Outsourcing and the Arbitrage Myth: Valuing the Intrinsic Risk of IT Offshoring

James Davis
Louisiana State University

Follow this and additional works at: http://aisel.aisnet.org/amcis2007

Recommended Citation
http://aisel.aisnet.org/amcis2007/208

This material is brought to you by the Americas Conference on Information Systems (AMCIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in AMCIS 2007 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.
ABSTRACT
The trend for businesses to move information technology (IT) resources offshore remains a relevant topic among IS professionals and researchers. An optimistic tendency has emerged referring to IT offshoring as an arbitrage opportunity. While the practice of offshoring offers some cost savings in the form of lower wages, there are intrinsic risks with IT offshoring. Using a real options approach, this paper seeks to develop a model for valuing the intrinsic risk associated with IT offshoring.

Keywords
IT Offshoring, Real Options, Valuing Risk

INTRODUCTION
A major direction in the outsourcing of IT services is the rise of exporting IT jobs offshore. While IT offshoring remains a relatively new trend, it is nevertheless, unmistakable. According to a 2005 NASSCOM study, the market for IT offshoring, inclusive of support, network administration and help desk is around US$70-$85 billion. The Bureau of Labor and Forrester Research, Inc. predict IT off-shoring will continue to grow (to the order of US$80-$150 billion by 2010) representing over a million IT related jobs (McCarthy 2004).

The popular press (Leach 2005; Roberts 2004; Walker 2006; Malone 2006), along with some academic researchers (Clemons & Aron 2004; Lammers et al. 2005), has exercised excessive optimism in the assumption that IT offshoring is an arbitrage opportunity and to a lesser extent that the IT function can be treated as a financial commodity (Hall & Liedtka 2005; Lee, Miranda, & Kim 2004; Miranda & Kim 2006; Oh, Gallivan, & Kim 2006; Dibbern et al. 2004). Arbitrage is defined as the exploitation of mismatched prices in two different markets, which results in profits without risk (Chance 2004). IT
offshoring is anything but “risk-free” (Aron et al 2005) and to our knowledge, no previous studies have adequately valued the intrinsic risk of IT offshoring.

OUTSOURCING

Evolution of IT Outsourcing

Similar to a manufacturing company outsourcing the fabrication of a part to a third party, businesses have steadily accepted the approach to outsourcing Information Systems (IS) services to outside vendors. IS outsourcing dates back to the early 1960s when Ross Perot’s EDS provided data processing services to Blue Cross/Blue Shield of Pennsylvania. The popularity of IS outsourcing continued to grow through the 1970s and 1980s culminating in an outsourcing agreement between Eastman Kodak and IBM worth $1 billion. The significance of the Kodak/IBM deal is the fact that it “legitimized” IS outsourcing as a strategic option for firms (Loh & Venkatraman 1992).

Some of the reasons behind outsourcing all or part of the IT function include: cost-savings, access to leading-edge technology, and focusing on core competencies (Dibbern et al. 2004, Clark et al. 1995, Hirschheim & Lacity 2000). Intelligent arguments have been made for the outsourcing and the insourcing of IT functions (Ang and Straub 1998, Lacity and Hirschheim 1993, Hirschheim and Lacity 1998). While both sides of the sourcing argument can justify their positions, cost remains the dominant theme throughout the outsourcing studies. Transaction cost theory states that companies will behave in a cost-economizing way and given the competitive nature of global markets outsourcing the IT function can appear to be an attractive alternative (Clark et al 1995). In contrast to the conventional wisdom that outsourcing the IT functions reduces costs, Hirschheim and Lacity (1998) found it common for insourcing organizations to replicate vendor’s strategies for reducing costs. In lieu of outsourcing to an external vendor, the insourcing organization would entertain proposals from outsourcing vendors and then allowing the internal IT managers to counter the vendor’s bid through replicating the proposed cost reduction tactics.

The insourcing versus outsourcing argument is exemplified by the arraignment where a vendor assumed operational control over a client’s IT assets (outsourcing) or the organization would mimic the vendor’s cost saving techniques (insourcing) (Dibbern et al 2004). Common to both of these scenarios is the personnel, assets, and facilities used to provide the service. In theory, if the vendor-client relationship were to be terminated, prematurely or otherwise, the organization could reassert control over their assets with minimal disruptions and risk. As the IT outsourcing phenomenon evolved, the IT function was relocated to locations that facilitate lower costs. This has led organizations to seek IT sourcing solutions from vendors located in other countries such as India and China.

Once an IT function has been outsourced offshore, the firm’s ability to perform the function in an internal manner will disintegrate quite rapidly and the function must be rebuilt should the firm choose to reinsource the function (Dixit 1989). An offshoring firm that fires a trained IT professional cannot rely on hiring the same person, and must expect to train a new one should it decide to internalize at a later date. Furthermore, offshoring firms lose part of their future bargaining power when it ceases internal production of an IT function (Lacity and Willcocks 1998).

Understanding and Managing Outsourcing Risk

Aron, Clemons, and Reddi (2005) developed a taxonomy of the forms of risk associated with outsourcing. Their taxonomy classifies the risks as strategic, operational, and intrinsic and they use the following definitions:

Table 1: Aron, Clemons, and Reddi (2005) taxonomy of outsourcing risk

<table>
<thead>
<tr>
<th>Type of risk</th>
<th>Elements that constitute the risk type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic</td>
<td>Risks that result from opportunistic behavior of one or both parties (buyer and supplier).</td>
</tr>
<tr>
<td>Operational</td>
<td>Risk of suboptimal output that results from a variety of cases, including complexity of operations, geographic separation, and communication limitations.</td>
</tr>
<tr>
<td>Intrinsic</td>
<td>Atrophy in the ability to execute the activity in-house, geopolitical risks, sovereign risk, and exchange rate risk.</td>
</tr>
</tbody>
</table>
Previous studies focused on the strategic and operational risks of IT offshoring (Aron et al 2005; Pfannenstein & Tsai 2004; and King 2005) suggesting ways to mitigate the risks via controls and other “best practices” from the field. Implementing quality assurance activities to mitigate strategic and operational risks add to the cost of IT offshoring whereas the expenditure can be measured directly. The same cannot be said for measuring intrinsic risk of IT offshoring. The problem may lie in the fact that offshoring decisions entail a portion of uncertainty. Tallon, Kauffman, Lucas, Whinston, and Zhu (2002) suggests traditional appraisal techniques do not adequately handle risk and uncertainty; therefore executives are forced to rely on instincts when making IT offshoring decisions. The real options approach to valuation is based on uncertainty which makes it more appropriate to evaluate sourcing decisions.

Consider the valuation of an outsourcing decision where management is contemplating offshoring part of the IT function. Using a traditional method, management would attempt to estimate future cash flows (or in the case of IT offshoring, cost savings) that may result when the IT function is moved offshore. The estimated cost savings would be a combination of the lower offshoring rate (compared to the cost of internal production) discounted by the expenditures for mitigating the strategic and operational risks. Missing from traditional methods is the ability to capture the value of the intrinsic risk: the further discounting of the expected offshore cost savings to account for future uncertainties involving geopolitical instability, natural disasters, terrorism, etc. Chance and Peterson (2002) recommend supplementing tradition methods with a Real Options Approach (ROA) that applies option-pricing methods to the valuation of capital investments in real decisions.

REAL OPTIONS

Insights and the Contribution of Real Options

Dos Santos (1991) found that executives undertook IT investments based upon a “gut feel” or “intuition”. Firms invest in technology to realize benefits later and traditional budgeting approaches, such as Net Present Value (NPV), are unable to capture the value of future benefits. Taudes et al. (2000) argued that since software platforms (in this case SAP) do not directly generate value organizations using NPV receive only a partial picture of the cost benefit because of the inability to exactly predict which applications will run on the system over time. If this is the case, evaluating IT offshoring decisions from a cost perspective may be best achieved using financial theories such as real options. One of the value-added components of using real options is that it takes into account management’s ability to create, execute, and abandon strategic and flexible options. Certainly, IT sourcing decisions can benefit from a real options approach (ROA) because of the difficulty evaluating the decision as a stand-alone cash flow.

The appealing characteristic of options is that it gives the option holder the “right” but not the “obligation” to conduct a future transaction at a price known today. In finance, options are derived from an asset (usually stock) to provide a means of managing financial risk. An American call (put) option gives the buyer the right to purchase (sell) the underlying asset at the strike price any time prior to the expiration date of the option. A European option is like an American option except it can only be exercised at the expiration date (Chance 2003). Likewise, real options are the right (but not the obligation) to acquire future business assets or opportunities.

Deriving the price of an option is not a trivial task. In their 1973 paper, Fischer Black and Merton Scholes published an options valuation formula known as the Black-Scholes model. The Black-Scholes model is the foundation on which most option valuation techniques are based (Chance and Peterson 2002). The original theory was directed toward pricing financial assets or more specifically, stock options (Chance 2004). Financial assets are claims on real assets where real assets are assets in physical form (e.g. land, buildings, etc) and include intellectual assets embodied in people (e.g. knowledge, skills, etc). The idea behind ROA is that ‘real’ assets can be valued using the Black-Scholes formula by mapping the appropriate cash flows onto the Black-Scholes parameters. The technique of mapping inputs from a ‘real’ decision into the Black-Scholes model has been used in evaluating IT infrastructure investments (Benaroch and Kauffan 1999, Taudes et al. 2000) and more recently for determining thresholds for in/out sourcing the IT function (Lammers et al. 2005).

Based on the same theoretical foundations as the Black-Scholes model, Cox et al. (1979) developed a simplified option pricing approach using a binomial distribution, or recombining tree, of underlying stock prices. At each step, the forks in the binomial tree represent the stock price moving up or down by an amount calculated using the volatility. “In applying the binomial model to an underlying asset, however, it is immediately obvious that the range of possible outcomes is greater than the two states that the binomial distribution can accommodate; however, that makes the model no less worthwhile. Its virtues are its simplicity and its ability to present the fundamental concepts of option pricing clearly and concisely.” (Chance 2004). An advantage of the binomial model is its transparency and ability to observe price changes at every step. As the number of binomial calculation steps increases, the binomial model converges on the Black-Scholes model (Chance and Peterson 2002).
In its simplest form, the real options approach (ROA) can be denoted as:
\[ \text{Strategic NPV} = \text{Traditional NPV} + \text{option value} \] (1)

The basic idea is to consider that the value of an investment extends beyond its value as measured by traditional NPV. The revised (or supplemented) NPV is referred to as strategic NPV (Chance and Peterson 2002). Applying the same considerations to the cost of IT offshoring, the total cost can be expressed as the traditional known costs plus an additional cost attributed to the intrinsic risk:
\[ \text{Total offshoring cost} = \text{Traditional IT off-shoring costs} + \text{Intrinsic value} \] (2)

**Case Study: Deutsche Bank**

To further illustrate valuing the intrinsic risk of IT offshoring, a convenient dataset from the Lammers et al (2005) threshold model will be utilized. In Lammers et al (2004), Deutsche Bank was comparing the internal production (high fixed costs with low variable costs) with outsourcing (low fixed costs with high variable costs). During periods of high output needs, internal production of the IT function is the more cost effective sourcing solution and would dominate the outsourcing option. By contrast, outsourcing of the IT function generated higher cash flows (in the form of cost savings) when output needs were low. At any given output level, one of the above sourcing options would be the dominating scenario (in terms of cost savings).

Suppose an organization, such as Deutsche Bank in 2003, is contemplating offshoring part of their IT function and while at present the function is produced internally management is uncertain as to the IT function’s future value in terms of rising offshoring costs and the strategic nature of the function. In this situation, the intrinsic risk is primarily based upon atrophy when the function is offshored and the possibility of reinsourcing the IT function if output needs grow such that reinsourcing is the cheaper alternative. Because of this uncertainty and the intrinsic risk of atrophy, the question then becomes: “When a firm is uncertain about the future of an offshored IT function, what is the value of the intrinsic risk?”

As a response to that question, we return to the Deutsche Bank offshoring scenario and evaluate the intrinsic risk of atrophy should Deutsche Bank need to reinsource their IT function. In this situation, the binomial model is preferred over the Black-Scholes model because it is more flexible and accounts for more assumptions about the outsourcing decision (Chance and Peterson 2002). Additionally, a two-period binomial model will be used for simplicity and to better illustrate a shorter-term contract since prior research found short-term contracts achieved higher success rates than long-term contracts (Lacity and Willcocks 1998).

At time 0, Deutsche Bank’s output requirements are \( O = 20,000 \text{ MIPS} \) where MIPS is the bank’s terminology for process transaction. Based on an estimated output volatility of \( \sigma = 12\% \) used in the Lammers et al (2005) model, an up factor of \( u = 1.12 \) and down factor of \( d = .88 \) will be used to construct a binomial model of future output needs (see figure 1). In subsequent periods, the model assumes a binomial evolution of output needs, i.e., in each period the output can take one of two possible values conditional on each previous value.
Using available information about the Deutsche Bank / IBM sourcing deal, Lammers et al (2005) developed an outsourcing price function of:

\[ P(MIPS) = 62 + 0.01 \times MIPS \] (3)

By the above formula, the cost of offshoring with an output requirement of 20,000 MIPS is 262 Million Euro.

The offshoring cost (denoted by S) is computed by inserting the output needs during the differing time periods into the cost function (3). The option price (c) at time period 2 is \( \text{Max}(0, S-X) \), where S is the offshoring cost and X is the cost to reinsource (250M euros). For \( c++ \), that gives an option price of \( \text{Max}(0, 312-250) = 62 \)M euros. The value of \( c-++ \) and \( c-- \) are calculated in the same manner with the value of \( c-- = 0 \) since offshoring would remain the dominating scenario (in terms of cost savings) and with output needs of 15,488 MIPS the reinsourcing option would expire worthless. At time periods 0 and 1, the option prices are calculated using a slightly different approach to account for discounting at the risk-free rate (for a detailed description of the binomial calculations see Chance and Peterson 2002).
In the above scenario, the value of the intrinsic risk (at time 0) is valued at 37 million euro. What is the significance of this value? In a world of uncertainty, forward-looking organizations should aspire to make a fully informed sourcing decision. Valuing the intrinsic risk of IT offshoring enables a firm to view the total cost and benefits in sourcing decisions. Business decisions are more like a series of options rather than a single projected cash flow and inherent in these decisions is uncertainty (Trejo 2000). IT offshoring involves intrinsic risks that warrant evaluation and a real options approach captures the value of those uncertainties.

**CONCLUSION**

IT offshoring gained popularity because higher returns, in the form of cost savings, can be gained from using a cheaper workforce. Firms have incorrectly viewed this as an arbitrage opportunity. By definition, arbitrage opportunities are risk-free and moving production of an IT function to an offshore location is not risk-free. If anything, IT offshoring adds additional risk because of the possibility geo-political instability, natural disasters, terrorist attacks, and general irreversibility of the commitment (Aron et al. 2005).

Applying a real options approach to the sourcing decision allows for a forward-looking analysis, where the value of risk is determined simultaneously with the sourcing decision. Firms that value the intrinsic risks associated with IT offshoring benefit by limiting exposure to adverse situations that can negatively affect external outsourcing vendors. In gaming, the gambler that stakes his/her entire fortune will lose everything the first time they make a losing wager (Poundstone 2005). There is a similarity with offshoring. Suppose a company had offshored its IT function to an area that was affected by the 2004 tsunami in the Indian Ocean. While unlikely, disasters of this scale can have disproportionate implications. The real options approach creates agility in the face of technological and global uncertainty.

Trejo (2000) observed that business decisions resemble a series of options instead of a single projected cash flow. As has been argued in this paper, traditional appraisal techniques are inadequate for option-like decisions such as the IT offshoring decision; this forces management to base decisions on intuition rather than quantitative analysis. Because of the nature of information systems, opportunities from offshoring (or insourcing) can be difficult to quantify monetarily to management (Taudes et al. 2000). Sourcing decisions are an investment to realize benefits later and using real options in the process adds...
to the quality of sourcing decisions because ROA assigns value to future opportunities and the stream of benefits can be obtained by making the right sourcing decision. A future direction for the application of ROA to IT offshoring is to further explore the opportunities sourcing decisions provide such as abandonment, expansion, and deferment.

REFERENCES