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Efforts and efficiency in partial outsourcing and investment timing strategy under market uncertainty

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ABSTRACT

Because outsourcing incurs hidden costs at the preparation stage and future profits are uncertain, outsourcing immediately is not always optimal. Thus, this paper studies when the optimal time to outsource is, by proposing a real option model. The timing strategy takes into account a firm's effort at the preparation stage and an outsourced proportion, because *ex post* future profits and consequently the optimal time are affected by how well prepared the outsourcing is and how large proportions a firm outsources. Based on the model, this research provides managerial implications about how outsourcing timing strategies should vary when outsourcing environments such as market uncertainty changes and a firm's effort. Our model shows that a firm can outsource earlier when an investment (effort) at the preparation stage is more efficiently made, when market becomes more stable, when it can expect higher marginal profits from the outsourcing, when it can outsource more proportion. Also, by comparing a widely used net present value model to our real option model, we show that the traditional method underestimates a firm's value for outsourcing and misleads a firm to outsource earlier. Finally, we provide a descriptive framework for a decision support system.

1. Introduction

Due to many benefits such as cost reduction, operational efficiency, and technological advantage (see Aksin, de Vericourt, & Karaesmen, 2008; Barthelemy, 2001; Quinn, 2000), many firms or clients have begun to consider outsourcing in-house operations. The report by Deloitte, 2008 showed that 70% of executives were very satisfied overall for their outsourcing initiative. Also, empirical studies about outsourcing in Japan and the US show that more productive firms are more likely to outsource, and so the outsourcing returns more profits and makes the firms much more productive (see Gorg, Hanley, & Strobl, 2008; Tomiura, 2005).

Despite increasing interests in outsourcing, little attention has been paid to partial outsourcing in either a qualitative or quantitative way. Especially, most quantitative literature assumes that a firm outsources its whole operation to a vendor. However, in some service area like a call center or IT company, many firms may worry about handing over their most important resources or technologies (see Aksin et al., 2008). In such environment, a firm can prefer keeping some proportion of the whole operations in-house, because the firm can keep its critical information or technology secured and outsource only less important part of the operations. Also, as discussed in Lacity and Willcocks (1998), industry defines a total outsourcing as transfer of the equivalent of more than 80% of the total operations. In other words, even though a firm considers total outsourcing, the firm still needs to manage a small portion of operation. As mentioned in these researches, even though partial outsourcing mostly occurs in practice, many researches have overlooked the crucial aspect of outsourcing, partiality, and very few quantitative models are developed so far.

Another latent feature of outsourcing is effort and efficiency. The importance of efforts at a preparation stage as hidden costs in an outsourcing contract is also recently emphasized with some qualitative studies. Barthelemy (2001) and Ross and Westerman (2004) pointed out that the efforts at an outsourcing preparation stage are a crucial factor that should be considered by a firm but usually ignored. They showed the hidden costs or efforts at a preparation stage are a quite large portion of the total investment costs and play an important role in better outsourcing outputs. At the preparation stage, a firm needs to decide the optimal level of efforts to improve quality or efficiency of outsourcing, and it incurs costs of development, liquidation, and transition. However, when a client makes more efforts before outsourcing, the client can expect a better vendor or high quality of products, which implies the client will have the higher efficiency of outsourcing. Before outsourcing, the process of transferring in-house to outsourcing may cause a client to move applications to a new environment or require relational efforts between a client and vendor. Also, the cost of searching a vendor or selecting a right one mentioned by

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Ngwenyama and Bryson (1999) can be another example of efforts before outsourcing. However, more endeavors in the above procedures can return more profits after outsourcing. Simply, a well-prepared outsourcing makes more profits.

Motivated by the necessity of valuing partial outsourcing and by the importance of consideration of effort and efficiency, this paper provides a quantitative valuation model. In addition, the proposed valuation model is established based on the real option theory (ROT) to incorporate a firm's managerial flexibility or an option to wait. In practice, a firm has option to wait to outsource because it currently produces through in-house operations. Thus, a firm needs to determine when to outsource. Our real option model will help the firm's timing decision and enables analyses of how the optimal outsourcing timing varies when many environments such as market uncertainty changes. To the best knowledge, this research is among the first to capture these three aspects: partiality of outsourcing, relation between effort and efficiency, and a firm's option to wait.

Based on the proposed model, we have studied the effects of important factors on investment timing strategies. The results show that a firm can outsource earlier, when market becomes more stable, higher marginal profits from the outsourcing are expected, a firm can outsource more proportion, and a firm's effort at the preparation stage is more efficient. Besides, the comparison study of a real option approach and a net present value method shows that the NPV underestimates the firm's values and suggests earlier partial outsourcing.

Section 2 provides a review of the detailed outsourcing literatures and provides literatures of a real option theory which will be applied to value partial outsourcing. The proposed valuation model for partial outsourcing with consideration of effort and efficiency is provided in Section 3. Section 4 analyzes outsourcing timings with respect to crucial factors such as a market uncertainty, marginal profit rate from outsourcing, a proportion to outsource and efficiency of efforts. Also, this section provides a comparison study of a real option theory (ROT) and a traditional net present value method (NPV). Section 5 describes how decision support system can be implemented. Section 6 provides conclusion with suggestions for further study.

2. Literature review

Recently, an outsourcing problem has become an increasingly productive research area. For an outsourcing investment, many researches studied outsourcing contracts between a client and a vendor from an organizational viewpoint, or derived optimal policies to maximize profits. Laffont and Tirole (1993) provided the most fundamental theories for contracts when a firm determines to outsource or procure products. Van Mieghem (1999) examined outsourcing conditions for different types of contracts. Besides these, extensive literature can be found (Bajari & Tadelis, 2001; Barnes-Schuster, Bassok, & Anupindi, 2002; Cachon & Zhang, 2006). Researches regarding optimal strategies also have been highlighted. Cachon (2003) provided intensive studies such as problems of determining a retail price as well as a quantity and extended models considering multiple competing retailers and involving stochastic demands. Plambeck and Taylor (2005) analyzed the investment decision of original equipment manufacturers (OEMs) about selling of production facilities to contract manufacturers. Ren and Zhou (2008) studied call center service outsourcing to coordinate staff level and service quality.

However, most literature for an outsourcing investment discussed above overlooked that outsourcing usually occurs in a certain proportion of the whole operations. With this observation, Shy and Stenbacka (2005) investigated the relation between a proportion of outsourced production and competition in a partial outsourcing contract. Alvarez and Stenbacka (2007) proposed a general outsourcing model that partial outsourcing is allowed. Their model shows that the higher uncertainty of a market increases an optimal proportion of outsourced production. Aksin et al. (2008) developed an outsourcing model for a call center service under uncertain demand of service calls. In the paper, they derived an optimal capacity of the contractor in the sense of partial outsourcing. Similarly, this paper takes the partiality of outsourcing into account in the model.

Moreover, studies about firm's efforts at preparation stage and its profits after a contract have been steadily examined. As to literature regarding efforts to improve the quality (efficiency) of outsourcing, Laffont and Tirole (1993) developed a model based on the relation between the firm's effort and vendor's efficiency and analyzed the impacts of efforts for different types of contracts. Also, Cachon (2003) developed a newsvendor model by allowing the firm to exert costly effort to increase demand in a subcontract problem. The paper studied a cost sharing contract for effort from a supply chain coordination perspective. Bhaskaran and Krishnan (2007) examined the investment for joint-development of products, as considering efforts of two firms in a contract to share development cost and work. However, especially for partial outsourcing, a study for examining the effect of the relation between effort and efficiency is rarely discussed.

For the discussed reasons, this paper develops a partial outsourcing valuation model with consideration of effort and efficiency. For the valuation method, currently, most firms evaluate an outsourcing contract by the Net Present Value method (NPV) which is the standard method for the investment analysis (Jeffery & Leliveld, 2004). The NPV method indicates that the client should outsource, as long as the value of an outsourcing contract yields more profits than in-house operations. However, we here need to recognize that, in many real world situations, outsourcing may be optional and the time to outsource may be flexible. The client can delay an outsourcing without causing any problem in the production, until the utility would be maximized. Therefore, when market is uncertain, the client would like to determine when to outsource with an option to delay as well as decide whether or not to outsource. However, as discussed in most financial economics literature (e.g., see Dixit & Pindyck, 1994; Luehrman, 1998; McDonald & Siegel, 1986), the standard NPV method fails to capture the option value or timing flexibility and can result in the exercise of investment before the optimal time, thereby causing a loss of an opportunity cost. Dixit & Pindyck (1994), for an investment under irreversible sunk costs and uncertainty, pointed out the investment opportunities and perpetual American options are equivalent and, as a consequence, the existence of opportunity costs fundamentally influences the decision-making behavior. Similarly in partial outsourcing, a decision maker has the managerial flexibility under uncertainty and some sunk costs. In other words the outsourcing firm has an option to exercise its outsourcing opportunity immediately or to hold this opportunity for a while. Thus, the proposed model in this paper will be developed based on the real option theory and provide a framework for helping a firm decide when to outsource.

Current literature has increasingly applied real option models to capture total values with a value of managerial flexibility and has argued that the real options approach are much better than the traditional NPV approach in decision-making (e.g., see Johnstone, 2002; Luehrman, 1998; Pindyck, 1991). In the literature of outsourcing or supply chain contract, the application of the real option theory has also been growing. Van Mieghem (1999) values the option of outsourcing to improve financial performance and supply chain coordination by analyzing a stochastic competitive game where a client and a vendor decide separately on their capacity investment levels. Also, Johnstone (2002) formulated a public