Netsourcing Strategies for Vendors: A Resource Based and Transaction Cost Economics Perspective

Sofiane Tebboune[1], Cathy Urquhart

Marketing, Operations and Digital Business, Manchester Metropolitan University Business School, All Saints Campus, Oxford Road, Manchester, M15 6BH, United Kingdom

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1 Corresponding author. Tel. +44 161 247 6692. Fax. +44 161 247 6350

E-mail address: s.tebboune@mmu.ac.uk

ABSTRACT

This paper discusses Netsourcing strategies for vendors, a little explored area of outsourcing research, using both a resource based (RBV) perspective and a transaction cost economics (TCE) perspective. Using both theories and an infrastructural view of IT service, we present a conceptual model of vendor sourcing decisions. We then present a number of propositions based on case studies of vendor decisions. Finally we conclude by discussing the theoretical contribution of RBV and TCE and, crucially, the value of combining both theories for the study of Netsourcing, and for other areas of IS research.

KEYWORDS

Netsourcing, IS Outsourcing, Transaction Cost Economics, Resource-based View, IT Infrastructure, Firm Boundaries

1.0 INTRODUCTION

The term Netsourcing was coined by Kern et al. (2002b, p. 1) as *"the practice of renting or 'paying as you use' access to centrally managed business applications, made available to multiple users from a shared facility over the Internet or other networks via browser-enabled devices."* Although this area has drawn substantial attention in recent years, it has previously existed in several other formats such as Application Service Provision (ASP) and Managed Service Provision (MSP) (Jayatilaka et al., 2003; Susarla et al., 2003; Tebboune, 2003). With the increase in focus on new IT sourcing strategies such as Utility Computing (Rappa, 2004; Carr, 2009; Armbrust et al., 2010; Brynjolfsson et al., 2010), research is coming to a consensus that the future of IT in organizations will be more utility-like. How vendors take decisions in this new environment will become an increasingly important issue, and this paper looks at the complexity of decisions that vendors need to take in such environments.

Much of the previous Netsourcing literature has focused on the customer-side of the model; studies such as those by Kern et al. (2002a) and Jayatilaka et al. (2003) attempted to investigate the parameters that potential customers take into considerations in order to evaluate the Netsourcing

option. On the other hand, very little research has been done on the supply-side of Netsourcing; due the novelty of the model, most previous research was concerned with its acceptance among the business community. This paper examines the decisions made by Netsourcing vendors, with regards to sourcing the infrastructural components necessary for them to offer their services. This is particularly important for some vendors who have various challenges in deciding how to differentiate themselves in a market where *'vanillarisation'* exists, because they are essentially offering the same applications. Furthermore, to help with understanding these various decisions, Transactions Cost Economics and the Resource-based View are used to model such decisions. The two theories are used as theoretical lenses that help to better structure our understanding.

The paper examines the following research questions;

- How do Netsourcing vendors source the infrastructural components necessary for them to offer their services?
- How can Transaction Cost Economics (TCE) and Resource Based View (RBV) theories help to anticipate the type of Netsourcing decision by a vendor?

The paper is structured as follows; in the next section, we discuss an infrastructural view of Netsourcing, then discuss the applicability of TCE and RBV to Netsourcing. We then introduce a theoretical model of decision making in Netsourcing. We then discuss our methodology for investigating how vendors source their Netsourcing components. We then report our results in applying our theoretical model to actual outsourcing decisions by vendors. Finally, we conclude by assessing how useful our theoretical model using RBV and TCE was for predicting vendor Netsourcing decisions, and how the interaction between RBV and TCE can be better exploited.

2.0 LITERATURE REVIEW

In this review, we first take an infrastructural view on Netsourcing, then we look at two theories of the firm – Transaction Cost Economics (TCE) and the Resource Based View (RBV).

2.1 AN INFRASTRUCTURAL VIEW OF NETSOURCING

Netsourcing as a phenomenon presented several challenges to the adopting customers. Among these challenges were customers' unfamiliarity with the business model, concerns over the security of the hosted data, as well as concerns over the reliability of the service provided (Kern et al., 2002b).

On the supply-side, however, other challenges can also be found, and it is the supply side that this paper is concerned with. One concern is related to the differentiation strategies needed by Netsourcing vendors (Tebboune, 2003); as many vendors attempt to deliver the same applications, there is a clear risk of *'vanillarisation'* - where several identical software offerings are offered by the same vendors and there is no unique selling point for those vendors. So vendors need to pay attention to how they might differentiate their offering in the market. Moreover, the technological infrastructure behind Netsourcing can be viewed as a *complex* technology, where according to Kern et al. (2002b, p. 84), *"a Netsourcer's key capabilities and business areas are the cross-integration and management of the various components of the Netsourcing infrastructure, the ultimate goal being a solution for the customer"*. This technological complexity implies the need to consider partnering arrangements, and we return to this issue later in the paper.

Looking at the infrastructure required for running Netsourcing, the components are generally related to networking, hosting, computing architecture, and software (Dewire, 2000; Kern et al., 2002b; Toigo, 2002; Smith and Kumar, 2004). Due to the wide spectrum of the different configurations Netsourcing can take (Kern et al., 2002a; Kern et al., 2002b), it is difficult, and of little use, to cite all the capabilities required for its delivery, and thus a more abstract representation is needed.

In a more generic definition, Toigo (2002) presents a classification of the required technologies for the provision of IT services, as represented in Figure 1. Toigo (2002) explains that any IT service (such as Netsourcing) requires five different generic components: data storage, server, network, application, and management.

Data storage provides the required space for storing data, as well as stored data access and data sharing, whereas the server component represents the computing infrastructure, which contains the hardware used for data processing. Moreover, the network allows the interconnection and interoperation of distributed servers, as well as providing access to applications and data for remote users. The application component represents the programs used to support business processes, which vary in many ways according to their use and their architecture, and therefore have direct impact on the requirements that need to be met by the other components described above. Finally, the management component deals with orchestration of the other four components; in the case of Netsourcing, this is the core component, where vendors need to optimise the interaction between the other components in order to ensure a successful delivery.

Figure 1: Infrastructural Model of IT Service (Toigo, 2002)

According to Singh (1997, p. 340), a complex technology is *"an applied system whose components have multiple interactions and constitute a nondecomposable whole." Singh (1997)* further concluded that firms commercialising complex technologies face the challenge of developing multiple capabilities, but few firms have the ability to develop the broad set of competencies required. From classifications for an IT service represented in Figure 1, it is clear that Netsourcing requires some rather disparate capabilities in order to function effectively, and thus fits perfectly in Singh's (1997) definition of a complex product. An important challenge for Netsourcing vendors is to be able to source all these components to deliver their services, which makes partnering a potentially suitable solution for having access to the needed components (Hagedoorn, 1993; Singh, 1997).

Partnering with other businesses who provide various components is not always the only suitable solution. Firms frequently consider the option of allying against other ones, such as *"do it yourself",* as expressed by Kanter (1989, p. 184). In other words, firms have frequently considered

the option of performing the required activity internally, against the option of allying with other firms that can perform it better. This has significantly altered the whole concept of the firm, where *"good fences make good corporations"* (Kanter, 1989, p. 183) used to be the main assumption of traditional management. According to Kanter (1989), this assumption has its limitations, in that it is costly, in time and resources, for any firm acting in today's highly competitive environment to perform everything internally, even if it has the capacity to do it. As a result, competitive success became perceived as requiring the integration of multiple capabilities across internal and external organizational boundaries (Lorenzoni and Baden-Fuller, 1995). Conversely, partnering is not always commonly considered as a better option either, where according to Murray and Mahon (1993) many firms see them as *"potential traps"* that may lead to mediocrity. In fact, several cases reported failed alliances, resulting from poor collaboration between partners (Medcof, 1997). Several reasons led to such poor collaboration, mainly poor partnering skills, unbalanced intentions among the partners, and incompatible business objectives (Dacin et al., 1997).

2.2 THEORIES OF THE FIRM IN IS RESEARCH

Theories of the firm, as used in IS research, may be helpful in understanding the issues that Netsourcing firms face. Classically, many theories have been used to investigate firms' boundary choices (Barney, 1999; Schilling and Steensma, 2002; Odagiri, 2003; Parmigiani and Mitchell, 2009). However, two of the most widely used are Transaction Cost Economics (TCE) (Williamson, 1975) and the Resource-based View (RBV) (Wernerfelt, 1984; Barney, 1991; Peteraf, 1993); both theories have been applied to a great extent in the field of strategic management and to a lesser extent in the area of Information Systems (Cheon et al., 1995; Lacity and Willcocks, 1995; Mata et al., 1995; Wade and Hulland, 2004; Watjatrakul, 2005; Nevo and Wade, 2010; Alaghehband et al., 2011; Lacity et al., 2011). The two theories have, also, seen some strong criticisms regarding their usefulness as well as usability in research (Ghoshal and Moran, 1996; Slater and Spencer, 2000;

Priem and Butler, 2001a; Priem and Butler, 2001b) but both still remain strong influences in management and have produced some compelling explanations.

2.2.1 TRANSACTION COST ECONOMICS (TCE)

TCE, originating from the work of Coase (1937), has seen its major development in the work of Williamson (1975), who aimed to make the theory more predictive, particularly concerning the transactions that would be organised within the firm (Madhok, 2002). Williamson (1989, p. 137) explains that TCE is consistent with the view that "economizing is the core problem of economic organization". It takes the transaction as the basic unit of analysis, focusing on economizing efforts that attend the organization of transactions (Williamson, 1989; 1991a). TCE is based around two main assumptions: the presence of bounded rationality and opportunistic behaviour (Williamson, 1975; Aubert et al., 1996). At the transaction level, TCE relies on three dimensions, according to which the transaction is described; asset specificity, uncertainty, and frequency of transaction. These dimensions help to differentiate between transactions, allowing to decide on the optimal way to perform these. Moreover, if these dimensions pertain simultaneously, the potential for opportunistic behaviour should be taken into consideration (Conner, 1991). These dimensions are described as follows:

- *Asset specificity:* this describes the ability of an asset to be reused for alternative purposes, and by alternative users without diminishing its value (Williamson, 1975; Williamson, 1989). In other words, an asset is seen as highly specific to a transaction, if it is durable and dedicated to the transaction (Aubert et al., 1996). If a firm, according to Kulkarni and Heriot (1999), possesses highly specific assets, than outsourcing an activity to a third party becomes a source of major problems, mainly contractual problems. Therefore, *"a firm with specific assets is more likely to organize the activities within its own boundaries, rather than into a transaction with a supplier."* (Kulkarni and Heriot, 1999, p. 45)

- *Uncertainty:* this refers particularly to behavioural uncertainty, including *'opportunism'* as a main concern of TCE (Williamson, 1975; Williamson, 1981; Williamson, 1996; Kulkarni and Heriot, 1999). Potential opportunism is considered on both parties of a contractual arrangement, where the sourcing firm may use the sourced technology for purposes other than agreed, or conversely the source firm may not provide the agreed level of service (Steensma and Corley, 2001). As this behavioural uncertainty becomes more important, the transaction costs increase as a result of the transacting parties trying to protect themselves by safeguarding the contract (Kulkarni and Heriot, 1999). Therefore, in order to mitigate such a risk of opportunism, a firm may choose to internalise the considered activity through hierarchical control.

  Frequency of transaction: this affects the choice of the governance mode enormously. According to Kulkarni and Heriot (1999), recurring transactions involve continuous bargaining, and thus are considered to be costly. As a result, Kulkarni and Heriot (1999, p. 45) concluded that *"increased frequency of transaction is often associated with internalisation of economic activities."* On the other hand, in the case of low-frequency transactions, firms would prefer taking the risk of opportunism and uncertainty, instead of creating a dedicated governance mechanism (Aubert et al., 1996).

  As a summary of the three dimensions used in TCE, and based on the work of Williamson (1975), Aubert et al. (1996) outlined a framework that combines these dimensions and describes the possible solutions (see Figure 2). From the framework outlined in Figure 2, Aubert et al. (1996) explained that when asset specificity is low, market transaction is the optimal solution; however, when asset specificity is high, the choice of governance mechanism depends on the two remaining dimensions: uncertainty and frequency. When uncertainty is of a low level, long-term relational contracting is preferred; such contracts include strategic alliances and outsourcing contracts. When high levels of uncertainty are present, then internal governance should be adopted when the frequency of recurrence of the transaction is high, and relational

governance (including strategic alliances and outsourcing contracts) should be adopted when transactions are occasional.

<table>
<tr><td colspan="2"></td><td colspan="3">Asset specificity</td></tr>
<tr><td colspan="2"></td><td>Low</td><td colspan="2">High</td></tr>
<tr><td rowspan="3">Uncertainty and measurement problems</td><td>Low</td><td rowspan="2">Market transaction</td><td colspan="2">Complete contract (long-term)</td></tr>
<tr><td rowspan="2">High</td><td>Relational governance</td><td>Internal governance</td></tr>
<tr><td colspan="2"></td><td>Occasional</td><td>Recurrent</td></tr>
<tr><td colspan="2"></td><td colspan="2">Frequency</td></tr>
</table>

Figure 2: Transaction Cost Framework (Aubert et al., 1996)

2.2.2 RESOURCE BASED VIEW (RBV)

RBV has emerged as an important theory in strategic management (Grant, 1991; Peteraf, 1993; Das and Teng, 2000; Fortune and Mitchell, 2012; Leiblein, 2011; Doherty and Terry, 2009), examining *"the link between a firm's internal characteristics and performance."* (Barney, 1991, p. 101) It also *"focuses on costly-to-copy attributes of the firm as sources of economic rents and, therefore, as the fundamental drivers of performance and competitive advantage."* (Conner, 1991, p. 121)

It adopts, according to Barney (1991), two main assumptions in analysing sources of competitive advantage: it assumes that firms within an industry (or group) may be heterogeneous with respect to the strategic resources they control, and that these resources may not be perfectly mobile across firms, and thus heterogeneity can be long lasting.

These assumptions came as a critique to the view that resources are homogeneous and fully mobile, largely adopted by scholars such as Porter (1985) who focused mainly on analysing the external

environment in which firms compete, and the threats and opportunities that the latter might face. As a result, it was argued that *"strategy formulation starts properly, not with an assessment of the organization's external environment, but with an assessment of the organization's resources, capabilities, and core competencies."* (Black and Boal, 1994, p. 132)

RBV relies on four dimensions, according to which resources are evaluated. These are: value, rarity, imitability and substitutability (Barney, 1991; Barney and Clark, 2007).

- Value: according to Barney (1991, p. 106), "resources are valuable when they enable a firm to conceive of or implement strategies that improve its efficiency and effectiveness."
- Rarity: rarity is an important condition for a resource or capability to be strategic. According to Barney (1991; 2007), firm resources that are widely available to competing firms cannot offer either competitive advantage or sustained competitive advantage.
- Imitability: imperfect imitability refers to the difficulty in reproducing the resources that lead to the same advantage achieved by the imitated firm. This is strongly consistent with the concept of causal ambiguity, where although the resources might be reproduced, the link between the original resources and competitive advantage is so unclear that the reproduced resources may fail to offer the same value.
- Substitutability: imperfect substitutability refers to the difficulty in substituting one firm's resources for another's, and achieving the same value, and thus the same competitive advantage. This mainly is explained by the idiosyncratic character of these resources, where perfect imitation is impossible, and therefore the substituted resources will not achieve the same objectives.

We would like to acknowledge at this point that Bromily (2005) has led a number of scholars away from this particular formulation of RBV – because of the notion that technology is indeed very imitable and substitutable. Consider for instance, Carr's (2003) statement of IT as a utility like

electricity. That said, we consider our conceptualisation of technology in outsourcing as application, network, server and data storage (see Figure 1) to be more nuanced. For instance, we would contend that some of these elements are not substitutable or imitable, and that it is these elements *in combination* that make them so. That said, the bulk of the work we are building does indeed use Barney's formulation and has been most commonly in this area. *mobile, imitable, and substitutable can be obtained through alliances."* In other words, a firm enters in an alliance arrangement with a firm that owns the required resources only if it fails to efficiently source these resources from elsewhere (Das and Teng, 2000). However, rarity as explained by Barney (1991) is of prime importance. Furthermore, Barney (ibid.) defined imitability and substitutability as the ways for a resource to become mobile. Therefore, for applying RBV to the context of partnering, the main consideration is that if a resource is rare, imperfectly imitable, and imperfectly substitutable, then a firm can obtain it through alliances (Barney, 1991; Das and Teng, 2000).

3.0 A THEORETICAL VIEW OF NETSOURCING

In this section, we introduce a conceptual model of Netsourcing, shown in Figure 3. This model combines the infrastructural, TCE and RBV perspectives discussed in the previous section. We then use this model to help us discuss, in turn, how the perspectives of TCE and RBV, combined with a generic view of infrastructure, might give insight into a vendors Netsourcing strategy.

Figure 3: A conceptual model of Netsourcing

3.1 NETSOURCING AND TCE

Beginning with *asset specificity*, most of the components necessary for running the Netsourcing model are standardised (Broadbent and Weill, 1997; Bharadwaj, 2000); equipment such as server technology has reached a commonly accepted standard that leaves very little difference between the various suppliers providing such hardware (Aubert et al., 1996). This creates very little risk of a

lockup effect, particularly from the suppliers' side. Consequently, the *data storage* and the *server* components can be considered to have very low asset specificity. The network layer can also be considered to have low asset specificity. The *network* for Netsorcing is usually the Internet, and is offered by a large number of Internet Service Providers (ISPs) and telecommunication companies. Although networking services are offered in different types and configurations, these services are not provided for particular Netsourcing delivery configurations, and are more of a standard nature. That said, the *human* asset specificity in this case is a little higher; knowledge about the application architecture, the platform that the servers run, and the number of users expected to the use the application, is important in order to provide optimised networking. So, even though the network layer can be seen as having low asset specificity, we need to qualify this assessment by noting that the network is core to the Netsourcing delivery.

The *application* is core to the Netsourcing model, and represents the basis to the service offering. The application is usually highly specific in nature, as it is directly linked to the business process to be supported, although, some categories of applications, such as e-mail, might not be as specific. *Human* asset specificity varies according to the type of application being offered.

In this case, there are two ends of a spectrum; on one hand, an application could be of a general character, usually not industry specific, and is horizontally provided in different markets. Such applications are of low asset specificity, as they are not specifically designed and customized to particular industries or a particular business process. On the other hand, applications could be industry specific, targeted at a specific vertical or niche market. Such applications are usually mission critical, such as enterprise applications (ERP, CRM, …etc.), and therefore tend to require in-depth knowledge about the business process being supported. Such applications are of *high asset specificity* as they are specifically designed and customised to a particular industry or a particular business process.

Regarding the *uncertainty* dimension of TCE, data storage, the server and the network components are indispensable for the Netsourcing vendor to be able to offer its services. Although these are also of low asset specificity, they are of prime importance for the proper functioning of the model. Unless these components are kept inhouse by the Netsourcing vendor, contractors' behavioural uncertainty could raise serious problems, which leads to an increase in the transaction costs due to the further involvement of the vendor. For instance, if the contractor proves to be behaving opportunistically in performing regular data backups, the Netsourcing vendor would be pushed to increase its monitoring, raising, thus, the transaction costs. Therefore, in this case, careful contracting with partners and ex ante considerations, as well as safeguarding measures should be considered.

The application, once it is designed and provided by the independent software vendor (ISV), it is then run from a server, and therefore at this point, no behavioural *uncertainty* is apparent. However, the Netsourcing vendor needs support for the offered application, particularly if they chooses to outsource it, and thus opportunistic behaviour might rise. This is further enhanced by the need to provide regular application updates, which is a core benefit of the Netsourcing model. Again, careful measures for ex ante contracting should be considered.

Finally, we can consider the *frequency* attribute and how it applies to the Netsourcing transaction. Data storage, server, and network components are necessary to the functioning of the Netsourcing model. Although these are of low *asset specificity*, the *frequency* of their related transactions is high. Data storage, for instance, is required continuously as the users use the Netsourcing service. The application component also can be qualified as requiring high frequency of transactions, depending on the application in question. Transactions with the software contractor are more on the support side, where the contractor has to ensure application support, and provide regular updates. Therefore, all the layers are considered to be highly recurrent.

To conclude this discussion, Table 1 summarises the TCE perspective on the key characteristics of each infrastructural element of the Netsourcing model.

Element	Asset specificity	Uncertainty	Frequency	Sourcing Strategy
Data storage	Low	High	Recurrent	Market transaction
Server	Low	High	Recurrent	Market transaction
Network	Low	High	Recurrent	Market transaction
Application	High	Low/High	Recurrent/Occ.	Relational contracting

Table 1: A TCE application to Netsourcing

3.2 NETSOURCING AND RBV

What happens if we analyse the components of the Netsourcing model in Figure 1 using the RBV perspective? In this section, we use the RBV concepts of rarity, imperfect imitability andimperfect substitutability developed by Das and Teng (2000) to analyse potential sourcing decisions. *Data storage*, *server* and *network* components, as explained in the previous section, are standardised in the computing industry. Therefore, there are no particular idiosyncrasies attached with these resources, as they are not directly linked to the business process being supported. Therefore, these Netsourcing elements are not rare, not imperfectly imitable, and not imperfectly substitutable, which excludes the option of forging a strategic alliance to source them.

Unless the Netsourcing vendor initially owns these resources, internalising them may see a major financial barrier. In fact, the costs of owning data centres, for instance, are so high that justifying the investment might become a major problem. Furthermore, acquiring the firm that owns this resource may lead to internalising other unnecessary and unsuitable resources, which may result in

added managerial burdens. Overall, these components, according to RBV, are better sourced through market exchange or inhouse development, if financially feasible.

The *application* element illustrates a totally different situation. The offered application is chosen because of its uniqueness. This is particularly valid in the cases where the application is designed and targeted at a specific vertical market, where the resource becomes rare, imperfectly imitable, and imperfectly substitutable due to the idiosyncratic knowledge involved. In this case, unless the Netsourcing vendor is an Independent Software Vendor (ISV), forging a strategic alliance with the application owner is a more valid option. If the application is not designed for a particular vertical market, and is more targeted at horizontal delivery, then unless the Netsourcing vendor owns the application, sourcing it through strategic alliances is still the most suitable option. The rationale for this is that the Netsourcing vendor will have to develop skills specialised in delivering the application, which results in the application becoming rare, as the skills are not necessarily transferable to other software applications. An acquisition might be a valuable option if it does not lead to internalising other unsuitable resources, such as other applications not needed for the Netsourcing offering. Internalisation, as an option, is hardly conceivable, due to the time and costs involved in developing applications inhouse, as well as the knowledge involved (Armour, 2000).

To summarise the discussion above, Table 2 outlines the sourcing characteristics of the Netsourcing components illustrated in Figure 1 using an RBV perspective.

Element	Rare	Imperfect imitability	Imperfect substitutability	Sourcing Strategy
Data storage	No	Low	Low	Market transaction
Server	No	Low	Low	Market transaction
Network	No	Low	Yes/No	Market transaction
Application	Yes	Yes	Yes	Strategic alliance/Acquisition

Table 2: An RBV application to Netsourcing

3.3 SUMMARISING EX ANTE STRATEGIES FOR NETSOURCING VENDORS FROM BOTH PERSPECTIVES

Having applied both TCE and RBV to the infrastructural model of Netsourcing, we are in a position to now characterise possible sourcing strategies for vendors (see Figure 4). The next step of our study is to validate these strategies by looking at primary data collected from existing vendors, and looking at how actual vendors have sourced their Netsourcing components. This will effectively help to compare ex-ante findings with ex-post. The next sections of this paper look at the methodology used for the study, and discusses some of the findings related to the Netsourcing model as well as the use of TCE and RBV in IS research.

Figure 4: Ex-ante sourcing decisions of the Netsourcing components

4.0 RESEARCH METHODOLOGY

For the purpose of understanding how vendors actually source their Netsourcing components, a case study methodology was seen as appropriate because a case study "examines a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or a few entities (people, groups, or organizations." (Benbasat et al., 1987, p. 371)

The choice of study cases was determined by the need to explore a variety of cases that represent different Netsourcing settings. The first two cases (Company A and Company B) were chosen due

to the differences in their partnering strategies, where the former was relying more on inhouse provision, whereas the latter was more into outsourcing. These two case studies were considered, by the authors, as representing two ends of a spectrum, and the remaining case studies were chosen within this spectrum. The main challenge in this phase was that not many firms accepted to participate in the research, because such decisions could be seen to be commercially sensitive. A total of ten small-to-medium enterprises (SMEs) participated in this research, but only six cases were used due to the incompleteness of the other four cases; the other four cases were either not suitable for the study due to less involvement with Netsourcing than anticipated, or their reluctance to divulge important information about their strategies.

The interviews conducted in this research were all either semi-structured or unstructured (Denzin and Lincoln, 1998) (see Table 4 in the Appendix for more details). The semi-structured interviews were the main source of data, where it was necessary to keep some level of passivity (Walsham, 1995). The interview questions were designed around the possible decisions that might occur, using the Netsourcing model as a guide. The concepts of TCE and RBV were not explicitly labelled as such during interviews. We also took care to make sure that our interviews allowed for the discussion of a range of outsourcing decisions rather than prejudging the type of decision that might be taken.

Therefore, the main purpose of the semi-structured interviews was to extract facts from the different interviewees, then map the different theoretical concepts onto those facts subsequently. The unstructured interviews were mainly complementary to the semi-structured ones, and generally took place over telephone conversations or during informal sittings. All the semi-structured interviews were tape recorded, and transcribed subsequently. Moreover, documentation in the form of white papers as well as internal reports was used when available.

As an illustration of how the theoretical concepts were mapped onto the interviews, Company A's vice president stated, regarding their data storage component: *"... we have a supplier that provides*

us with storage, but we are in a contract that we signed two years ago, and it is now extortionate because a) it was a hype to the bubble, b) hardware costs within have gone to the floor, so we are trying to get out of that and we will take on storage ourselves as well…"

This translates into *low asset specificity* for data storage; in fact, as admitted by this executive, as data storage hardware costs dropped enormously, it became financially possible for Company A to internalise its data storage operations. Therefore, although it is an important component of the Netsourcing model, data storage, in this case, is still regarded as non asset specific.

Furthermore, the managing director of Company C stated: *"…because in our contracts we guarantee 99% of time of our service, and so obviously we have a very high level of confidence in the ability to deliver a reliable product, and their reliability is based on two things, our application as well as how the application is hosted…so we have to make sure that USi and us are very much in synch about what our requirements are… additionally, we have got what customers require, we have certain levels of integration and documentation about the security and the reliability of the service…"* This statement clearly demonstrates that although the asset specificity here is very low, the company still needs to ensure high standards of its operations, which increases the uncertainty and measurement problems associated with these.

The collected data were analysed in two phases. A within-case analysis (Eisenhardt, 1989) was done on a case-per-case basis, where the objective was to compare the predicted outcomes of TCE and RBV in Tables 1 and 2 to the actual sourcing strategies in each case study. Furthermore, a cross-case analysis (Eisenhardt, 1989) was used to analyse the patterns across all the cases, and further investigate the explanatory power of both TCE and RBV.

A hosting element was added to both the data storage and server layers as a result of the data analysis; although hosting is not included in the initial model in Figure 1, most interviewees made the distinction between the hosting and operations for both data storage and server layers, and it was judged important to keep this distinction.

5.0 FINDINGS

Our findings in this section are organised as follows: First, we present our within-case analysis. Second, we present 6 propositions about Netsourcing decisions based on our findings in the individual cases as well as in the cross-case analysis.

	Data Storage		Server		Network	Application
	Operations	**Hosting**	**Operations**	**Hosting**		
Ex-ANte	Market	Market	Market	Market	Market	Inhouse/Alliance
Company A	Inhouse	Alliance	Inhouse	Alliance	Alliance	Market
Company B	Inhouse	Market	Inhouse	Market	Market	Inhouse
Company C	Inhouse	Alliance	Inhouse	Alliance	Alliance	Inhouse
Company D	Market	Market	Market	Market	Market	Inhouse
Company E	Inhouse	Market	Inhouse	Market	Market	Inhouse
Company F	Inhouse	Market	Inhouse	Market	Market	Inhouse/Alliance

Table 3: The sourcing modes of the Netsourcing components in the studied cases

Table 3 summarises the sourcing outcomes from the case studies (a more detailed breakdown of the results is shown in Tables 5 to 8 in the Appendix).

One of our most important findings was that RBV and TCE failed to predict almost half of the decisions. These differences could be due to the possibility that TCE and RBV are not powerful enough on their own to predict the majority of the sourcing modes of the Netsourcing layers, or other unknown factors associated with the context of the decision, that we were not privy to.

However, as a result of the within-case and the cross-case analysis, we could see that a problem with our predictions was related to the initial assumptions made regarding the different Netsourcing layers. Our assumption was that the software layer was the most value-adding Netsourcing component, and that the remaining layers were pure commodities, necessary for Netsourcing provision but do not carry extra value. A lot of the published academic work on Netsourcing shares this viewpoint. For instance, Dewire (2000, p. 15) stated that *"[a vendor] provides the application service as its primary business."* Although Dewire (2000) recognises the need for the other layers of the Netsourcing model, she argued that the main source of value for Netsourcing would be the delivered application. However, Dewire (2000) also predicted that the other Netsourcing layers

may start to play a more important role in the future, particularly if the vendor in question owns one or more of these layers. Similarly, Kern et al. (2002b, p. 5) stated that *"the primary product of an application service provider (ASP) is business applications, managed remorely by the ASP."* This also places great emphasis on the application as being the single most important Netsourcing layer. Kern et al. (2002b) also recognise the need for the other Netsourcing layers for successful delivery, but do not cite these as being major value drivers. Additionally, Bennett and Timbrell (2000) also define Netsourcing as focusing mainly on delivery of software applications, defining the latter as being the *'scope'* of Netsourcing.

5.1 NETSOURCING STRATEGY PROPOSITIONS

This section details the propositions that came from our findings.

Several of the studied organizations did indeed find the application layer to be the most important in their Netsourcing delivery, as the literature states, but only if they owned the application layer. For instance, the CEO of Company F stated:

"…the software is an absolutely key ingredient in the solution… as I say prefer a relationship with a database provider, who we're working together very closely, rather than a data centre provider because that's a commodity…"

Moreover, the managing director of Company E also stated:

"… if you own the software you are going to deliver that… I think if you want to set up a business [as a Netsourcer] and you don't own the software, you have very little value I think…"

In the cases of Company B and Company E, their Netsourcing business propositions were simply to offer their existing software application as an online service. Both companies kept their initial business of selling and maintaining software applications in a traditional way, but used the Netsourcing model to extend their distribution channel. Similarly, although Company D produced content only, they thought of the Netsourcing model as an extra distribution channel for increasing

reach, and thus increasing revenues. Finally, Company F produced a content-independent 3D user interface, and bundled it with content that is sourced from an external content aggregator. Here, again, the idea of using the Netsourcing model was only natural to the company in order to increase its sale revenues. It is also worth mentioning that all these companies – Company B, Company D, Company E, and Company F – generate most of their revenues from their non-Netsourcing-based business.

Proposition 1: Vendors that own the application layer will offer value based on the traditional Netsourcing definition.

One key finding is that software being the core of the delivery is not always true for vendors. Some other vendors, such as Company A and Company C used different other layers in order to create or add value to their businesses. In the case of Company A, for instance, the application layer was sourced from external third-party Independent Software Vendors (ISV). Initially, the company started its business as a pure Netsourcing aggregator, simply delivering the different software applications in question, using the Netsourcing model on a one-to-many basis. According to the company's VP of its managed services division, the company was not very successful then as it could not distinguish itself in the market, and thus could not attract enough customers to generate acceptable levels of revenues, where he stated:

"...when you are a small company, what you have to do is be flexible, and you have to give customers what they want, and that is what we do..."

It is clear here that the company could not generate enough value from its initial strategy of implementation of the Netsourcing model. The company rethought its business model in order to find ways to generate value. As a result, the company targeted the *network* layer as the main source of value; they kept the same software implementation skills, and the same application layer, but focused on giving customers a unique experience by providing them with services tailor made for them, and delivered via vLANs (virtual local area networks) provided by their network provider.

Consequently, the company succeeded in setting its business apart in the market, and thus managed to attract a healthy customer base.

Company C also generated its value from more than the application they delivered. The company's main business proposition was a solution that is only achievable using the Netsourcing model. Although the whole solution revolved around the application they developed for managing and distributing M&As-related digital documents, the actual value that drives its business came more from the network layer, as well as the hosting parts of the their data storage and server layers. Their business relied on the software application to provide an integrated platform for managing and distributing the digital documents, and thus the software only helps the idea to materialise. However, what is of prime importance to the potential customers, according to Company C's managing director, is the security of their documents, and thus the company's focus was mainly on making its *network* and hosting secure and appealing to customers.

This is a major development in the Netsourcing market, whereby value generating can shift away from the application layer.

PROPOSITION 2: VENDORS THAT DO NOT OWN THE APPLICATION LAYER WILL SEEK TO OFFER VALUE BASED ON THE REMAINING NETSOURCING LAYERS.

The next set of propositions, are considered together, because these propositions draw on both TCE and RBV. In this section we are endeavouring to explore how combinations of TCE and RBV viewpoints can help us build better understanding about the Netsourcing phenomena.

If we examine Table 3, it is clear that the partnering strategies of those two clusters of companies was rather different; Company A and Company C relied more on strategic alliances than the remaining Netsourcing vendors. As explained by Kittilaksanawong (2007), strategic alliances are particularly valuable for creating value using resources external to the firm's resources capabilities.

When we consider how TCE can assist our understanding of decisions, we arrive at the above proposition. An important phenomenon was seen to be repeated very frequently in the case studies. There were a number of instances where the studied firms either decided to integrate or ally for transactions of *low* asset specificity. This is clearly in contradiction with Williamson's (1975) definition of TCE. For instance, Company A, Company B, Company C, and Company E all chose to produce data storage- and server-related operations inhouse. All of the interviewed executives from these firms confirmed that the reason for insourcing those transactions was mainly to be able to take control on the Netsourcing delivery, which translates into higher uncertainty. Moreover, Company C chose to ally with a network provider, although their network layer is of low asset specificity. According to the company's managing director, that decision was purely to make sure that their network is run properly and securely, thus due to high uncertainty. Finally, Company D chose to *internalise* part of its non asset specific application layer, and Company F chose to *ally* with a database provider in order to avoid the performance problems that were encountered by the company in the past.

It is important to understand here that in all these instances, the decisions to insource or ally were totally based on the *uncertainty* attribute of the transactions, even though *asset specificity* was low. Thus the uncertainty attribute has played an important role in the sourcing decisions. However, what is not understood is the reason why uncertainty is influencing these decisions.

As previously discussed in TCE as defined by Williamson (1975; 1991a), the three main transaction attributes to be considered when analysing sourcing decisions are *asset specificity*, *uncertainty*, and *frequency* of transacting. However, among these three, asset specificity and uncertainty are the main determinants (Williamson, 1989; 1991a; Mahnke et al., 2005). Moreover, among the latter two attributes, asset specificity is the most powerful determinant of sourcing decisions (Williamson, 1981). According to Williamson (1985, p. 55), asset specificity refers to *"durable investments that are undertaken in support of particular transactions, the opportunity cost of which investments is*

much lower in best alternative uses or by alternative users should the original transaction be prematurely terminated." When asset specificity is low, sourcing should always be from the market. The rationale behind this is that in the presence of trivial levels of asset specificity, numerous suppliers should effectively compete. However, when asset specificity is present to a non-trivial level, the sourcing decision should include the other TCE dimensions – uncertainty and frequency of occurrence. (Williamson, 1981; 1989; Aubert et al., 1996; David and Han, 2004) Furthermore, according to Mahnke et al. (2005), this overpowering character of asset specificity in TCE has received strong support in internal production vs. external procurement decisions.

Although the application of TCE has been widely in support of the dominance of asset specificity in the make-or-buy decisions (David and Han, 2004; Mahnke et al., 2005), other researchers have attempted to associate more power with uncertainty. Leiblein and Miller (2003), for instance, developed a conceptual model in which they argued that uncertainty would lead to integration for transactions involving both high and low values of asset specificity in the semiconductor industry. However, they failed to prove that empirically, where their results showed that uncertainty leads to integration only in the presence of high asset specificity.

When we take an RBV perspective on Netsourcing, the delivery of services relies on many distinct capabilities (the different Netsourcing layers) that are hardly possible for one single firm to own them all. Therefore, Netsourcing fits perfectly the definition of a complex service. Moreover, the successful delivery of Netsourcing services depends heavily on the performance of each layer, where failure in any layer will affect the entire service, no matter how strategic or non-strategic the layer is. Additionally, as explained by Dewire (2000, p. 15), a Netsourcing vendor *"is responsible for delivering on the customer's contract regardless of its structure – sole provider or partnered."* In the case of Company A, for instance, the main concern was to make sure that the SLAs provided to customers are fully met in order to avoid any financial sanctions. According to the company's VP of its managed services division, the reason for internalising data storage and server operations

was to be able to take full control on the service, although those elements were not strategic. This, also, refers back to the fact that uncertainty, under the TCE explanation, where it seems that uncertainty emerges due to the complementarity between the different Netsourcing layers. However, this is not valued by all the studied firms. For instance, Company B did not consider hosting for the data storage and the server layers to have any uncertainty linked to it.

An important conclusion to be drawn here is that the choice of the unit of analysis under RBV was not very appropriate. Although under TCE the choice of the unit of analysis, being the transaction for each of the Netsourcing layers was appropriate; each layer needs a sourcing mode, and thus it makes sense to evaluate the production costs and the transaction costs associated with each layer. However, in the case of RBV, although each resource is important in its own right, the complementarity between these resources is even more important, and in the studied cases, this complementarity has greatly influenced the sourcing modes. Therefore, the complementary capability of the different layers exceeds that of the individual resources, which might translate into what could be expressed as a *"Netsourcing capability"*. The Netsourcing capability would be important then to consider in addition to the individual components.

Proposition 3: Vendors will internalise or ally for transactions that are surrounded by uncertainty due to their effect on the Netsourcing capability.

> *Proposition 3.1: Vendors will internalise the transactions when it is financially possible, and the access to the capability in question is possible.*
>
> *Proposition 3.2: Vendors will ally for transactions when it is financially not possible to internalise it, and the access to the capability is not possible.*

Proposition 4: Vendors will use the market for transactions that are not surrounded by uncertainty.

6.0 DISCUSSION

On the theoretical side of the findings of this research, there are several important issues that are worth an in depth discussion. To begin with, from the analysis of the case studies, the following was extracted:

- Just over a third of the overall sourcing modes were not explained by either theory.
- Just over half of the overall sourcing modes could not be explained using TCE.
- Just over a third of the overall sourcing modes could not be explained using RBV.
- All the sourcing modes that were explained using TCE were also explained using RBV.
- Some of the sourcing modes that were not explained using TCE, were explained using RBV.

From the statements above, it seems that both TCE and RBV were successful in explaining only two thirds of the actual ex-post sourcing modes of the Netsourcing layers in the studied cases. However, in analysing the different outcomes of the case studies, the two theories were applied independently, and therefore the results are not those of combined explanations. Another important finding here is that RBV seems to have, in this research, more explanatory power than TCE. However, it not possible here to confirm that RBV is a more reliable theory than TCE. In a highly acclaimed research conducted by Lacity and Willcocks (1995), where the researchers used TCE to explain IT sourcing decisions, it was found that 87.5% of the cases failed to be explained using TCE. In concluding their research, they stated: *"[w]e hope that this paper serves to stimulate debate among the information technology academic community on the applicability of using transaction cost theory as an explanator of information technology sourcing decisions. We believe this debate is important because adoption of theories from other disciplines needs to be critically examined within our own discipline."* (Lacity and Willcocks, 1995, p. 241) As a response to this, part of Lacity and Willcocks' (1995) results were re-analysed by Aubert and Weber (2001) using RBV. The main finding of this re-analysis was that the same data provided a much stronger support

for RBV. In concluding their research, Aubert and Weber (2001) did not claim support for RBV over TCE, but valued the fact that the two theories can be differentiated empirically, and thus they compete to explain sourcing decisions.

TCE and RBV have both seen successful and unsuccessful uses in explaining different issues in organizations. Most importantly, TCE and RBV are frequently seen as competing theories (Conner, 1991; Eisenhardt and Schoonhoven, 1996; Combs and Ketchen, 1999; Das and Teng, 2000), where each has a distinctive explanatory power independently of the other. However, several other researchers have praised the complementary nature of the two theories (Foss, 1996; Mahoney, 2001; Leiblein and Miller, 2003; Barney et al., 2001). In fact, even Williamson (1991b) recognised the usefulness of what he calls *"strategising"* as complementary to *"economising"*.

It was explained above that there were issues with both the use of TCE and RBV. Under TCE, just over half of the overall sourcing modes were not explained, however, it was also understood that uncertainty, as a transaction attribute, played an important role in several of the sourcing decisions made by the different studied firms, particularly those of low asset specificity. Due to the fact that asset specificity overpowers the remaining transaction attributes, TCE failed to explain those sourcing decisions. Moreover, under TCE, it was not clear why such uncertainty emerges. Using RBV, it became clearer that the uncertainty is emerging from the fact that the different layers directly affect the overall performance of the Netsourcing delivery, and thus it becomes critical for certain vendors under certain conditions, to consider the Netsourcing capability as a whole in addition to the individual layers.

According to Leiblein and Miller (2003), *"[w]hile TCE focuses on the relationship between characteristics of isolated transactions and the likelihood of ex post opportunistic behavior, the RBV emphasizes how the opportunity to create competitive advantage by exploiting unique firm-level attributes affects the value of the incentives, administrative controls, and adaptation mechanisms offered by competing forms of organization."* This is precisely what the present

research has proved; the studied vendors aim to provide value to their customers. Depending on the source of value in their model, these vendors will choose different sourcing modes for their remaining layers. By combining TCE and RBV, in the case of this research, better explanations could be provided. For example, in the case of Company A, data storage operations were internalised, despite the fact that asset specificity was low, because of the high uncertainty surrounding the transaction due to the effect of that on the company's Netsourcing capability. Similarly, Company B internalised the same layer because of the same reason. However, in the case of Company C, for example, they allied with a third-party network provider for the same reasons, not only because internalising that was not possible financially, but also because it is a specialised capability that is not easily accessible.

Conversely, in the case of Company A, the application layer was sourced from the market, although it was of high asset specificity. Although this case was unique, it could also be explained using the same logic; the company did not perceive any uncertainty surrounding the application layer because the software applications in question were standardised, but asset specific, packages that are well known to the company, and that have already been tested, and thus unlikely to negatively affect the overall performance of the Netsourcing delivery.

RBV, as defined by Barney (1991), is a theory that focuses on firm resources as a unit of analysis, as opposed to transactions in the case of TCE. It is mainly a theory of competitive advantage as opposed to a theory of economising as in the case of TCE. RBV has, recently, gained tremendous coverage in the strategic management literature (Wernerfelt, 1995; Barney, 2001) and has also attracted some interest from a variety of other disciplines like IS (Mata et al., 1995; Bharadwaj, 2000; Melville et al., 2004; Watjatrakul, 2005) The main tenet of RBV is that in order for a firm to achieve and sustain competitive advantage, it must be capable of implementing unique strategies, which involve the use of strategic resources (Wernerfelt, 1984; 1991). Consequently, resources that are valuable, rare, imperfectly imitable, and imperfectly substitutable are potentially sources of

sustained competitive advantage (Barney, 1991). However, as explained by Barney (1991), *"the study of sustained competitive advantage depends, in a critical way, on the resource endowments controlled by a firm."* Therefore, it is understood that an organization's strategy depends greatly on the resources it owns, and the strategic value of such resources.

Complexity of products and services in many industries, particularly the technologically-driven ones such as IT, is important to consider. Complexity, according to Tyler and Steensma (1995), refers to the diversity of technologies needed for the development process, where the bigger the variety of these technologies, the greater the complexity becomes. According to Ohmae (1989, p. 145), *"[t]oday's products rely on so many different critical technologies that most companies can no longer maintain cutting-edge sophistication in all of them."* Therefore, an important characteristic of complex products would be the complementarity between the needed technologies. Bharadwaj (2000, p. 172), for instance, discussed the strategic value of IT capability and argued that *"[a]lthough the individual components that go into the infrastructure are commodity-like, the process of integrating the components to develop an infrastructure tailored to a firm's strategic context is complex and imperfectly understood"*

To conclude here, the combination of both TCE and RBV has showed that two parameters play a major role in Netsourcing-based sourcing decisions: uncertainty, and resource complementarity of the Netsourcing layers (Netsourcing capability).

7.0 CONCLUSION

This research has attempted to investigate the sourcing strategies of Netsourcing vendors. Two theories – TCE and RBV – were applied in order to predict the potential sourcing strategies employed by Netsourcing vendors, and it was concluded that although each theory, independently, could not explain the full extent of the decisions taken by the studied companies. However, when these theories were combined, their explanatory power can be improved tremendously. We would

contend that this constitutes a unique contribution of our study. This contribution we feel can have some interesting repercussions on IS research, particularly that the latter's recent focus has been on the complementarity of IT-based resources and business processes (Doherty and Terry, 2009). This research also contributes to the debate on the usefulness of the existing theories of the firm in predicting and explaining boundary choices. Although recently some studies focused on scrutinising single theories such as Transaction Cost Economics (Alaghehband et al., 2011; Lacity et al., 2011) this study takes a different approach by looking at the combinatory power of more than one theory. The impact here is both theoretical and practical; theoretically, the contribution of this study is to offer a view on how multiple theories can help to better understand boundary choices, particularly in the context of IS outsourcing. Moreover, the practical significance here is that managers who are involved in such decisions might find that considering multiple units of analysis can help them to make better decisions.

The limitations of this research, however, are several. Firstly, the data used here are rather small in size; although the case studies used here have proved to be very useful, a larger study will help to enhance the strength of the results. Furthermore, the inclusion of more theories such as agency theory, and resource dependence theory could help to even further widen the theoretical lens, and possibly improve the consistency of the results.

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APPENDIX

Organization	Respondent	Type of Interviews
Company A	CEO	Unstructured
	VP of the Managed Services Divison	Semi-structured Unstructured
Company B	Co-Founder	Semi-structured Unstructured
	Manager of the Netsourcing Solution	Untructured
Company C	Managing Director	Semi-structured Unstructured
Company D	CEO	Semi-structured Unstructured
Company E	Managing Director	Semi-structured Unstructured
Company F	CEO	Semi-structured Unstructured

Table 4: Interviews conducted for data collection

		Asset Spec.	**Uncert.**	**Freq.**	**Rare**	**Imp. Imit.**	**Imp. Subst.**	**Actual**	**Expected (TCE)**	**Expected (RBV)**
Comp. A	Operation Hosting	Low High	High High	High High	No Yes	Low High	Low High	Inhouse Alliance	Market Inhouse	Market Alliance
Comp. B	Operation Hosting	Low Low	High Low	High High	No No	Low Low	Low Low	Inhouse Market	Market Market	Market Market
Comp. C	Operation Hosting	Low Low	High High	High High	No Yes	Low High	Low High	Inhouse Alliance	Market Market	Market Alliance
Comp. D	Operation	Low	Low	High	No	Low	Low	Market	Market	Market

	Hosting	Low	Low	High	No	Low	Low	Market	Market	Market
Comp. E	Operation	Low	High	High	No	Low	Low	Inhouse	Market	Market
	Hosting	Low	Low	High	No	Low	Low	Market	Market	Market
Comp. F	Operation	High	High	High	Yes	High	High	Inhouse	Market	Market
	Hosting	Low	Low	High	No	Low	Low	Market	Market	Market

Table 5: The sourcing modes of the Data Storage layer in the studied cases

		Asset Spec.	**Uncert.**	**Freq.**	**Rare**	**Imp. Imit.**	**Imp. Subst.**	**Actual**	**Expected (TCE)**	**Expected (RBV)**
Comp. A	Operation	Low	High	High	No	Low	Low	Inhouse	Market	Market
	Hosting	High	High	High	Yes	High	High	Alliance	Inhouse	Alliance
Comp. B	Operation	Low	High	High	No	Low	Low	Inhouse	Market	Market
	Hosting	Low	Low	High	No	Low	Low	Market	Market	Market
Comp. C	Operation	Low	High	High	No	Low	Low	Inhouse	Market	Market
	Hosting	Low	High	High	Yes	High	High	Alliance	Market	Alliance
Comp. D	Operation	Low	Low	High	No	Low	Low	Market	Market	Market
	Hosting	Low	Low	High	No	Low	Low	Market	Market	Market
Comp. E	Operation	Low	High	High	No	Low	Low	Inhouse	Market	Market
	Hosting	Low	Low	High	No	Low	Low	Market	Market	Market
Comp. F	Operation	High	High	High	Yes	High	High	Inhouse	Market	Market
	Hosting	Low	Low	High	No	Low	Low	Market	Market	Market

Table 6: The sourcing modes of the Server layer in the studied cases

	Asset Spec.	Uncert.	Freq.	Rare	Imp. Imit.	Imp. Subst.	Actual	Expected (TCE)	Expected (RBV)
Company A	High	High	High	Yes	High	High	Alliance	Inhouse	Alliance
Company B	Low	Low	High	No	Low	Low	Market	Market	Market
Company C	Low	High	High	Yes	High	High	Alliance	Market	Alliance
Company D	Low	Low	High	No	Low	Low	Market	Market	Market
Company E	Low	Low	High	No	Low	Low	Market	Market	Market
Company F	Low	Low	High	No	Low	Low	Market	Market	Market

Table 7: The sourcing modes of the Network layer in the studied cases

	Asset Spec.	Uncert.	Freq.	Rare	Imp. Imit.	Imp. Subst.	Actual	Expected (TCE)	Expected (RBV)
Company A	High	Low	High	Yes	High	High	Market	Alliance	Alliance
Company B	-	-	-	-	-	-	Inhouse	-	-
Company C	-	-	-	-	-	-	Inhouse	-	-
Company D	Low	Low	High	No	Low	Low	Inhouse	Market	Market
Company E	-	-	-	-	-	-	Inhouse	-	-
Company F	Low	High	High	No/Yes	Low/High	Low	Inh./Alliance	Market	Market/Alliance

Table 8: The sourcing modes of the Application layer in the studied cases