THE ROLE OF STRUCTURAL EMBEDDEDNESS IN AN IT OUTSOURCING NETWORK

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Abstract

The design of governance to safeguard against a vendor's opportunistic behaviour is one of the critical issues in information technology outsourcing (ITO) since this behaviour causes cost escalation and service debasement. The roles of structural embeddedness underlying network governance have been gaining its importance as complementary or substitutable governance in ITO. Our research attempts to reveal how structural embeddedness can affect the decision-makings of clients and vendors and their resulting outcomes in an ITO network and how these effects are moderated by various ITO network structures according to outsourced IT services. An agent-based simulation and game-theoretic approach are adopted to build a simulation model to describe ITO networks with various structures and ITO transactions between clients and vendors. Finally, the future research directions are discussed.

Keywords: IT Outsourcing, Structural Embeddedness, Opportunistic Behaviour

1 INTRODUCTION AND THEORETICAL BACKGROUND

A vendor's opportunistic behaviour is one of the considerable risks which cause cost escalation and service debasement in information technology outsourcing (ITO) (Aubert et al., 1999). The roles of structural embeddedness underlying network governance have been reported to be effective in mitigating opportunism and improving performance in various research contexts (Dacin et al., 1999). We aim to enhance the understanding of its impacts in an ITO network by revealing how a geodesic distance between ITO parties can affect their decision-makings and outcomes, and how these effects are moderated by the whole ITO network structure.

Structural embeddedness can play a significant role in safeguarding against a vendor's opportunistic behaviour in an ITO network (Ravindran et al., 2009). It is defined as the extent to which "*a dyad's mutual contacts are connected to one another in a network*" (Granovetter, 1992). This definition implies that when making decisions (e.g. cooperation or opportunistic behaviour), organisations are enforced to consider the social contexts facing them because information on their actions is diffused through interconnected ties in a network. In fact, a wide range of industries have increasingly used structural embeddedness, which has been verified to be effective (Jones et al., 1997).

Despite the abundance of literature reporting the effects of structural embeddedness, however, the following important gaps still persist in ITO. Firstly, many of the related studies have explicitly or implicitly focused on an organisation's network position (Dacin et al., 1999). For example, the recent study of Ravindran et al. (2009) empirically shows several significant relationships between the network position of a contracting party and longevity of an ITO contract. It is, especially, suggested

that the number of a vendor's ITO ties is positively correlated with the longevity of an awarded contract because a vendor with many of the ties is less likely to behave opportunistically. A vendor's network position alone is, however, insufficient to clarify how to safeguard against its opportunistic behaviour in an ITO network. In case that technology changes quickly and there is a difficulty in measuring performance, a client can improve its performance by outsourcing IT services to a vendor who keeps up with the current pace and is more trustworthy. The possibility to select this advanced and cooperative vendor could be enhanced when the client extends the searching scope of candidate vendors, which can cover indirect contacts as well as direct ones. Therefore, this exploring range, measured by a geodesic distance, is the important property to assess the effects of structural embeddedness in an ITO network. Secondly, it is argued that that much of attention has been paid to the individual organisation level and there is a paucity of literature on the whole network level (Provan et al., 2007). Their review of the empirical literature also reveals that there is, surprisingly, very little work on business networks and one of the significant research gaps is which business network structures are more effective than others. We believe that an ITO network provides an ideal platform to examine this research question because its structure varies with outsourced IT services: there may be a large or small number of clients and vendors; ITO ties may be dense or sparse; network centralities may be high or low. Therefore, it needs to be tested how the effects of structural embeddedness at the level of individual organisations are moderated by the whole ITO network structure.

Based on this reasoning, our research aims to enhance the understanding of the roles of structural embeddedness in an ITO network. More specifically,

- How can a geodesic distance between ITO parties affect the following aspects: client's vendor selection, vendor's opportunistic behaviour and their resulting pay-offs?
- How can the effects of structural embeddedness at the level of individual organisations be moderated by the whole ITO network structure?

Both an agent-based simulation and game-theoretical approach are introduced to provide the clues to answer the research questions. Also, we place emphasis on a vendor's opportunistic behaviour, which is represented as providing a low quality of IT services (Goo et al., 2007).

This paper is organised as follows. The second section provides the brief literature review related to the central issues in our research. In the third section, the initial simulation procedure is described to test the research questions. Finally, the contribution and further research are discussed.

2 LITERATURE REVIEW

There are two main research streams which investigate how to prevent a vendor's opportunistic behaviour in ITO: formal contracting and relational governance (Poppo and Zenger 2002), which is also inferred from two review papers on ITO (Dibbern et al., 2004; Lacity et al., 2009). Firstly, formal contracting is suggested to be the fundamental governance to control a vendor's opportunistic behaviour (Chen and Bharadwaj, 2009). A client can control this behaviour by designing a more complex and customised contract which clearly stipulates a vendor's obligations or responsibilities (Poppo and Zenger, 2002). The view of this governance is based on the premise that the disputable contract items identified ex-ante can be verified ex-post by a third party (Ravindran et al., 2009). The premise is, however, open to doubt in ITO because several requirements are too complex and difficult to specify ahead of time (Kalnins and Mayer, 2004). Secondly, relational governance is considered to be effective governance (Poppo and Zenger, 2002). A vendor's opportunism can be mitigated by the mutual agreements arising from iterative transactions between two partners, where repeatedness is the necessary condition for this governance (Baker et al., 2002). The assumption is, however, still strong in ITO since a particular client and vendor need not to be repetitively involved in outsourcing identical IT services (Ravindran et al., 2009).

The research of formal contracting and relational governance has been conducted based on the premise of dyadic relations. In additions to such relations, however, organisations, resources, information and other flows are arguably embedded in a broader and more complex network (Gulati et al. 2000;

Provan 1993). Embeddedness is defined as "*the contextualisation of economic activity in on-going patterns of social relations*" and is classified into four categories: structural, cognitive, political and cultural (Dacin et al. 1999). Among them, we focus on structural embeddedness, which is described as "*the configuration of the linkages between people or units*" (Nahapiet and Ghoshal 1998) or the extent to which "*a dyad's mutual contacts are connected to one another in a network*" (Granovetter 1992). The existing studies to examine various research contexts reveal that structural embeddedness underlying network governance serves as successful governance for preventing opportunistic behaviour and improving organisational performance (Borgatti and Foster 2003; Brass et al. 2004; Dacin et al. 1999; Jones et al. 1997). One of the critical issues on it is "*how a network position affects both opportunity and action*" (Dacin et al. 1999). There have been, therefore, a considerable number of studies addressing the effects of a network position on the various forms of outcomes. Among them, the recent research of Ravindran et al. (2009) shows that the network position of a contracting party is positively correlated with the longevity of a contract in an ITO network. Their research places emphasis on the effects of a vendor's network position on its opportunistic behaviour. These impacts are, however, insufficient to explain how to safeguard against an opportunistic vendor as described in the previous section. We attempt to fill the research gap by developing a simulation model.

3 SIMULATION MODEL

An agent-based simulation and game-theoretical approach are introduced to test the research questions. The former simulates "*the behaviours of adaptive actors who make up a social system and who influence one another through their interactions ··· and the outcomes of interest which are the consequences of the agent behaviours* ···" (Harrison et al., 2007) and is useful in case of challenging to obtain empirical data (Davis et al., 2007). The latter is a powerful and essential tool for the analysis of supply chains "*in which the decisions of multi agents affect each agent's pay-off*" (Cachon and Netessine, 2006). Consequently, these approaches are suitable for the case that it is difficult to attain the empirical data sets on complex and interdependent ITO transactions among many clients and vendors in ITO networks with various structures.

We model an ITO network which arises from the stock of prior ITO transactions and association memberships, which are one of the frequently used ways to establish informal relationships (Carroll and Teo, 1996; Geletkanycz and Hambrick, 1997; Hansen, 1999). At this point, there may be a problem concerning the correctness of transferred information. The delivery of uncodified knowledge such as a vendor's trustworthiness or tendency to behave opportunistically is closely related with tie strength and competitiveness between a sender and receiver. A strong tie is beneficial to exchange this kind of knowledge while a high level of competitiveness discourages the willingness to do so (Hansen, 1999). Therefore, when a client attempts to acquire information on vendors, tie strength and competitiveness among the parties involved in communication should be considered. Tie strength and competiveness are specified by the frequency of ITO transactions and the number of overlapping memberships, and structural equivalence respectively.

In addition, ITO Transactions are modelled as games between clients and vendors. Each outsourcing partner is also represented as an agent which makes a decision to maximise its long-term pay-off. The theoretical background of the game in our research is found from efficient wage theory (Kim, 2000), which is modified for the application to ITO. The decision problem of a client is to select an advanced and trustworthy vendor which is expected to make better performance. The decision problem of a vendor is to decide how many resources it spends on the provision of an IT service. The less resources are devoted to an IT service by the vendor, the lower quality of it is provided for the client, and vice versa. The vendor can, therefore, gain the immediate profit by providing a low quality of an IT service. Information on this ITO result is, however, diffused through interconnected ties in an ITO network and the vendor would be deprived of transaction opportunities in the future.

Finally, although there are the various indicators of ITO outcomes (Dibbern et al., 2004), our research introduces a discounted average pay-off, which is originally used to calculate a player's long-term pay-off in an infinitely iterative game (Kim, 2000). A particular client and vendor, however, need not to be repeatedly involved in outsourcing identical IT services (Ravindran et al. 2009). The condition of

repetitiveness is, therefore, relieved by the research of Kandori (1992), which shows that a player may endure its immediate loss in order to gain its long-term profit even in a non-repeated game when community enforcement exists. Consequently, the modified discounted average pay-off provides an analytic framework which can explicitly reveal ITO outcomes.

The simulation proceeds as follows. In the first phase, an ITO network is generated. The whole network structure varies with the following parameters: the number of clients and vendors; the average and variance of their degree centralities on prior ITO transactions. These parameters specify the size, density and centrality of an ITO network respectively. Based on the average and variance, the degree centrality of each client and vendor is generated. Association memberships are also randomly given to them. Then, tie strength and competitiveness are calculated. In the second phase, a client explores candidate vendors within a given geodesic distance. The accuracy of transferred information on vendors depends on tie strength and competitiveness among the parties involved in communication. The criteria for selecting a vendor include its technical level, cooperative tendency and IT service price. In the third phase, the selected vendor chooses to provide a high or low quality of an IT service to maximise its long-term pay-off in accordance with the decision-making function. Once the transaction is completed, the client transfers the updated information on the vendor's decision-making to others through interrelated ties in an ITO network. Other clients utilise this information in the future transactions with the vendor. Therefore, the vendor makes a decision, considering its own degree centrality and the degree centralities of the client and transmitters.

4 CONCLUSION AND FURTHER RESEARCH

The contribution of this paper is to open a black box that encapsulates the roles of structural embeddedness in governing a vendor's opportunistic behaviour and improving organisational performance in an ITO network. More specifically, this research aims to show how a geodesic distance affect a client's vendor selection, a vendor's decision-making (providing a high or low quality of an IT service) and their resulting pay-offs. In addition, it attempts to reveal how these effects are moderated by the whole network structure. An agent-based simulation coupled with a game-theoretic approach is expected to represent the decision-makings of ITO partners and the interactions among them as a knowledge diffusion mechanism in an ITO network.

The work is still in progress and the followings are next steps in the study. Firstly, a simulation will be implemented based on the developed simulation model. The model is allowed to adjust the parameter values. Therefore, the first step will find the initial combination of the parameter values for a base model which reflects the findings on the impacts of structural embeddedness in the extant literature. Once a base model is derived, the whole network structure will vary to see the effects of changing the values on the outcomes from the base model. Secondly, the simulation model will apply other factors specific to ITO. For example, the uncertainty stemming from rapid advances in IT technology is one of the distinct features in ITO. It is a research issue to investigate how the presence of uncertainty influences the behaviour of ITO partners under the existence of structural embeddedness.

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