



Information systems outsourcing projects as a double moral hazard problem

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ARTICLE INFO

Article history:

Received 2 September 2009

Accepted 23 June 2011

Processed by B. Lev

Available online 6 July 2011

Keywords:

Outsourcing

Information system

Game theory

ABSTRACT

In the past two decades many organizations have turned to other organizations to satisfy their information systems needs. Information systems outsourcing arrangements cover the spectrum from agreements involving the delivery of all information services to those providing specific services such as systems development, communications management, desktop computing provision and maintenance, and so on.

In this paper we model information systems outsourcing arrangements as a non-cooperative game with two players: a company and an outsourcing vendor. The game between the two players has an inherent double moral hazard problem as the success of the information system outsourcing project depends on the actions of both players, which are costly for them and are not directly contractible. Both parties make their decisions taking into account the effects that these decisions have on the other player's actions. In our analysis, we compare the solution obtained without a moral hazard problem (the first-best solution) to the one obtained under a double moral hazard setting (the second-best solution). We demonstrate some results based on the assumption that increases in the productivity of the vendor lead to increases in the productivity of the company. Further we establish that outsourcing contracts should provide no separate payment for failure to the outsourcing vendor although effectively many of them do. We also provide a sharing rule for providing appropriate incentives for the vendor and examine the dynamics associated with this sharing rule. Finally, we further provide for the characterization of response functions and the ensuing Nash solution including the optimal outsourcing fee. This allows for the nuanced consideration of the degree of interaction between the effort of one party and the productivity of the effort of the other party. This particular interaction has not been explored formally in the extant research literature.

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1. Introduction

Information services (systems) outsourcing occurs when an organization contracts with another organization for the provision of some or all of its information service needs. Such needs may include the provision of new applications systems, the complete overhaul of the organization's information infrastructure, or simply running the organization's present information systems. Since many information services are difficult to assess and are delivered over an extended period of time it is difficult to ensure that the outsourcing vendor (henceforth simply 'vendor') acts in the best interest of the outsourcing company (henceforth simply 'company'). There are a variety of responses that are appropriate in this type of situation. One approach is to design

incentives so that the vendor will be motivated to act in best interests of the company.

Over the past two decades considerable attention has been directed towards the outsourcing phenomenon in general and the information services outsourcing phenomenon in particular (for an excellent review of the IT outsourcing literature over the last two decades see [1]). Michell and Fitzgerald [2], for example, describe the selection process of the IT outsourcing vendor. A variety of authors have discussed, in general terms, the relative advantages and disadvantages of outsourcing. Early on, Gupta and Gupta [3] argue that outsourcing can lead to a reduction in costs but may also lead to a loss of control and an uncertain level of service. In a similar vein Kelly [4] argues that, in addition to the factors identified by Gupta and Gupta, outsourcing may lead to a loss of strategic direction for the company. Fink [5] discusses the security and control considerations in information systems outsourcing. In a later work Aubert et al. [6] state that "Some argue that outsourcing IT leads to lower costs, economies of scale, access to socialized resources, and new business ventures." (p. 4)

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Aubert et al. [6] further identify a variety of risks associated with outsourcing including hidden costs, contractual difficulties, service debasement, and loss of organizational competencies. A much more extensive review of research investigating benefits associated with outsourcing is provided by Dibbern, Goles, Hirschheim, and Jayatilaka [26]. Clearly the nature and significance of the benefits and risks associated with outsourcing are contingent on both the nature and the range of activities which are outsourced.

Papers directed towards the theoretical analysis of the economics of outsourcing span about the same period as those addressing the outsourcing phenomenon in general. However, typically this research is presaged by seminal work in the economics domain. Information system outsourcing represents a stylized setting where creation of a good or service is outsourced to one individual or organization by another independent individual or organization. To the extent that efficient markets exist these transactions are relatively uncontroversial. However, when it is difficult to specify *ex-ante* the specifications for the product or service and there are significant uncertainties associated with the development of the product or service, and associated costs, outsourcing may become challenging.

Williamson [7] recognized that prior work in classical economics did not provide an explanation as to why transactions would be performed within the organization rather than mediated through the market. As such, his work on transaction cost economics (TCE) recognized the potential existence of opportunism on the part of the individual, or organization, providing outsourcing services and the need for monitoring to reduce the likelihood of opportunistic behavior. Clearly *sans* monitoring TCE faces significant information asymmetries.

Recently Jiang et al. [8] have utilized a real option-based approach to investigating a generic outsourcing situation (in their case related to the Beijing Olympic Games). This approach has not, however, been focused on information systems outsourcing even though Jiang et al.'s analysis embraces two key characteristics of information systems outsourcing namely uncertainty and rapidly time-sensitive costs.

An alternative modeling approach involves the principal/agent approach with information asymmetries. In the following section we will review the research literature that represents previous examples of attempts to use economics derived models of information systems and indicate the location of our research in the domain.

2. A review of the research literature

2.1. The information systems and economics literature

One of the first papers to attempt to develop an economic framework for analyzing outsourcing contracts is Richmond et al. [9]. Their analysis uses the concept of incomplete contracting and focuses on systems development. It differentiates between a user group and a development group that may be located in the same organization (in-sourcing) or in a different organization (outsourcing). In contrast with our approach, they use simulations, instead of closed-form solutions, to investigate whether in-sourcing dominates outsourcing. They note that while in some cases in-sourcing dominates outsourcing this is not always the case.

Wang et al. [10] provide a formal analysis of contractual structures for custom software developments though without explicitly representing double moral hazard. They also consider a somewhat more nuanced consideration as to the nature of in-sourcing by introducing central management as a communications mediator and budget balancer. As with earlier work modeling the

systems development process, they use a two-stage model. In their subsequent analysis the authors both provide intuitions derived from their formal modeling approach and also numerical analysis. They demonstrate a mechanism that can achieve the first-best solution for internal sourcing in situations where there are information asymmetries between the user group and the development group. They further note that in order for outsourcing to dominate internal sourcing the external developer must have considerable cost advantages.

As we have indicated above one common approach to modeling situation where one party develops a product or service for another is the principal/agent model. In the first instance it would appear that the challenge for the principal is that the agent may not exert optimal effort. Thus, this approach incorporates a single moral hazard dimension to outsourcing. Elitzur and Wensley [11] utilize a principal/agent game-theoretic approach to model information systems outsourcing arrangements. Their approach makes the traditional assumptions with respect to the principal/agent model. Their study focuses on designing contracts to deal with two types of moral hazard—one relating to the effort expended by the outsourcing vendor in providing the outsourced service and one relating to the outsourcing vendor's potential use of confidential information for his own benefit. They further establish a variety of propositions with respect to optimal contract characteristics in this situation.

Whang [12] has also investigated the outsourcing of information systems development from an economic perspective. In particular, he models information systems development as a multi-stage process. However, Whang [12] does not take into account important uncertainties with respect to the development project relating to changing requirements and the revision of estimates of the cost and value of the development project. Further, given the analytic approach adopted by Whang [12], he is unable to take into account information asymmetries or moral hazard issues that arise as a result.

Subsequent to Richmond et al. [9] and Whang [12] a considerable body of literature has grown up that addresses the application of many different research approaches to many different aspects of the outsourcing phenomenon.

Interestingly, in spite of an increasing body of research literature focused on the outsourcing phenomenon few researchers have extended game-theoretic modeling approaches along the lines initiated by Richmond et al. [9] and Elitzur and Wensley [11] who, as noted above, investigated a situation involving information asymmetries and, in the latter case, single moral hazard issues that arise as a result of these asymmetries.¹ Neither has the information systems research literature explored the nature and impact of information asymmetries further in a principled way or focused further on moral hazard issues arising from such information asymmetries.

2.2. A focused review of the economics literature addressing double moral hazard

One of the main directions for the development of principal/agent models of information systems outsourcing would be to investigate situations where double moral hazard is likely to occur. We provide a more extended rationale for this later on when we introduce the particular model but, in essence, information systems outsourcing arrangements are characterized by the fact that both parties exert effort that is unobservable by the other party. This gives rise to a

¹ An extensive review of this literature can be found in Dibbern et al. (2004). However, as we have noted, in their classification only papers by Richmond et al. [9], Whang [12], and Elitzur and Wensley [11] are referred to in the context of extant research having a 'theoretical economic approach'.

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