require understanding of the ERP and organizational processes and data structures);
3. Perform some of choice 1 and choice 2; or
4. Ignore the problem.

Most organizations approach the customization/tailoring decision with out proper information required to reach a good decision.

Long payback period

Another not well understood statistic is that the return-on-investment for most organizations runs to almost three years or in CIO terms – no benefits will be realized until your successor's, successor is in the job of the CIO who implemented the ERP project. A recent Meta Group study indicated the median annual savings from the new ERP average \$1.6 million/annually on (roughly) \$30 million dollar investment one year after implementation is completed. And a Deloitte survey of Fortune 500 companies found one in four suffering a drop in performance when their ERP system went live.

Data quality costs

A recent data management study performed by *Price, Waterhouse, Coopers* survey revealed the two troubling facts about organizational data quality:

- "Only 15% of companies are very confident of the data received from other organizations"
- "Only one in three companies are very confident in the quality of their own data"⁵

Garbage in – garbage out as they say. Poor quality data input can be fatal to ERP projects. Just imagine the confidence that the new system engenders as they get bad data out of the system more easily than the legacy system.

⁵ PriceWaterhouseCoopers, *Global Risk Management Solutions, Global Data Management Survey 2001: the new economy is the data economy*, 5/23/01 accessed on 8/8/01 – [http://www.pwcglobal.com/Extweb/service.nsf/8b9d788097dff3c9852565e00073c0ba/0cae4d32ccbaba2380256a0d004e454b/\\$FILE/Data+Management+brochure.pdf](http://www.pwcglobal.com/Extweb/service.nsf/8b9d788097dff3c9852565e00073c0ba/0cae4d32ccbaba2380256a0d004e454b/$FILE/Data+Management+brochure.pdf)



Other ERP Hidden Costs

Other common "hidden" ERP implementation costs⁶ include the following:

- **Training** – the most underestimated budget item because knowledge workers almost invariably have to learn a new set of processes, not just a new software interface/
- **Integration and testing** – analyzing, implementing and testing literally hundreds of links between ERP and other corporate software.
- **Customization** – of the ERP happens when it can't support one or more of your business processes and you decide to make it do what you want. You'll have to do it all over again in the new version.
- **Data analysis & conversion** – ERP data must be combined with external data for analysis purposes and organizations are likely to underestimate the size and cost of the conversion process.
- **Consultants ad infinitum** – When users fail to plan for disengagement, consulting fees run wild. To avoid this, companies should identify objectives for which its consulting partners must aim when training internal staff. Include metrics in the consultants' contract; for example, a specific number of the user company's staff should be able to pass a project-management leadership test—similar to what Big Five consultants have to pass to lead an ERP engagement.
- **Replacing your best and brightest** – staffing the project with the best and brightest is required because the software is complex and the business changes dramatic. Huddle with HR early on to develop a retention bonus program and create new salary strata for ERP veterans.
- **Implementation teams can never stop** – After ERP, you can't go home again - the implementers are too valuable. Because they have worked intimately with ERP, organizations can't afford to send their project people back into the business because there's so much to do after the ERP software is installed.

ERP Metadata Value in Support of ERP Implementation

Using a semi-automated approach, you can support your ERP initiative in a range of ways – knowledge of ERP metadata can help you to:

- Understand your existing environment in terms of organizational strengths and weaknesses.

⁶ http://www.cio.com/research/erp/edit/erpbasics.html#erp_really accessed 10/9/02.

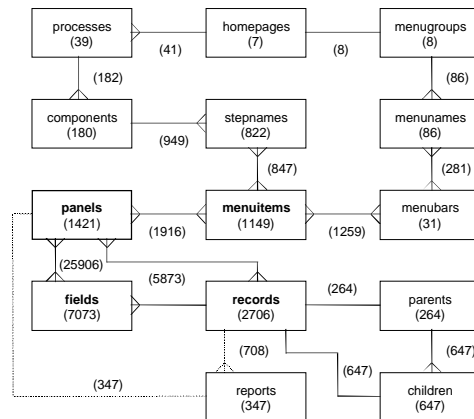


- Objectively assess individual ERP solutions in terms of their fit with your organizational practices.
- Assess various software versus procedural change options as you try to respond to identified gaps.
- Really understand the logical and physical data structures and their corresponding accessibility.
- Cleanse and otherwise prepare your data for conversion to the ERP.
- Speed up interface development based on our knowledge of the system metadata.
- Lower costs associated with ERP planning, implementation, project management, and conversion.

Understanding the ERP metadata structures enables you to develop and apply effective, engineering-based approaches as opposed to the brute force approaches adopted by many organizations.

Extracting the metadata of ERP systems permits organizations to more rapidly gain a fact-based understanding of their ERP challenge. For organizations that have not experienced an ERP implementation discomfort, ERP metadata can be used by the organization for a variety of purposes ranging from gaining an architectural perspective to accomplishing physical data mapping and migration.

The figure on the right illustrates the basic metadata architecture for a version of a major enterprise resource planning (ERP) vendor's package.⁷ It is interesting to understand what this simple metamodel tells us about this vendor's system.



- Direct interactions happen between four primary components – users select MENUITEMS to navigate to PANELS in order to access data from specific FIELDS and RECORDS.
- Much detail must surmounted in order to achieve access to the desired panel – literally hundreds of MENUITEM and business process STEPNAME combinations!

⁷ Extracted from Peter Aiken et. al. *Reverse Engineering New Systems for Smooth Implementation*. IEEE Software. March/April 1999 16(2):36-43. and other sources copyrighted by the author.



- This same detail makes it possible to determine MENUITEM navigation information required to implement a specific business process STEPNAME.
- It is possible to obtain detailed descriptions of the vendor's perspective on specific business processes.
- Only a subset of the total number of records is addressed by reports – possibly indicating a requirement for additional report writing capabilities.

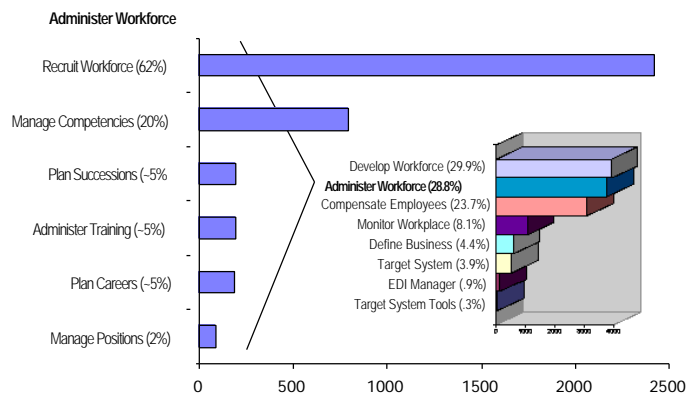
The dotted line connecting RECORDS, REPORTS and PANELS did not exist in the operational system; IDR created these lines by uncovering linking metadata and increasing the ERP metadata value. IDR has developed baseline metadata descriptions of multiple ERP applications. This "out of the box" metadata has proven key to effective strategic systems implementation and has considerable value. These assets are often key to jump-starting new initiatives or restarting stalled projects.

Understanding the metadata of both your legacy systems and your desired ERP target can save the implementation effort in at least five ways:

1. **Cost:** Compared to the standard conversion practice, metadata solution has saved an order of magnitude in total conversion costs, to include significant amounts of employee time and resources.
2. **Efficiency:** Metadata assets enable the implementers to greatly outperforming other analysts using manual analysis approaches.
3. **Effectiveness:** By approaching data migration with an engineering-based solution data quality measures are able to become integrated conversion process components. Not only is the initial investment less costly, but its payoff increases with respect to maintenance and upgrades.

4. **Communication**

Effectiveness: While not really a separate category from #3 above, it is worth pointing out to that management is able to make more informed decisions when the ERP implementation is presented using fact-based metadata (see figure at right illustrating the relative complexities of various software modules).



5. **Risk Mitigation:** three primary categories include:



- a. Error reduction: Human interpretation errors are significantly reduced and through-put is increased using our metadata extraction technologies.
- b. Conversion measures: Our fact-based analysis has enabled us to optimize for tasks variations as the target analysis focus changes).
- c. Low implementation cost: Proof of concept leading directly to business cases requires a minimal investment and can return a positive cash flow.

Only through careful planning of a metadata-based implementation strategy can organizations hope to avoid standard ERP pitfalls.