Using Option Valuation Approach to Justify the Investment of B2B E-Commerce Systems

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ABSTRACT
Companies that seek to jointly build a B2B e-commerce system with their supply chain partners face a challenge to estimate the investment value while the attitude of supply chain partners toward the participation is full of uncertainty. This research provides an option valuation approach that clarifies the investment uncertainties by analyzing the expected revenue, cost, project risks, and time to the market for both buyers and sellers, which the buyer can take as a guideline while designing the B2B e-commerce systems. Although the potential of option pricing models on evaluating IT value is discussed in prior literature, the models are never applied to evaluating the investment strategy of B2B e-commerce systems, of which the success depends on the participation of multiple parties. The model developed examines the effect of counteractions between the supplier and the buyer with the potential to assist managers designing a “win-win” investment strategy.

Keywords: Compound option model, B2B electronic commerce, IT investment, Supplier participation

1. INTRODUCTION
As we look at today’s economy, we see an emerging trend that supply chain partners are joining forces to create B2B e-commerce (EC) systems to serve the needs of each other in a particular market. Jointly developed by supply chain partners, these B2B EC systems have the advantage of leveraging the financial resources and supply chain knowledge, thus providing gains to all of them. The benefits are multi-folded. For instance, the B2B EC can be developed as an initiative for participants to cooperate with each other in developing and promoting various standards for content, technology, and business processes. The standards will greatly simplify the communications among various buyers and suppliers even though the individual process can be extremely complicated. Moreover, the establishment of those standards is the foundation of any cooperation and collaboration effort. Since the B2B EC systems are often initiated by supply chain leaders who have already built deep relationships with their upstream and downstream companies, it serves as a single connection or entry point to the industry.

However, many B2B EC have less success to attract members than they expect, because for most of the buyers and sellers, whether the participation makes economic sense is still a question mark. Although companies can reduce transaction costs by participation, sharing their product and marketing information through the B2B EC can be very risky. National semiconductor, for instance, is not likely to share production schedules until the electronics firm is sure that competitors won’t have access to the data. Besides, the industry must forge the development of
industry-wide information and business process standards to enable B2B EC. But these standards won’t come easily as competing manufacturers fiercely defend long-held business practices. DaimlerChrysler and GM, for example, will struggle to agree on production forecast formats, let alone a common process for sharing and refining that information with suppliers.

As indicated above, the risks involved in the participation make trading partners’ attitude toward B2B EC participation full of uncertainties, especially in the initial stage of system development. It causes two problems for the organization to estimate their investment value. First, the predicted benefits may not occur if the participation is not enough. However, the traditional capital budgeting method, such as NPV (Net Present Value) assumes all the predicted benefits will actually occur, not allowing for problems with conversion effectiveness (Locus 1999). Second, NPV assumes that the interest rate is constant and has no variability. But, if we view the development of B2B EC systems as a form of ‘two-stage project’, whether the partners choose to use the system (second stage investment) adds value to the owner company’s infrastructure investment (first stage investment). The variability in the partner side should be different from the developer side. Thus, the adopter is easily biased against funding the B2B EC systems by using NPV analysis. To solve the problem, a more promising evaluation approach with the concern of partner participation uncertainties should be built.

Three research questions are expected to answer in this paper:

1. What are the important determinants of B2B EC participation?
2. Is there any effective approach to estimate the investment value of B2B EC systems while taking the industrial trading partners’ action and competition pressure into concern?
3. What is the best investment strategy that the developer can choose to enhance the overall payoff for both participants and itself?

2. LITERATURE REVIEW

Traditional IT payoff research focuses on well-known financial measures, such as the return on investment (ROI), net present value (NPV), the internal rate of return (IRR), and the payback period. These methods may be suitable to measure the value of simple and intra-organizational IT applications, such as transaction processing and office automation systems within single or several business units (Martinsons, Davison, and Tse 1999). However they are not as well-suited for systems that across business boundaries, where uncertainty and risks is added to the situation as the investment payoffs are no longer depend only on internal contingencies but also on the decisions of trading partners (Gebauer and Buxmann 2000). Those methods, with the constant interest rate, assume all the predicted benefits will actually occur, not considering the risks or opportunities created by stopping, decreasing, or increasing investment due to the responses of adopters (Locus 1999, Kohli, and Sherer 2002). Its capability to assess IOS value is thereby limited (Benaroch and Kaufman 1999, 2000 and Chang 2002).

Facing the limitations of traditional financial accounting measures, there is another group of researchers uses the process-oriented approach to IT payoff assessment, in order to demonstrating the importance of understanding the process changes that must support payoff (Kohli and Sherer 2002). Balanced scorecard is one representative work (Kaplan and Norton 1992, 1993, 1996), which provides a hierarchical framework to link the
strategic activities with company’s financial performance. Furthermore, they extend their valuation analysis from internal business processes to customer satisfaction, the ability to learn and grow, and the shareholder values to offer a complete view of business performance and provide metrics for potential competitive impact other than cost effects. Although this approach attempts to establish the association between different levels of measures, ex, direct level and indirect level, however it doesn’t investigate the equations that the firms can link the operational improvement to financial performance, and thus limits the practical value. In addition, the intermediate variables such as inventory turnover and cycle time reduction were selected to capture the IT value across the functional areas. It does not consider the impacts across the units and organization boundaries (Barua, Kriebel, and Mukhopadhyay, 1995).

Since there are drawbacks while solely using firm-level financial analysis or process-level analysis, some researchers suggested the use of Real Option models to deal with the uncertainties of IT investments (Benaroch and Kauffman 1999, 2000). Those approaches explicitly consider the variance of the expected rate of return on the project and thus have the potential to take the uncertainties of IOS investment into account. There have been a lot of attempts made to apply option theory to IT investments. Santos (1991) applied Margrabe exchange option model (1978) to determine the value of ‘second-stage’ IT projects. Two years later, Kambil, Henderson and Mohsenzadeh (1993) introduced the option perspective to establish a linkage between many categories of IT investments and business value. Kumar (1996) made a note to compare the difference between Black-Scholes model (1973) and Margrabe model in the treatment of the cost of the ‘second-stage’ project. Zhu (1999) introduced Geske compound option model (1979) to treat IT investment projects as a sequence of growth options. The most current development is from Benaroch and Kauffman (1999, 2000). They applied Cox and Rabinstein binomial option pricing model (1985) and Black-Scholes models to evaluate IT investment, with a real case study on the Yankee-24 electronic banking network.

Although there is a growing research to apply real option approach to IT investment (Martinsons, Davison, and Tse 1999), few research put it into IOS or e-business context (Chang 2001). Compared with financial and process models such as NPV models and Balanced Scorecard models, we think real-option approach provides a better approach to identify the uncertainties involved in IOS investment. However substantial modifications should be made to reflect the IOS environment. The changes stem from our view that: (1) the perspective of participants (i.e. supply chain partners) has to be taken into consideration. (2) IOS projects are commonly carried out for the benefits of both focal companies and the trading partners as a whole (rather than individual company within a large market). We will introduce the new modeling efforts in the next section, but before that alternative real-option models are summarized below.

3. MODELING THE INDUSTRIAL TRADING PARTNER PARTICIPATION AS CORPORATE REAL OPTIONS

By analogy, an investment in a B2B EC system can be considered as two nested options. Similar as the first option will give its holder the right to buy the second option by paying the first striking price, investment in a B2B EC infrastructure will give the initiator the ability to attract industrial trading partners to join by paying its development costs. Just
as the second option gives the holder the right to acquire the stock by paying the second strike price, trading partners’ participation will give the initiator expected revenues by paying the connection costs. Further, just as the investor can choose not to exercise the option on the first exercise date (if the option on that date is lower than the first strike price) or on the second exercise date (if the option on that date is lower than the second strike price), firms can decide not to initiate B2B EC development and their trading partners can choose not to participate. Thus, the trading partners’ participation is equivalent to the stock on which the compound option is written, while the investment in the B2B EC is similar as purchasing the right to write an option contract.

The binomial and Black-Scholes models described in the last section only consider a ‘plain’ option, where no nested options are embedded. As indicated above, B2B EC investment involved at least two options (i.e. initiator’s option and partners’ option), so we need advanced models which relax some of the limitations of the basic models. In this proposal, we introduce Geske compound option model (Geske 1979), which is derived from Black-Scholes model but is able to value nested sequence of options (i.e. compound options). The model is built around the concept that the exercise of one option leads to the exercise a specific option in the next stage, quite similar as the sequential nature existed in the B2B EC investment.

Zhu (1999) has mentioned the applicability of Geske model to the IT investment, but the paper did not apply it in the inter-organizational environment. Latter on, Chang (2001) applied the Geske model in a game-based valuation framework to consider the suppliers’ payoffs of buyer-based e-marketplaces. With the reference of both research works, we add the participation variability into the model and eliminate the constant interest rate. We also consider the time variability during the development and participation stage. In addition, we attempt to propose a measure system to combine the user-oriented valuation studies (which the focus is on “user-oriented benefits and costs”) with the option valuation models. The model is described as follows.

\[ V_c = B_2N_2(d_2 + \sigma_2\sqrt{t_2 - t_1}) - C_2N_1(d_2) - C_1 = 0 \]

(1)

\[ B_2^* = \text{that value of } B_2 \text{ such that} \]

\[ B_2N_1(d_2 + \sigma_2\sqrt{t_2 - t_1}) - C_2N_1(d_2) - C_1 = 0 \]

\[ d_1 = \frac{\ln(d_{1/2}^V B_2 / B_2^* + 1/2 \sigma_2^2 t_1)}{\sigma_1 \sqrt{t_1}} \]

\[ d_2 = \frac{\ln(d_{1/2}^V B_2 / C_2 + 1/2 \sigma_2^2 t_2)}{\sigma_2 \sqrt{t_2}} \]

\[ \rho = \frac{d_1}{d_2} \]

The function, \(N_1\), is the cumulative normal distribution, and \(N_2\) is the cumulative bivariate normal distribution function with upper integral limits \(a\) and \(b\) and correlation coefficient \(\rho\). The variable \(B_2^*\) is the threshold value of \(B\) above which the compound option should be exercised\(^1\). Other notation is explained below:

\(V_c\): the payoff of the compound option (i.e. the payoff of B2B EC investment)
\(B_2\): the current revenue of second-stage project (i.e. B2B EC’ revenue after partners’ participation)
\(C_1\): the strike price for the first-stage project (i.e. the

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1 \(B^*\) is the value of the underlying asset (i.e. the value of supplier participation) at time \(t_1\), for which the compound option value \((V)\) at time \(t_1\) equals \(X_1\). If the actual \(B\) is above \(B^*\) at time \(t_1\), the first option will be exercised; if it is not above \(B^*\), the option expires worthless (Hull, 2000).
anticipated development costs for initiating B2B EC systems)

$C_2$: the strike price for the second-stage project (i.e. the anticipated development costs incurred at the partner side)

$\sigma^2$: the variance of the expected revenue from the second-stage project (i.e. partners’ participation), computed as $\sigma^2_{B2} + \sigma^2_{C2} - 2 \rho_{B2C2} \sigma_{B2} \sigma_{C2}$; $\sigma^2_{B2}$ is variance of the rate of change of participation costs, $\sigma^2_{C2}$ is variance of the rate of change of participants’ revenue, and $\rho_{B2C2}$ is correlation between development costs and revenues for the participants.

t_1: The first exercise date (i.e. the time before which the option to develop the B2B EC must be exercised)

t_2: The second exercise date (i.e. the time before which the option for the partners to participate in the B2B EC systems must be exercised). We consider it as a normal distribution with the mean $t_2$ and the variance $\sigma^2_{t2}$ (i.e. $t_2 \sim N(t_2, \sigma^2_{t2})$)

d: is a discounted factor while considering the competitive pressure in the industry

Based on the model, the process to calculate the payoffs of B2B EC investment is depicted as the figure 1

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2 The value of $\rho_{B2C2}$ depends on how much revenue draws from participation costs. Since participation costs are determined by the fixed partner IT infrastructure (i.e. the flexibility of the existed system and the scope of use), we expect there is a low correlation between participation costs and revenue. To simplify the computation, we assume it is zero.
RosettaNet-enabled e-procurement solutions.

Both the case company and its subcontractors knew that automating procurement would provide broad range of benefits for both partners. First, the RosettaNet-enabled e-business IT infrastructure supports interoperability among different systems within the enterprise. Users have the flexibility of accepting multiple messaging formats and data transport languages from both new and existing technologies. Second, collaborative process technology enables general industry and company-specific information exchange to all authorized members. Companies and their suppliers are able to share real-time information and exchange ideas for decision management and knowledge sharing, improving the timeliness of choices made, as well as internal and external communication and coordination, and facilitation of organizational learning. Third is the simplified procurement process achieved by simultaneously connecting all parties to facilitate the real-time collaboration. Faster constraint visibility and resolution reduce overall inventory and cycle time.

While RosettaNet implementation is expected to provide better value than traditional IOS, it also incurs some costs. The case company had to consider three uncertainties related with supplier participation: uncertainty about the participation, uncertainty about the connection costs, and uncertainty about the time to participate.

**Participation uncertainty:** The participation uncertainty directly affects whether the expected revenue will be achieved. The environment surrounding the supplier and the organization relationship may force or encourage the participation. We discuss three sources of such participation uncertainty. First is the switch cost. As the supplier has a lot of investments highly specific to the relationship, it is costly for the supplier to switch to another buyer. Second is the length of the contract. If the supplier has a long-term relationship with the company, it means there exist a direct or indirect promise of guaranteed volumes and repeat business, which reduces the supplier risk to participate. The last is the ownership participation. The higher the ratio is, the deeper engagement is between the supplier and the buyer, and the less risk for suppliers to participate.

**Cost uncertainty:** The flexibility of the supplier IT resource, such as network/telecomm connectivity, platform compatibility, and data/application modularity, and the level of intra-process or inner-process information sharing affect the cost and time to incorporate the e-commerce systems into the organization IT infrastructure, and thus affect the value realization of participation. We discuss two uncertainties related with supplier IT infrastructure: (1) the flexibility of IT and (2) the level of information sharing.

**Time uncertainty:** After supplier decides to participate, the next question for them is when is the best time to join. The time may vary depending upon the trusting climates between the supplier and the buyer. A good trusting climate can reduce the supplier’s doubt about the buyer proposed benefits and therefore shorten the time to participate. The trusting climate can be measured by the number of training programs offered to the suppliers for using the B2B e-commerce systems, the availability of incentives offered to the suppliers to adopt the systems, and the average responding time to supplier’s technical requests.

Those uncertainties directly affect how the buyers design their investment strategies. There are several key decisions involved in the development process of buyer-based B2B e-commerce systems. The case company has to decide when to develop the system and estimate the expected return after the
supplier participates. There are also two decisions for the supplier: the time to participate the systems and the connection costs to the e-commerce systems. Both supplier and buyer will choose the strategy, which can bring her the best payoffs. The advantage for each timing strategy is summarized in Figure 2.

![Figure 2](image)

**4.1 Choosing a Pricing Model for Alternative Investment Strategies and Eliciting Model Parameters**

Based on the previous discussion, we define four investment-timing scenarios and show the payoff in Figure 3.

**I** The case company decides to invest the infrastructure immediately and the supplier then decides to participate immediately after the infrastructure is built:

Both players don’t consider deferred entry: there is no deferral option in both sides. That means both options are exercised immediately. Past literature (Cox and Rubinstein 1985, Santos 1991, Benaroch and Kauffman 1999) formulated this scenario as a Cox and Rubinstein binomial option pricing problem, assuming both options are matured immediately and the payoff on a second-stage project is the maximum of zero if development expenditures exceed its benefits (i.e. the supplier will not participate if revenues do not exceed connection costs). $V_B$ represents the investment value in this scenario (Figure 3 (I)). $B_1$ is the expected revenue from the infrastructure development, independent from the revenue of supplier participation; $p_i$ is the probability of supplier participation; $B_{2i}$ is the value that will actually be realized for each possible outcome of supplier participation; $r$ is risk-based discount rate for the investment. We assume the buyer and the supplier share the option value equally, resulting in a $(V_B/2, V_B/2)$ payoff for each firm.

**II** The case company decides to defer its investment while considering the uncertainties of supplier participation, but once the

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investment is made, the supplier participates immediately:
Only the buyer considers deferred entry: the investment possesses only one deferral option at buyer side. Because the development cost is fixed at the time the buyer decides to invest in the B2B e-commerce system, we don’t need to consider the variability of the development costs happened in the company side. It makes more sense to employ Black-Scholes model for its assumed deterministic exercise price and plain option (no nested options involved).
V_s represents the investment value in this scenario (Figure 3 (II)). σ^2 is the variance in its expected return of the infrastructure investment and e^{rt} is the present value factor for risk-neutral investors. The payoff for each firm is (V_s/2, V_s/2).

(III) The case company invests the infrastructure immediately, but the supplier defers its participation under uncertainty
In this scenario, the supplier participation is viewed as an option, while the exercise of this option leads to the acquisition of a technology. Different from scenario II, the supplier connection cost is uncertain at the time the B2B e-commerce system infrastructure starts to build. Thus, we can’t take the development cost of the supplier participation as a deterministic value. It is more suitable to employ Margrabe model, which determines the value of an option to exchange one risky asset for another using stochastic development costs. V_M represents the investment value in this scenario (Figure 3 (III)). The payoff for each firm is (V_M/2, V_M/2), where is the Margrabe option value plus the expected cash flow from the B2B e-commerce system infrastructure investment.

(IV) The case company decides to defer its investment, same as the supplier
When both company and supplier decide to wait, it can be seen as a compound option, which has been discussed in section three. Both firms are able to employ deferral option, where the connection costs of supplier participation is uncertain. V_C represents the investment value in this scenario (Figure 3 (IV)). The payoff for each firm is (V_C/2, V_C/2).

**Table:**

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Formula</th>
<th>Payoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invest</td>
<td>$V_B - C_t + \frac{B_t}{(1+r)^t} - \sum_{i=1}^{n} \sum_{j=0}^{m} (B_t + \sigma B_t (T_1 - T))$</td>
<td>$(V_B, V_B)$</td>
</tr>
<tr>
<td>Wait</td>
<td>$V_B - C_t + \frac{B_t}{(1+r)^t} - \sigma B_t (T_1 - T)$</td>
<td>$(V_B, V_B)$</td>
</tr>
<tr>
<td>Invest</td>
<td>$V_M - C_t + \frac{B_t}{(1+r)^t} + \sigma B_t (T_1 - T)$</td>
<td>$(V_M, V_M)$</td>
</tr>
<tr>
<td>Wait</td>
<td>$V_M - C_t + \frac{B_t}{(1+r)^t} + \sigma B_t (T_1 - T)$</td>
<td>$(V_M, V_M)$</td>
</tr>
</tbody>
</table>

**Figure 3. Payoffs for company and supplier in four investment-timing scenarios.**
Next, we need to estimate the uncertainties during the implementation. Based on the description above, three uncertainties need to be solved: participation uncertainty, cost uncertainty, and time uncertainty. The estimation of these parameters is described as follows,

A. Participation and Cost Uncertainties

If we assume the variation in $B^2$ and $C^2$ is normally distributed, the $\sigma^2_{B^2}$ and $\sigma^2_{C^2}$ can be estimated by the following function:

$$\sigma^2_{B^2} = n_B^*p_B (1-p_B)$$

$$\sigma^2_{C^2} = n_C^*p_C (1-p_C)$$

where $n_B$ is the percentage of the fluctuation within the expectation, $p_B$ is the percentage of change above or below the expected value (i.e. $B^2$), and $p_C$ is the percentage of change above or below the development costs (i.e. $C^2$). We can express $n_B$ as an implicit function $n_B = n_B (a_1, a_2, a_3, a_m)$, where $a_i (i=1$ to $m)$ is the environmental factor affecting the fluctuation of prediction, the same as $n_C = n_C (b_1, b_2, b_3, b_k)$, where $b_i (i=1$ to $k)$ is the environmental factor affecting the fluctuation of supplier connection costs.

Based on the discussion in section three, $n_B = n_B$ (switch cost, ownership ratio, contract length) and $n_C = n_C$ (IT flexibility, level of integration). If we assume each factor of our interest has equal contribution and are the only sources to the variability, we can calculate the variability using Cobb-Douglas function:

$$n_B = S^3 O^3 C^3$$

$$n_C = F^2 I^2$$

$$F = \frac{Con + Com + Mod}{3}$$

$$I = \frac{Int + Ext}{2}$$

where $S$ is the switch cost, $O$ is ownership ratio, and $C$ is contract length. The IT flexibility is computed by three resources:

(1) $Con$ is the extent of connectivity, measured by the percentage of end users inside the supplier company are planned to connect to the e-marketplace.

(2) $Com$ is the platform compatibility, measured by the percentage of hardware inside the supplier company can support the e-marketplace.

(3) $Mod$ is the modularity of data, measured by the percentage of applications software inside the supplier company can be transported and reused across the e-marketplace.

The level of IT integration is computed by two resources:

(1) $Int$ is the extent of the internal integration, measured by the extent of integration of the e-marketplace with the back-end supplier system.

(2) $Ext$ is the extent of the external integration, measured by the percentage of transactions implemented via the e-marketplace.

B. The variability of time can be measured using the similar approach.

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3 $p_B$ and $p_C$ can be obtained from the subjective estimate of the system development staff.

4 The reason we use Cobb-Douglas production function is because it lies between the extremes of the linear production function and the Leontief production function, assuming some degree of substitutability among inputs. The assumption corresponds to the characteristics of our proposed influential factors here, some degree of correlation among the factors.

5 The values of those three factors are normalized, which means each value represents a relative importance of buyer-based B2B e-commerce to all the other IT projects for the supplier.
\[ \sigma^2_{t_2} = (1 - Tra)^\frac{I}{3} (1 - Inc)^\frac{I}{3} (1 - Req)^\frac{I}{3} \tag{4} \]

We assume good trusting climates between organization and the supplier contribute to the reduction of time variability. \( Tra \) represents the availability of the training programs, \( Inc \) is the availability of the incentives, and \( Req \) is the average responding time to supplier’s technical requests.

5. ANALYSIS RESULTS

Through in-depth interview and company’s financial reports, we require all the parameters we need for each investment timing model. The payoffs for the case company and its subcontractor in four investment-timing scenarios are shown in Figure 4.

![Payoffs for Manufacturer](image)

**Assumption:**
1. The infrastructure development costs (C1): capital investment + software investment + employee salary (Assume each manufacturer has equal investment) = (250M + 180M) / 56 + 250*30,000 = 15.5M
2. B1 = transaction revenues: 25% * 600000M * 0.05 * 0.047 = 353M, 353M / 56 = 6.3M
3. R: 7% risk-free interest rate
4. Connection cost: $400 * 5 * 12 * 100 + 100 * 30,000 = 4.4M (Assume 100 employees worked on this project. The monthly software subscription fee is $400 for each application.)
5. The expected revenue: 6890M / 750 = 9.2M (Suppose 750 participants)
6. T1 = 2 years
7. T2 = 0.5 year
8. \( d_1 = 1 \) year
9. \( d_2 = 2 \) years ± 0.975 \( \sigma \) ± 0.5 ± 1.96 \( \sigma \)
10. \( \sigma: Pb = 75\% \) (conservative prediction), \( Pe = 0.5, s:0.1, c:0.1, \alpha:0.1, \text{com:0.1, com:0.1, mod:0.1, int:0.1, ext:0.1, tra:0.1, inc:0.1, req:0.1} \)
11. d = 0.25

Figure 4. The payoffs calculated for the manufacturer and the supplier in four investment-timing scenarios using data from case company.
A third source of uncertainty is time uncertainty. Suppliers may fear that online marketplaces will break up long-standing relationships between them and their customers, which can seriously delay the time they decide to participate. Those uncertainties may make suppliers to adopt a deferral option. As a result, to make both parties better off, the analysis tells us the manufacturers should have more time to gain the consensus from the suppliers and have more supplier commitment before development. Manufacturer’s deferral option can digest most supplier uncertainty and encourage their participation.

6. CONCLUSION AND FUTURE RESEARCH

This paper examines the impact of supplier participation uncertainty on evaluating the investment value of B2B e-commerce systems through a game-based option valuation model. The contribution of this research is multi-folded: First, the research applies the compound option model to improve the pitfalls of traditional NPV approach and plain option models (ex: Black and Schole’s model), so uncertainties can be considered both in the buyer side and the supplier side, which is more related with B2B e-commerce system investment. Besides that, we also enhance the original compound option model by adding the time variability and development cost variability, so the uncertainties related with supplier lock-in costs and time to the market can be considered while estimating the investment value. In addition, we develop a measurement system to estimate the variability, linking the user-oriented benefit/cost studies with the option models. For example, to effectively estimate the variability of expected revenues in the option model, we suggest the use of three measures: switch costs, ownership ratio, and contract length. Although the validity of those measures has to be further justified, the approach provides a practical way to estimate multiple variances in the option model. At last, we add the dimension of competitive advantage by using the game theories, which gives us a way to evaluate the counteraction between the suppliers and buyers.

However, the model has its limitations. We have to assume the buyer and the supplier have the same reasoning of thinking. In the traditional compound option model, the first option and the second option is bought by the same company, but now the first option is from the buyer and the second option is from the supplier. Since it is common in the economic theory to assume everyone will choose the behavior that is best to herself. This assumption should not affect our evaluation results too much. Secondly, we only consider the competition and uncertainty in the supplier side. However, for some e-marketplaces, the founders are the competitors in the same industries. The uncertainties and the competition among those industrial competitors should also affect the investment decisions. As a result, the model presented here can be extended to a two-stage game in the future where the competition between the buyers can be viewed as the first stage game and the equilibrium derived affects the second stage game that is the competition between the suppliers.

 REFERENCES


摘要

關鍵字：複合選擇權模式、B2B 電子商務、IT 投資、競局理論