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Evaluation of ERP outsourcing

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Abstract

Outsourcing has evolved as a viable means to attain cost savings in organizational information technology. This option, however, involves significant risks. This paper discusses why formal cost evaluation models are difficult to apply in this decision, and demonstrates how multi-criteria methods can be used to support this critical decision.

Scope and purpose

Outsourcing through application service providers has become a viable way for organizations to obtain enterprise resource planning (ERP) systems. The choice of outsourcing avoids many risks associated with installing and operating ERP systems in-house, but conversely risks reliance on the ASP as well as potential security issues. These issues involve many subjective factors that are not easy to quantify accurately. A multi-criteria approach for evaluating of ERP outsourcing decisions is presented.

1. Introduction

Outsourcing has evolved into a way for IT to gain cost savings to organizations. This is true for ERP (enterprise resource planning) just as it is for other IT implementations. ERP rental was estimated to be $6.4 billion in 2001 by Forrester Research Inc. [1]. Bryson and Sullivan [2] cited competitive pressures as motivation for many organizations to outsource major IT functions. Eliminated jobs make businesses more productive. Often those jobs eliminated are from IT [3].

The next section of the paper will review the current status of ERP outsourcing. The Section 3 will review factors involved in outsourcing decisions. Qualitative aspects of the ERP outsourcing decision will be demonstrated through two cases. Analytic techniques to support this decision that consider both quantitative and qualitative factors will then be shown. The conclusions will review points.

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2. Current status

Outsourcing is attractive to many types of organizations, but especially to those that have small IT staffs, without expertise in enterprise systems [4]. Some organizations, such as General Motors, outsource entire IT operations [5]. There also are on-demand application providers willing to provide particular services covering the gamut of IT applications [6]. Reasons for use of an ASP included the need to quickly get a system on-line (even to bridge the period when an internal system is installed), or to cope with IT downsizing. ASPs can help both small carriers develop new capabilities quickly, as well as providing faster implementations at multiple locations for large companies [7], and provide access to automatic updates and new applications. They also provide a more flexible way to deal with the changing ERP vendor market [8].

ERP can be outsourced overseas. Overseas outsourcing takes advantage of tremendous cost saving opportunities. Hoffman and Thibodeau [9] provided a relative salary schedule by country, with extracted information given in Table 1.

These pay schedules are subject to inflation, and Indian pay rates were expected to increase by double-digit rates over the next few years. ERP skills is one of the areas where higher inflation is expected. However, the expertise available in India still makes them a highly attractive source of IT. Over a period of years, those in other countries such as China are expected to overcome current language barriers and develop sufficiently mature IT skills to draw work from India.

Dial, manufacturer of soap and other products, recently reorganized its IT and installed a SAP suite run by EDS to replace a mix of applications from Siebel, Oracle, Manugistics, and other sources [10]. Dial's 50 IT employees were to be transferred to EDS after an 18 month, $35 million dollar project. Only a small governance team was to be retained by Dial, with the purpose of dealing with IT strategy, architecture, and industry applications. Overall expenses for the transfer were expected to be $110 million. The chief of Sun stated that ultimately 90% of IT jobs will be outsourced [11]. Other outsourced ERP applications included the California State Automobile Association (with Accenture to run a PeopleSoft system), ASAT Holdings hiring IBM to implement their SAP system [10].

Gartner Inc. has estimated monthly fees for ERP outsourcing of 300–1000$ per user [12]. There is a tradeoff, in that costs and some form of risks are reduced by outsourcing, but other companies view ERP as too mission-critical to yield control. The biggest risks of outsourcing are downtime and loss of operational data. Informatica Corp. outsourced human resources software because they felt they could continue to operate even if that system went down. However, they did not outsource other ERP modules. Outsourcing can involve specialty products, not requiring a full-scale ERP, such as enterprise asset management (EAM) systems [4] or HR systems [13]. Federal-Mogul Corp. experienced quick growth through acquisitions, with the need to consolidate 27 different ERP implementations. This operating environment was considered totally unsuitable for outsourcing, other than technical work such as programming in SAP's programming language. Huff [7] concluded that the tradeoff was between savings in capital investment and technical expertise through ASP, versus control and customization abilities better served through in-house IT.

Government use of ERP has its own set of characteristics. Joplin and Terry [14] reported the value of outsourcing financial systems in government. Benefits of application hosting were stated as lower opportunity costs of software

Table 1
Average programmer salary

Country	Average programmer salary
Vietnam	$3475
India	$7500
China	$7550
Russia	$10 000
Czech Republic	$12 350
Mexico	$20 500
Ireland	$24 500
Israel	$29 150
Singapore	$30 950
US	$65 000

Table 2
Factors for and against outsourcing ERP

Reasons to outsource	Reasons against outsourcing
Reduced capital expenditure for ERP software and updates	Security and privacy concerns
Lower costs gained through ASP economies of scale (efficiency)	Concern about vendor dependency and lock-in
More flexible and agile IT capability	Availability, performance and reliability concerns
Increased service levels at reasonable cost	High migration costs
Expertise availability unaffordable in-house (eliminate the need to recruit IT personnel)	ERP expertise is a competency critical to organizational success
Allowing the organization to focus on their core business	ERP systems are inextricably tied to IT infrastructure
Continuous access to the latest technology	Some key applications may be in-house and critical
Reduced risk of infrastructure failure	Operations are currently as efficient as the ASPs
Manage IT workload variability	Corporate culture does not deal well with working with partners
Replace obsolete systems	

Based on Bryson and Sullivan [2], CIO Insight [16], Clymer [6].

ownership, and avoiding problems of developing and retaining IT staff. Regan and Virzi [15] argued that it is more difficult to work in the governmental sector than in a private company, because of the need to be able to defend proposals in public hearings. That application also involved the use of ERP to reduce State jobs, which led to difficulties with the state information worker union.

3. Pros and cons of ERP outsourcing

Bryson and Sullivan [2] cited specific reasons that a particular ASP might be attractive as a source for ERP. These included the opportunity to use a well-known company as a reference, opening new lines of business, and opportunities to gain market-share in particular industries. Some organizations may also view ASPs as a way to aid cash flow in periods when they are financially weak and desperate for business.

There are risks in outsourcing. Bryson and Sullivan noted that in many cases, cost rise precipitously after the outsourcing firm has become committed to the relationship. One explanation given was the lack of analytical models and tools to evaluate alternatives. These tradeoffs are recapitulated in Table 2.

Bryson and Sullivan noted reasons that an ASP might shirk their commitments, such as ASP success, or conversely ASP bankruptcy. Their site might be attacked and vandalized, or destroyed by natural disaster. Each organization must balance these factors and make their own decision. The following cases demonstrate two organizations that reached different conclusions.

4. Cases

Two cases are presented to demonstrate tradeoffs involved in ERP outsourcing decisions. The first is representative of the conventional approach, with vendor software installed within the organization. The second relates GMs move to outsourced ERP.

Russ Berrie & Co. is a firm retailing gift related items [17]. In 1998 and 1999 they spent $19.2 million to install a system from SAP. However, they experienced problems in tracking incoming orders, and some customer orders vanished from the system. Shipments were delayed or canceled. The firm wrote off $10.4 million to end the project, and reverted to its old systems. In 2001 they were experiencing inefficiencies in their supply chain, and considered options for a more contemporary system. Big 5 consultants were contacted, and provided precise predictions of expense reduction that were viewed by Berrie as unrealistic. Four ERP vendors were contacted (Intentia International, JDEdwards, Oracle,

PeopleSoft). Each vendor was then interviewed, with a set of no-budge technical criteria including user ability to access the system through the Web, thin architecture that would not require a great deal of software resident on user PCs, and software installation in stages. A diverse set of users was included to increase user involvement. Intentia was dropped due to a perception of insufficient Web technology. Berrie developed a scoring system where each of the vendors were rated on a 1–5 scale over dozens of weighted features (such as technology platform, and strength of sales order processing). Bids were obtained iteratively, allowing each vendor to provide a price for the specific kind of system needed by Berrie. A JDEdwards system including finance, order processing, human resources, procurement, and other modules was to be installed in five phases by June 2003 with the help of a consultant.

General Motors' IT head was interviewed by eWeek [5] concerning their ERP outsourcing. As one of the first to outsource such a large system, GM acquired EDS in their first generation. This was not without problems in that GM felt that they had no management control. In the second generation GM used a combination of companies, although one company provided most of the service. In 2003 they were in the midst of a third generation emphasizing a balance of competing outsource companies, each required to work with the others. This required standardization. The intent was to outsource all IT, but to retain control over everything. In 2003 GM was spending $1 billion less on IT than they had in 1996. In 1996 they also spent about $1.5 billion on Internet applications to link with suppliers. Originally they had 7000 legacy information systems, 4000 of which were gone within 5 years.

The Berrie case demonstrates the need for control over key computing resources and security. Outsourcing can be negative with respect to those features. However, some organizations (even as large as General Motors) feel that these factors can be controlled, and that they benefit by outsourcing technical matters so that they can focus on their core competencies.

5. Methods

The ideal theoretical approach is a rigorous cost/benefit study, in net present terms. Methods supporting this positivist view include cost/benefit analysis, applying net present value, calculating internal rate of return or payback. These methods are widely known [18]. Many academics as well as consulting practitioners take the position that this is crucial. However, nobody really has a strong grasp on predicting the future in a dynamic environment such as ERP, and practically, complete analysis in economic terms is often not applied.

5.1. Use of formal methods

Mabert et al. [19] surveyed a large number of Midwestern U.S. manufacturing firms who had implemented ERP systems. Olhager and Selldin [20] replicated the study in Sweden. These surveys yielded the proportions of analysis applied to ERP adoption decisions as shown in Table 3.

It seems counterintuitive that not all firms implementing ERP applied formal ROI analysis, although the argument still holds that detailed analysis of imprecise estimated figures is often a waste of time. In this study, some firms used multiple evaluation methods. These firms for the most part anticipated that the adopted system would serve their organizations over 7 years.

The Gartner Group consistently reports that IS/IT projects significantly exceed their time (and cost) estimates. Thus, while almost half of the surveyed firms reported expected implementation expense to be less than $5 million, we consider that figure to still be representative of the minimum scope required. However, recent trends on the part of

Table 3
ERP proposal evaluation technique use

Financial method	Reported use US	Reported use Sweden
ROI	53%	30%
Payback	35%	67%
Expected NPV	15%	12%
Other	11%	20%

Extracted from Mabert et al. [19], Olhager and Selldin [20].

Table 4
ERP installation project cost proportions

Installation cost proportion	US	Sweden
Software	30%	24%
Consulting	24%	30%
Hardware	18%	19%
Implementation team	14%	12%
Training	11%	14%
Other	3%	1%

Extracted from Mabert et al. [19], Olhager and Selldin [20].

vendors to reduce implementation time probably have reduced ERP installation cost. Mabert et al. [19] also investigated the proportion of total costs by ERP component, with results given in Table 4.

In the US, vendors seem to take the biggest chunk of the average implementation. Consultants also take a big portion. These proportions are reversed in Sweden. The internal implementation team accounts for an additional 14% (12% in Sweden). These proportions are roughly reversed in Sweden with training.

Total life cycle costs are needed for evaluation of ERP systems, which have long-range impacts on organizations. Unfortunately, this makes it necessary to estimate costs that are difficult to pin down. McCarthy [21] identified the following soft impacts on a total cost model:

- software upgrades over time, to include memory and disk space requirements;
- integration, implementation, testing, and maintenance;
- providing users with individual levels of functionality, technical support and service;
- servers;
- disaster recovery and business continuance program;
- electrical service requirements, to include required building modifications;
- staffing.

5.2. Qualitative factors

While cost is clearly an important matter, there are other factors important in selection of ERP that are difficult to fit into a total cost framework. Van Everdingen et al. [22] conducted a survey of European firms in mid-1998 with the intent of measuring ERP penetration by market. The survey included questions about the criteria considered criteria for supplier selection. There were 2623 responses for supplier selection criteria. The criteria reportedly used are given in the first column of Table 5, in order of ranking. Product functionality and quality were the criteria most often reported to be important. Column 2 gives related factors reported by Ekanayaka et al. [23] in their framework for evaluating ASPs, while column 3 gives more specifics in that framework.

While these two frameworks do not match entirely, there is a lot of overlap. ASPs would not be expected to have specific impact on the three least important criteria given by Van Everdingen et al. The Ekanayaka et al. framework added two factors important in ASP evaluation: security and service level issues.

5.3. Alternative ERP form

The overall ERP selection decision involves the seven broad categories of alternatives shown in Table 6. Each specific organization might generate variants of selected alternatives that suit their particular needs.

5.4. Multiple criteria analysis

Cost-benefit analysis seeks to identify accurate measures of benefits and costs in monetary terms, and uses the ratio benefits/costs (the term benefit-cost ratio seems more appropriate, and is sometimes used, but most people refer to cost-benefit analysis). Because ERP projects involve long time frames (for benefits if not for costs as well), considering the net present value of benefits and costs is important.

Table 5
Selection evaluation factors

ERP supplier selection (Van Everdingen et al. [22])	ASP evaluation (Ekanayaka et al. [23])	Ekanayaka et al. subelements
1. Product functionality	Customer service	1. Help desk & training 2. Support for account administration
2. Product quality	Reliability, scalability	
3. Implementation speed	Availability	
4. Interface with other systems	Integration	1. Ability to share data between applications
5. Price	Pricing	1. Effect on total cost structure 2. Hidden costs & charges 3. ROI
6. Market leadership		
7. Corporate image		
8. International orientation		
	Security	1. Physical security of facilities 2. Security of data and applications 3. Back-up and restore procedures 4. Disaster recovery plan
	Service level monitoring & management	1. Clearly defined performance metrics and measurement 2. Defined procedures for opening and closing accounts 3. Flexibility in service offerings, pricing, contract length

Table 6
Alternative ERP options

Form	Advantages	Disadvantages
In-house	Fit organization	Most difficult, expensive, slowest
In-house + vendor supp.	Blend proven features with organizational fit	Difficult to develop Expensive & slow
Best-of-breed	Theoretically ideal	Hard to link, slow, potentially inefficient
Customize vendor system	Proven features modified to fit organization	Slower, usually more expensive than pure vendor
Select vendor modules	Less risk, fast, inexpensive	If expand, inefficient and higher total cost
Full vendor system	Fast, inexpensive, efficient	Inflexible
ASP	Least risk & cost, fastest	At mercy of ASP

Based on [18].

Multiple criteria analysis [24–26] considers benefits on a variety of scales without directly converting them to some common scale such as dollars. The method (there are many variants of multiple criteria analysis) is not at all perfect. But it does provide a way to demonstrate to decision makers the relative positive and negative features of alternatives, and gives a way to quantify the preferences of decision makers.

We will consider an analysis of five alternative forms of ERP: a system built in-house, a best-of-breed system, a vendor system customized to provide functionality unique to the organization, a vendor system without customization, and an ASP. We will make a leap to assume that complete total life cycle costs have been estimated for each option as given in Table 7.

The greatest software cost is expected to be for the in-house option, while the ASP would have a major advantage. The best-of-breed option is expected to have the highest consulting cost, with ASP again having a relative advantage. Hardware is the same for the first four options, with the ASP option saving a great deal. Implementation is expected

Table 7
Total life cycle costs for each option ($ million)

Option	Software	Consultants	Hardware	Implement	Train	Total cost
A: In-house	15	8	6	5	4	38
B: Best-of-breed	12	9	6	6	6	39
C: Customized	13	7	6	8	2	36
D: Full vendor	9	6	6	5	7	33
E: ASP	3	4	0	2	7	16

Table 8
Relative scores by criteria for each option in example

Option	Customer service	Reliability, Availability, Scalability	Integration	Cost	Security	Service level
A: In-house	1	0.3	1	0.2	1	0
B: Best-of-breed	0.6	0.7	0.7	0.1	0.9	.8
C: Customized	0.9	0.5	0.9	0.3	0.9	.7
D: Full vendor	0.7	1	0.3	0.5	0.9	1
E: ASP	0.5	0	0.3	1	0	1

to be highest for the customized system, with ASP having an advantage. Training is lowest for the customized system, while the full vendor system (and the ASP option) the highest.

But there are other important factors as well. This total cost estimate assumes that everything will go as planned, and may not consider other qualitative aspects. Multiple criteria analysis provides the ability to incorporate other factors.

Perhaps the easiest application of multiple criteria analysis is the simple multi-attribute rating theory (SMART) [27], which identifies the relative importance of criteria in terms of weights, and measures the relative performance of each alternative on each criterion in terms of scores.

In this application, referring to Table 5, we will include criteria from Ekanayaka et al. [23] of

- customer service,
- reliability, availability, scalability,
- integration,
- financial factors,
- security,
- service level monitoring and management.

The relative importance is given by the order, following Van Everdingen et al. [22].

Scores. Scores in SMART can be used to convert performances (subjective or objective) to a zero–one scale, where zero represents the worst acceptable performance level in the mind of the decision maker, and one represents the ideal, or possibly the best performance desired. Note that these ratings are subjective, a function of individual preference. Scores for the criteria given in the value analysis example could be as in Table 8.

The best imaginable customer service level would be provided by developing the system in-house. The ASP option is considered suspect on this factor, but not the worst imaginable. The full vendor system is expected to be the most reliable, while the ASP option the worst. The in-house option can be designed around existing practices, making it easy to integrate. The full vendor system and the ASP are rated low on this factor, but not the worst imaginable. Costs reflect Table 8, converting dollar estimates into value scores on the 0–1 scale. The ASP option has the best imaginable cost. The in-house system is rated as the best possible with respect to security issues, while the ASP is rated the worst possible. Service level ratings are high for the full vendor system and the ASP, while the in-house system is rated the lowest possible.

Weights. The next phase of the analysis ties these ratings together into an overall value function by obtaining the relative weight of each criterion. In order to give the decision maker a reference about what exactly is being compared,

Table 9
Worst and best measures by criteria

Criteria	Worst measure	Best measure
Customer service	0.5—ASP	1—In-house
Reliability, availability, scalability	0—ASP	1—Full vendor
Integration	0.3—Full vendor & ASP	1—In-house
Cost	0.1—Best-of-breed	1—ASP
Security	0—ASP	1—In-house
Service level	0—In-house	1—Full vendor & ASP

Table 10
Weight estimation from perspective of most important criterion

Criteria	Worst measure	Best measure	Assigned value
1-Customer service	0	1	100
2-Reliability, availability, scalability	0	1	80
3-Integration	0	1	50
4-Cost	0	1	20
5-Security	0	1	10
6-Service level	0	1	5

Table 11
Weight estimation from perspective of least important criterion

Criteria	Worst measure	Best measure	Assigned value
6-Service level	0	1	10
5-Security	0	1	25
4-Cost	0	1	50
3-Integration	0	1	90
2-Reliability, availability, scalability	0	1	150
1-Customer service	0	1	200

the relative range between best and worst on each scale for each criterion should be explained. There are many methods to determine these weights. In SMART, the process begins with rank-ordering the four criteria. A possible ranking for a specific decision maker might be as given in Table 9.

Swing weighting could be used to identify weights [27]. Here, the scoring was used to reflect 1 as the best possible and 0 as the worst imaginable. Thus the relative rank ordering reflects a common scale, and can be used directly in the order given (which was based on the Van Everdingen et al. survey [22]). To obtain relative criterion weights, the first step is to rank-order criteria by importance. Two estimates of weights can be obtained. The first assigns the least important criterion 10 points, and assesses the relative importance of each of the other criteria on that basis. This process (including rank-ordering and assigning relative values based upon moving from worst measure to best measure based on most important criterion) is demonstrated in Table 10.

The total of the assigned values is 265. One estimate of relative weights is obtained by dividing each assigned value by 265. Before we do that, we obtain a second estimate from the perspective of the least important criterion, which is assigned a value of 10 as in Table 11.

These add up to 525. The two weight estimates are now as shown in Table 12.

Table 12
Criterion weight development

Criteria	Based on best		Based on worst		Compromise
1-Customer service	100/265	0.377	200/525	0.381	0.38
2-Reliability, availability, scalability	80/265	0.302	150/525	0.286	0.30
3-Integration	50/265	0.189	90/525	0.171	0.18
4-Cost	20/265	0.075	50/525	0.095	0.08
5-Security	10/265	0.038	25/525	0.048	0.04
6-Service level	5/265	0.019	10/525	0.019	0.02

Table 13
Value score calculation

Criteria	Wgt	In-house	Best-of-B	Custom	Full vend	ASP
Customer service	0.38	$\times 1.0 = 0.380$	$\times 0.6 = 0.228$	$\times 0.9 = 0.342$	$\times 0.7 = 0.266$	$\times 0.5 = 0.190$
Reliability, avail, scalable	0.30	$\times 0.3 = 0.090$	$\times 0.7 = 0.210$	$\times 0.5 = 0.150$	$\times 1.0 = 0.300$	$\times 0 = 0.000$
Integration	0.18	$\times 1.0 = 0.180$	$\times 0.7 = 0.126$	$\times 0.9 = 0.162$	$\times 0.3 = 0.054$	$\times 0.3 = 0.054$
Cost	0.08	$\times 0.2 = 0.016$	$\times 0.1 = 0.008$	$\times 0.3 = 0.024$	$\times 0.5 = 0.040$	$\times 1.0 = 0.080$
Security	0.04	$\times 1.0 = 0.040$	$\times 0.9 = 0.036$	$\times 0.9 = 0.036$	$\times 0.9 = 0.036$	$\times 0.0 = 0.000$
Service level	0.02	$\times 0.0 = 0.000$	$\times 0.8 = 0.016$	$\times 0.7 = 0.014$	$\times 1.0 = 0.020$	$\times 1.0 = 0.020$
Totals		0.706	0.624	0.728	0.716	0.344

The last criterion can be used to make sure that the sum of compromise weights adds up to 1.00.

Value score. The next step of the SMART method is to obtain value scores for each alternative by multiplying each score on each criterion for an alternative by that criterion's weight, and adding these products by alternative. Table 13 shows this calculation.

In this example, the ASP turned out to be quite unattractive, even though it had the best cost. The cost advantage was outweighed by this option's poor ratings on customer service levels expected, reliability, availability, and scalability, and integration, which were the three highest rated criteria. The value score indicates that a customized system would be best, closely followed by an in-house system and a full vendor system.

Other multiple criteria methods. Note that there are many other approaches implementing roughly the same idea. The best known is multi-attribute utility theory, which uses more sophisticated (but not necessarily more accurate) methods to obtain both scores and weights. The analytic hierarchy process is another well-known approach [28].

6. Conclusions

Outsourcing ERP is a very important issue. ASPs have recently become major players in this market. While some forms of outsourcing on a large scale have been around for over a decade, in the past outsourcing was done through major software firms acting as service consultants, such as EDS.

Outsourcing in its current form introduces a number of important issues. While the cost of outsourcing is expected to be much lower, paradoxically it could lead to very high costs if things go wrong. The total life cycle cost estimated is quite unpredictable. ASPs also offer lower risk with respect to the vendor market, but again paradoxically involve the highest risk with respect to ASP survival. Meaningful and accurate cost benefit ratios in this environment are very hard to implement. Multiple criteria analysis offers a way to incorporate less quantified factors into rational decision models.

7. Uncited reference

[11].

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