Portfolios of Exchange Relationships: An Empirical Investigation of an Online Marketplace for IT Services

Uladzimir Radkevitch, Eric van Heck and Otto Koppius

ERIM REPORT SERIES *RESEARCH IN MANAGEMENT*	
ERIM Report Series reference number	ERS-2007-035-LIS
Publication	May 2007
Number of pages	28
Persistent paper URL	
Email address corresponding author	uradkevitch@rsm.nl
Address	Erasmus Research Institute of Management (ERIM) RSM Erasmus University / Erasmus School of Economics Erasmus Universiteit Rotterdam P.O.Box 1738 3000 DR Rotterdam, The Netherlands Phone: + 31 10 408 1182 Fax: + 31 10 408 9640 Email: info@erim.eur.nl Internet: www.erim.eur.nl

Bibliographic data and classifications of all the ERIM reports are also available on the ERIM website: www.erim.eur.nl

ERASMUS RESEARCH INSTITUTE OF MANAGEMENT

REPORT SERIES

RESEARCH IN MANAGEMENT

ABSTRACT AND KEYWORDS	
Abstract	Small firms face distinct problems and opportunities when procuring IT resources. Whereas previous work focused at the level of firm or buyer-supplier dyad, we address portfolios of buyer-supplier relationships at an online marketplace for IT services. Using the portfolio approach, we develop a buyers taxonomy and analyze properties of resulting clusters. Our investigation reveals four clusters of buyers with distinct mixes of long-term and short-term supplier relationships. Although reverse auctions are found to be associated with short-term relationships and negotiations support long-term relationships, buyers in different clusters use the two mechanisms in combination to a different extent.
Free Keywords	Online markets, IT services, Outsourcing, Buyer-supplier relationships, Reverse auctions, Performance
Availability	The ERIM Report Series is distributed through the following platforms: Academic Repository at Erasmus University (DEAR), DEAR ERIM Series Portal Social Science Research Network (SSRN), SSRN ERIM Series Webpage Research Papers in Economics (REPEC), REPEC ERIM Series Webpage
Classifications	The electronic versions of the papers in the ERIM report Series contain bibliographic metadata by the following classification systems: Library of Congress Classification, (LCC) LCC Webpage Journal of Economic Literature, (JEL), JEL Webpage ACM Computing Classification System CCS Webpage Inspec Classification scheme (ICS), ICS Webpage

PORTFOLIOS OF EXCHANGE RELATIONSHIPS: AN EMPIRICAL INVESTIGATION OF AN ONLINE MARKETPLACE FOR IT SERVICES

Uladzimir Radkevitch
Department of Decision and Information Sciences, RSM Erasmus University
P.O. Box 1738, 3000 DR Rotterdam, the Netherlands
uradkevitch@rsm.nl

Eric van Heck
Department of Decision and Information Sciences, RSM Erasmus University
P.O. Box 1738, 3000 DR Rotterdam, the Netherlands
evanheck@rsm.nl

Otto Koppius
Department of Decision and Information Sciences, RSM Erasmus University
P.O. Box 1738, 3000 DR Rotterdam, the Netherlands
okoppius@rsm.nl

Abstract

Small firms face distinct problems and opportunities when procuring IT resources. Whereas previous work focused at the level of firm or buyer-supplier dyad, we address portfolios of buyer-supplier relationships at an online marketplace for IT services. Using the portfolio approach, we develop a buyers taxonomy and analyze properties of resulting clusters.

Our investigation reveals four clusters of buyers with distinct mixes of long-term and short-term supplier relationships. Although reverse auctions are found to be associated with short-term relationships and negotiations support long-term relationships, buyers in different clusters use the two mechanisms in combination to a different extent.

Keywords: Online markets, IT services, outsourcing, buyer-supplier relationships, reverse auctions, performance.

Introduction

Traditionally, small firms face more difficulties accessing and using information technology (IT) resources, including access to IT outsourcing providers, than their larger counterparts (Carmel & Nicholson, 2005; Nooteboom, 1993). This situation is rooted in small firms' poorer access to financing (Dean, Brown, & Bamford, 1998) and poorer in-house availability of dedicated high-skilled technical personnel (Nooteboom, 1993). In offshore IT outsourcing small firms face relatively high costs of contacting, contracting, and controlling suppliers than large firms (Carmel et al., 2005).

However, with the growth of IT spending by small firms, wide-spread use of Internet and emergence of a wide range of intermediaries, the situation has started to change. The recent rise of online marketplaces for professional services contributes to improving the access of small firms to offshore suppliers of outsourcing services (Radkevitch, van Heck, & Koppius, 2006b). IT services, such as website design and software development, are a primarily focus for these marketplaces. The leading online marketplaces with a strong focus on IT services include Elance Online, Rent a Coder and eWork.

Marketplaces for IT services provide a valuable ground for studying a number of exchange-related issues of theoretical and practical importance. Recent studies addressed bidding and buying behavior under conditions of costly bidding and bid evaluation (Carr, 2003; Snir & Hitt, 2003); market participation costs (Snir & Hitt, 2004), yield management for IT service providers (Kim & Altinkemer, 2006) and buyer's commitment and opportunism (Radkevitch, van Heck, & Koppius, 2006a). The present study focuses on two main themes that emerge in light of the increasing use of online IT marketplaces by small firms: 1) the development of long-term as opposed to short-term buyer-supplier relationships and 2) the underlying use and effects of exchange mechanisms (open reverse auctions vs negotiations). The main research question this study intends to answer is this: What types of buyer ego networks are formed at online IT marketplaces for small firms and what are the properties of these types?

This study takes an exploratory approach. We aim at deriving a taxonomy of repeat buyers (small firms) of IT services based on buyers' relationship orientation and exchange mechanism use. Ego networks, or

portfolios of exchange relationships, have been chosen as a unit of analysis to enable the focus on the combination of these dimensions.

An illustrative example of an ego network in the IT industry can be found in a setting described in (Rottman & Lacity, 2006). According to them, a US company in the financial service industry maintained joint ventures and contracts with 14 Indian IT outsourcing companies when the market for mortgage applications was very hot. After a slowdown on the market, the client company terminated these relationships while the headcount of internal IT staff remained on the same level (Rottman et al., 2006).

From a theoretical perspective, this study contributes to the understanding of the different configurations of buyer-supplier relationships in online IT markets. From a managerial perspective, we provide insights into how online markets for IT services, while traditionally aimed at enabling short-term efficiencies, could also serve exchange relationships that rely on long-term considerations.

The remainder of the paper is organized as follows. First, we discuss theoretical roots of the dimensions of the taxonomy. This is followed by a discussion of the methodology, the data, and the analytical procedures. Finally, we discuss the empirical findings and formulate conclusions and theoretical and managerial contributions.

Theoretical Background: Portfolios of Exchange Relationships

As the objective of this paper is to explore empirical configurations of buyer-supplier relationships and buyers' use of exchange mechanisms, we chose to focus on the buyer ego network as a unit of analysis. An ego network consists of an ego (central node or firm in our case), alters (the nodes or firms the central firm is connected to), ties between ego and alters (in our case - projects between the buyer and suppliers) and ties between alters (the latter is not applicable in our case due to the fact that different bidders do not have a relationship). The concept of ego network in social network analysis resonates with the concept of "portfolio of relationships" in the marketing literature. For instance, (Bensaou, 1999) used the latter concept in his study of the relationships between manufacturing companies in the automotive industry and their suppliers. Similarly, by using ego networks or portfolio of relationships in the present study, we are

able to capture the key dimensions of interest in the taxonomy development as structural or compositional properties of ego networks. In the remainder of the paper we are using both terms (buyer ego networks and portfolios of relationships) interchangeably.

The literature tradition in both inter-organizational relationships and information systems contains confirmatory and exploratory approaches to empirical research. Confirmatory approaches take a taxonomy deduced from extant literature and test for the occurrence of pre-defined constructs and types, whereas exploratory approaches derive the taxonomy inductively from the data and then relate them back to theory. While traditionally the confirmatory approach has tended to dominate, exploratory approaches have been used effectively as well, particularly in situations where existing theory was deemed insufficiently detailed to do justice to the richness of the field setting. In the area of inter-organizational relationships the exploratory approach has been employed to extract and analyze empirical patterns of inter-organizational relationships and sometimes to relate them to their antecedents and performance characteristics (Bensaou & Venkatraman, 1995; Cannon & Perreault Jr, 1999). In the information systems literature the exploratory approach has been used to develop the taxonomy of eBay buyers and relate resulting buyer types to auction winning likelihood and extracted surplus (Bapna et al, 2004).

The advantage of the exploratory approach over the confirmatory approach is that the former allows for uncovering empirical patterns that can depict the limits of existing theories, while its disadvantage lies in that there is little or no theoretical guidance for the selection of variables (Bensaou and Venkatraman, 1999). This disadvantage of the interpretive method will be mitigated in our study by drawing on extant theories in selecting the dimensions for taxonomy extraction.

Taxonomy Dimensions

Inter-organizational relationships

The two polar modes of interorganizational exchange relationships are transactional and relational exchange. Transactional exchange is characterized by short-term, arm's-length transactions with a

competitive attitude (Dyer & Singh, 1998). Four characteristics of transactional exchange are: 1) nonspecific asset investments, 2) minimal information exchange, 3) separate technological and functional systems within each party; low interdependence between the systems; 4) low transaction costs and minimal investments in governance (Dyer et al., 1998). In the transactional exchange firms exploit market efficiencies to derive one-time profit; in the relational exchange firms are seeking "relational rent" over a longer period of time and/ or over a series of transactions (Ganesan, 1994). In the relational exchange, parties rely on relational attributes, such as trust, commitment, collaboration, information sharing, etc (Dyer et al., 1998; Ganesan, 1994) to create value.

While in the literature on interorganizational relationships (e.g. the relational exchange theory or the embeddedness perspective) a lot of efforts have been invested into the aspects such as antecedents, composition and consequences of relational exchange (Dyer et al., 1998; Groves & Valsamakis, 1998; Morgan & Hunt, 1994; Noordewier, John, & Nevin, 1990), stages and processes of relationships development (Dwyer, Schurr, & Oh, 1987; Narayandas & Kasturi, 2004; Ring & Van de Ven, 1994) and relational governance and opportunism (Jap, 2003; Jap & Anderson, 2003; Poppo & Zenger, 2002; Stump & Heide, 1996; Wathne & Heide, 2000), relatively little has been researched with regard to the interplay between transactional and relational elements of exchange (Daly & Nath, 2005; Lambe, Spekman, & Hunt, 2000; Poppo et al., 2002; Radkevitch & van der Valk, 2005). These can be, for example, software development projects, where parties work jointly on system requirements, develop functional specifications, solve problems during the project run and deploy the application. In this study we try to uncover the empirical types of relationships portfolios from the viewpoint of transactional (short-term) vs relational (long-term) orientation.

Reverse auctions

An auction is defined as "a market institution with an explicit set of rules determining resource allocation and prices on the basis of bids from participants" (McAfee & McMillan, 1987). In reverse auctions

suppliers compete online for a contract to supply goods or services to the buyer and the prices go down. On one hand, reverse auctions stimulate competition among suppliers (Carter, Kaufmann, Beall, & Carter, 2004; Jap, 2003) and make them concerned about buyer's opportunistic behavior (Jap, 2003). On the other hand, reverse auctions are believed to be compatible with several dimensions of relational exchange, as reverse auctions can be used to source long-term contracts, can co-exist with a high level of trust (Radkevitch et al., 2005) and collaborative buyer-supplier relationships (Smart & Harrison, 2003). In addition, in real-life situations, bidder and buyer behavior is influenced by a variety of factors that are not covered in existing auction theory (Jap, 2002). Therefore, the extent of the use of reverse auctions by repeat buyers is the second dimension of our taxonomy.

Transaction characteristics

Transaction cost economics regards transaction characteristics as a determinant of exchange governance (Williamson, 1985). High level of transaction attributes such as frequency of transactions, asset specificity and technological uncertainty calls for hierarchical exchange governance to minimize the transaction costs. While hierarchies are efficient in keeping down the costs of coordinating complex transactions, market governance is advantageous when transactions are less complex and exchange efficiency is achieved due to low costs of production (Williamson, 1985). In a similar fashion, transaction attributes become important for the choice of an exchange mechanism. For instance, more complex construction projects, where ex-post negotiations are likely, are found to be more appropriate for negotiations, while less complex contracts with no ex-post negotiations fit well competitive bidding (Bajari & Tadelis, 2001). Therefore, our third dimension is related to the complexity characteristics of IT projects.

Antecedents of portfolio composition

In this study we take into account a number constructs that are likely to shed additional light on the emergence of the clusters of buyers (buyer commitment/ opportunism, buyer relational orientation and

buyer experience) and their performance outcomes (buyer satisfaction). These additional insights will also contribute to the validity of our taxonomy (Punj & Stewart, 1983). It should be understood that with the exploratory approach, it is not possible to formulate a priori hypotheses regarding the effects of these antecedents or how different clusters will affect the outcomes, since the amount and types of clusters are not known at this point.

Buyer commitment/ opportunism

This construct was introduced in (Radkevitch et al., 2006a), where it was explored on the level of individual transaction and shown to influence the likelihood that a contract will be awarded. Here we extend its use to the level of portfolio of relationships (ego networks) in order to explore its impact on the way portfolios are organized.

Buyer experience

Taking into account buyer's experience at the marketplace is important at least from the viewpoint that more experience means, ceteris paribus, that a buyer has worked on more projects and with larger overall budget. More experience allows more room for the development of long-term relationships with suppliers.

Performance Characteristics

Buyer satisfaction

We intend to explain buyer satisfaction with the supplier performance as a performance characteristic related to different clusters. Throughout the literature, higher satisfaction is associated with a higher level of relational elements in the inter-organizational exchange (Griffith, Harvey, & Lusch, 2006; Poppo et al., 2002).

[Figure 1 here]

The conceptual framework in Figure 1 summarizes the relationships between the three groups of factors under investigation: 1) the dimensions that form the clusters of ego networks (in the center of the framework); 2) the antecedents of the clusters, i.e. factors that may have an influence on the behavioral characteristics of buyers in different clusters and 3) performance characteristics that may vary for different clusters.

Methodology

Empirical setting

The transaction data were obtained from a leading online marketplace for professional services, used by around 60.000 buyers. The range of services encompasses IT services and other professional services (e.g. translation, accounting, etc). Established in 1998, the online marketplace contains around one thousand active projects at any point of time across all service categories and data on tens of thousands of auctions completed to date. By early 2006 the overall value of transactions facilitated by the marketplace exceeded USD 90 million. The range of services that can be procured via the marketplace encompasses IT services and other professional services (e.g. translation, accounting, etc). Software application development is one of the most populated areas of the marketplace. Buyers are businesses and individuals predominantly from the US, while suppliers are small/ medium IT companies and freelancers located in India, Eastern Europe and Russia. Some of the most active suppliers have turnover over USD 100,000 in accomplished projects over the recent six months and over USD one million over the time of their presence at the marketplace.

The exchange process is as follows. Before buyers and suppliers are able to enter the exchange, they are required to register at the marketplace. Participation for buyers is free of charge while a periodical fee applies to suppliers (the latter also pay a commission on accomplished transactions). The buyer starts an auction by posting a request for proposals. The project allocation mechanism comes in two basic types: open auctions (all suppliers can bid) and invite-only auctions (only invited suppliers can bid). In 95% of

cases there is only one supplier in the invite-only auctions, therefore we consider the invite-only auctions to be bilateral negotiations. In the open auctions the different suppliers are bidding and the buyer chooses the winner (which might not necessarily be the one with the lowest price).

The buyer is able to rate supplier's performance. The accumulated supplier's rating is a part of the reputation and trust mechanism at the marketplace.

Data

We collected data of buyers' activity at the most populated sub-marketplace, Website Development. There were several stages in data collection and data processing. First, we focused on repeat buyers with a considerable exchange track record at the marketplace to ensure that each buyer had done enough projects to make up a reasonable portfolio. We identified most active buyers using a cut-off level of 20 awarded projects (this included all projects awarded at the marketplace, not only IT-related). This resulted in a sample of 530 buyers that awarded 20 to 300 projects each, starting from the market foundation in 1999 until May 2006.

Second, we filtered out project from outside IT categories (namely, Web design and development, Simple Website and Web Programming) and projects with incomplete data, e.g. where buyer feedback on supplier performance was absent. In case the feedback on at least 70% of projects was available (which is the cut-off level we chose to ensure a reasonable amount of data in an ego network), the ego network was included in the further analysis.

The final check was to make sure that ego networks contain data only from either of the two rather homogeneous project groups: 1) Web Programming or 2) Web Design and Development combined with Simple Website projects. The two latter sub-categories were combined into a single group because a visual examination of the data had shown that the same suppliers tend to be active in both of these two sub-categories.

The procedure resulted in 104 ego networks containing data on 2,167 projects worth a total of USD 1,111,130. The data were standardized in order to avoid disproportional impact of nominally higher

variables in the cluster analysis. See Table 1 for descriptive statistics and Table 2 in the Appendix – for correlations between the variables.

On the software tools side, Kapow RoboSuite software was used for web data extraction; MS Excel and SPSS were employed at the stage of data processing and analysis.

Operationalization

Relationship characteristics. Two variables operationalize Relationships characteristics. First, *Share of projects per supplier with the highest number of transactions*, reflects the relative importance of the supplier that performs the largest share of projects for a given buyer in buyer's relationships portfolio. A high level of this variable would indicate that such buyers are building stronger, longer term exchange relationships with this supplier, while buyers with a low level are more likely to treat all suppliers alike. Second, *Duration of relationships with the most often used supplier* as an additional indicator of the strength of buyer's relationships with the most used suppliers, which allows incorporating time dimension of a relationship into the analysis.

Reverse auction use. *Share of projects procured via open reverse auctions* is a straightforward measure indicating the proportions of reverse auctions in the overall number of buyer's transactions.

Transaction characteristics. Variables *Average project value* and *Average project length* serve as proxies for project size and complexity. *Portfolio size* is a characteristic of the volume of buyer's transactions at the portfolio level, rather than at the level of a single project.

Buyer commitment/ opportunism. According to (Radkevitch et al., 2006a), opportunistic (as opposed to committed) buyers at online marketplaces for IT services, are inherently likely to start auctions without awarding projects to suppliers in order to receive free advice or for price benchmarking. While their research was conducted on the level of individual projects, here we attempt to extrapolate this intuition to the level of individual buyers. *Number of awarded projects divided by number of posted projects* seems to be an appropriate proxy for this purpose as buyers with lower level of this ratio seem to be more prone to opportunistic behavior than buyers who award higher proportion of projects.

Buyer experience. In order to capture different aspects of buyer's experience at the online marketplace we capture dimensions of time (*Duration of the presence at the marketplace*), conducted transactions (*Overall number of awarded projects*) and the volume of transactions (*Overall spent*).

Buyer satisfaction. To measure buyer's satisfaction with the performance of supplier we use an indicator readily available at the marketplace – the rating the buyer assigns to the supplier after a project has been accomplished. To find the *Average satisfaction rating* for buyer's portfolio we find an average of ratings for all projects in a portfolio. Finally, *Satisfaction with the most often used supplier divided by average satisfaction* serves to compare buyer's relative satisfaction with the most used supplier across clusters.

Table 3 in the Appendix summarizes the variables that operationalize our three taxonomy dimensions: relationship characteristics (share of projects per supplier with the highest number of projects in an ego network, %; duration of relationships with the most used supplier, days), reverse auction use (share of open auctions in the ego network, %) and transaction characteristics (monetary size of projects in an ego network, USD; average project bid, USD; average project length, days) as well as the antecedents and performance characteristics.

Table 4 provides details on the 4-cluster solution.

Analysis

[Table 1 here]

Cluster analysis consists of two stages – identification of the number of clusters and clustering observations in the sample. While there is normally little uncertainty with regard to the second stage, the first one can be realized in a variety of ways. In the present study we chose to apply rather simple and elegant solution suggested by Bapna et al. (2004).

First, we applied K-means clustering method to find a number of different cluster solutions for our dataset. The method clusters objects into k partitions based on their attributes. The method assumes that the attributes form a vector space and aims to minimize the total within-cluster variance. It is commonly used in the IS and marketing studies as a part of the procedure to develop taxonomies of actors, e.g. bidders (Bapna et al., 2004) or buyers (Cannon and Perreault, 1996).

Second, as advised by Bapna et al. (2004), for each cluster solution we calculated average distance from points in a cluster to the relevant cluster center (intra-cluster distance) and minimum distance between cluster centers among all clusters (intercluster distance). Better cluster solutions have smaller intra-cluster distances (the clusters are more homogeneous) and larger intercluster distances (the clusters are situated more apart from each other). Then, we establish the optimal solution by dividing intercluster difference of a cluster by intra-cluster difference of the same cluster, which is dissimilarity ratio (Bapna et al., 2004), and comparing them. The optimal cluster should have the highest dissimilarity ratio. According to the results in Table 4, in our case the first solution is the one with five clusters containing 38, 4, 14, 42 and 6 ego networks respectively.

The second-best solution is the one with 9 clusters. However, taking into account the size of the dataset at hand, the interpretation of resulting clusters would not produce sensible results.

[Table 4 here]

After comparing the 5-cluster solution with the 4-cluster solution (9, 39, 11 and 45 ego networks) we found only a lot of similarities between them. Clusters 5 and 4 in the 5-cluster solution consist of members of clusters 3 and 4 of the 4-cluster solution respectively. Cluster 1 in the 5-cluster solution consists of members of cluster 2 in the 4-cluster solution plus one member of cluster 4. The composition of clusters 2 and 3 of the 5-cluster solution is somewhat more diverse. Cluster 2 contains two members of cluster 3 of the 4-cluster solution, one member of cluster 1 and one member of cluster 4. Cluster 3 contains eight members of cluster 1 of the 4-cluster solution, five members of cluster two and one member of cluster 4. Summarizing, three clusters of the 5-cluster solution are almost identical to three clusters from the 4-cluster solution in terms of membership homogeneity, and most of the members of cluster 3 (5-cluster solution) come from cluster 1 (4-cluster solution). In other words, the properties of clusters in the 5-cluster solution will be similar to those of the 4-cluster solution.

Taking into account the similarity of the 4 and 5 cluster solutions and the small size of three clusters in the 5-cluster solution, it was decided to base the further analysis on the 4-clusters solution.

Based on the characteristics of ego networks in the clusters, i.e. the means of the variables used for clustering as presented in Table 5, we came up with the following names for the buyers in these clusters: Transactional buyers, Relational buyers, Small diversifiers and Large diversifiers. In assigning the label, the emphasis was put on how buyers in different clusters prefer to organize relationships with their suppliers (e.g. allocate most work to one supplier or use many suppliers; maintain short-term or longer-term relationships with the suppliers) and how they use different exchange mechanisms.

Cluster 1. *Transactional buyers.* Most projects in ego networks of this type are procured via open reverse auctions (70%). Transactional buyers allocate few projects with a single preferred supplier, 32%, which is the lowest level among all clusters and also have the shortest duration of relationships with this supplier, 241 days. It is interesting to note that while the average project value here is the smallest among all clusters (USD 397), the projects take longer to accomplish (48 days) than more expensive projects of Relational buyers (USD 504 and 30 days respectively). One possible explanation is that it takes longer for Transactional buyers to set up a sound communication and coordination processes with less familiar suppliers.

[Table 5 here]

Cluster 2. *Relational buyers.* These buyers use open reverse auctions the least of all four types (16% of projects); by contrast, in 84% of cases they use negotiations, i.e. invite-only auctions. Their project value (USD 504) is higher than that of Transactional buyers, which might be due not only to the projects' sheer size and complexity but also to the fact that Transactional buyers receive lower values as a result of competitive bidding at reverse auctions. A key factor distinguishing Relational buyers from the other three clusters is the allocation of a higher share of projects (78%) to a single supplier. The duration of relationships with the preferred supplier, although being two times higher than the one of Transactional buyers, still falls considerably behind those of the both Diversifiers clusters. As the buyers in this cluster rarely use competitive reverse auctions and tend to allocate over ¾ of projects to a single long-term supplier we term this cluster "*Relational buyers*".

[Figure 2 here]

Clusters 3 and 4. *Small diversifiers and Large diversifiers*. The two remaining clusters exhibit more similarities than differences, therefore we analyze them together. Considering the moderate use of reverse auctions and a rather high share of projects allocated to the preferred supplier, we suggest that buyers in these clusters might be combining long-term suppliers with a fair share of short-term, transactional relationships. Hence the choice of the name – "diversifiers". Buyers in these clusters prefer to allocate projects via negotiations over auctions, the latter being used in 46% and 33% of cases respectively. Similarly, *Small diversifiers and Large diversifiers* favor single preferred suppliers (allocating to them 63% and 56% of projects), although to lower extent than Relational buyers. The duration of their relationships with the preferred suppliers is equally long – 873 and 806 days respectively. The differences between *Small Diversifiers and Large diversifiers* lie in the size of the portfolio, in which *Large diversifiers* are far ahead any other cluster (USD 35,888) and the project length. With regard to the latter, *Small diversifiers* have the lead with 105 days, which is almost two times higher than the project length of *Large diversifiers*, whose project value is over three times higher. A possible reason is that these are smaller firms or individuals lacking project management skills.

Figure 2 schematically illustrates the four types of ego networks. Centers node ("ego") is a buyer connected to suppliers ("alters") by thick or dotted lines (reverse auctions and negotiations respectively). The size of the ego circles illustrates portfolio size of the buyers, while the relative size of the darker alter (preferred supplier) indicates an approximate proportion of business allocated to the preferred supplier.

The next step in the analysis is to determine the links between clusters and their antecedents and performance. We conduct Scheffe test for differences to test for significance of the pairwise differences between the means of the variables that underlie the antecedents and outcomes, see Table 6, last column. Scheffe test is a procedure recommended for use in case of unequal sample sizes. With regard to *Number of awarded auctions/ Number of posted projects* differences between Transactional and Relational buyers as well as differences between Relational buyers and Small diversifiers are significant. No differences in the Number of awarded projects are significant. With regard to Overall spent, Large diversifiers are significantly different from all other clusters. Finally, Transactional and Relational buyers are

significantly different with regard to the Duration of presence at the marketplace, Average satisfaction and Satisfaction with the most often used supplier.

Below we discuss the results with respects to the cluster antecedents and performance characteristics.

Buyer commitment/ opportunism. The analysis shows a linkage between the relatively low project award rate and two clusters: *Transactional buyers* and *Relational buyers*. This can hardly be explained by the properties of the projects such as complexity and uncodifiability, as the projects come from rather homogenous categories. Also, it cannot be explained by the differences in the project value, as it is only marginally lower for *Transactional buyers* than for *Relational buyers*. A plausible explanation, in line with (Radkevitch et al., 2006a), is that *Transactional buyers* are more opportunistic than *Relational buyers* and have a tendency to post projects without awarding them to suppliers. Instead, they might sometimes use the marketplace for price benchmarking or obtaining free advice from suppliers (Radkevitch et al., 2006a).

[Table 6 here]

Buyer experience. The only significant difference between *Transactional* and *Relational buyers* in terms of experience is in the duration of their presence at the market, 1,595 vs 1,330 days.. One explanation to that is that *Transactional buyers* represent a deliberate stance of buyers toward organizing their exchange relationships in a transactional manner, rather than a universal stage in the evolution of ego networks. An alternative explanation would be that Relational buyers, after having spent close to four years at the marketplace, suddenly change their behavior and start behaving as Transactional buyers, switching from one supplier to another every new project. The latter explanation seems unlikely and does not correspond to our observations over buyers' behavior at the online marketplace. Anther factors undermining the version of Relational buyers converting into transactional comes from the discussion of satisfaction of the two types of buyers.

Buyer satisfaction. The difference in the means of two variables operationalizing buyer's satisfaction with the supplier performance (average satisfaction and satisfaction with the most often used supplier divided by average satisfaction) are significant for Transactional and Relational buyers.

The small differences in the level of satisfaction between different clusters may be to some extent due to the fact that at online markets for IT service supplier performance ranking is used by buyers mostly to reward or punish suppliers for good or bad performance respectively, rather than to objectively rank the performance. Over 90% of ranked projects have the highest possible rating.

This result, nevertheless, indicates that Relational buyer enjoy higher satisfaction with the supplier's performance than Transactional buyers. This result goes quite in line with the extant literature in that higher level of buyer-supplier relationships leads to higher satisfaction of the buyer with the exchange outcomes (Griffith, Harvey, & Lusch, ; Poppo et al., 2002). It is also interesting that the level of satisfaction according to both measures is the highest for Relational buyers across all clusters, while for Transactional buyers it is the lowest.

The results of our analysis that produced significant results also enhance the validity of the developed buyer taxonomy.

Discussion and Conclusions

The present study focused on configurations of exchange relationships between repeat buyers and suppliers at online IT service marketplace and on buyers' use of reverse auctions or bilateral negotiations for realizing transactions. We drew on the social network theory and used buyer ego networks as a unit of analysis to empirically derive taxonomy of ego networks of repeat buyers of IT services by using clustering techniques. Further, we analyzed connections between clusters of buyers' and cluster antecedents and outcomes.

There are several key findings in the present study. First, our exploratory approach revealed the existence of four clusters of repeat buyers at the marketplace – transactional buyers, relational buyers and small diversifiers and large diversifiers. These labels were derived on the basis of buyers' mode of organizing their relationships with the suppliers. While transactional buyers tend to switch suppliers often, relational buyers develop long-term dyads with selected suppliers, with whom they conduct many projects. The existence of a relatively large cluster of buyers that rely on long-term relationships with the suppliers

comes somewhat as a surprise, as the marketplace positioning and functionality emphasizes a competitive, transactional way of procuring IT services. The clusters of Small and Large diversifiers seem to combine both arm's-length and close ties with their suppliers. The high levels of experience across all clusters indicates that these clusters are not simply intermediary stages of the evolution of buyer's ego networks, but rather deliberate stances that are defined by an inherent intention of different buyers to pursue different exchange relationship strategy. Furthermore, quite in line with the literature on interorganizational relationships, relational buyers were found to be significantly more satisfied with the supplier performance than buyers in other clusters (although the difference in the level of satisfaction is marginal and all are at the top end of the satisfaction range), while Transactional buyers have the lowest level of satisfaction.

We were also able to control the distribution of ego networks belonging to different marketplace sub-groups across different clusters. Overall, there were 31 ego networks with Web Programming (WP) projects and 73 ego networks combining Web Design and Development and Simple Website projects (WDD). Transactional cluster contained 18 WP and 27 WDD projects, Relational cluster – 6 WP and 33 WDD projects, Small diversifiers – 3 WP and 8 WDD projects and Large diversifiers – 4 WP and 5 WDD projects. It seems that WP projects are overrepresented in the Transactional cluster, while they are underrepresented in the Relational cluster.

Second, reverse auctions are found to be associated with a short-term, transactional relationship orientation, while bilateral negotiations support long-term, relational orientation. However, even relational buyers use open reverse auctions to a certain extent. This is a sign that different exchange mechanisms may be used interchangeably at different stages of the development of supplier portfolios. For instance, a buyer can first run one or several sequential projects via the competitive open auction procedure. At a later stage, when the supplier's quality has been proven and longer-term relationships start to emerge, the buyer switches to a non-competitive bilateral negotiation procedure. Similarly, a relational buyer can occasionally hold an auction to check whether or not a better supplier has become available in the meantime and then possibly switch to the new supplier and build a relationship with that

supplier. Therefore, while transactional buyers use reverse auctions for project allocation on the basis of the price, supplier's reputation, project proposal as well as actual and reported experience, relational buyers use reverse auctions as a screening instrument, substituted with bilateral negotiation for further projects once the trust in a supplier has been established.

This result also has important theoretical implications as it shows that different governance mechanisms are used concurrently by the same buyer. This implies that studies that focus solely on the relationship with one particular supplier (as is commonly done in the literature, e.g. (Ring et al., 1994), but see (Heide, 1994) for a recent exception), may only paint a very partial picture of buyer behavior. The few existing studies at the portfolio level, e.g. (Uzzi, 1997) and (Goerzen & Beamish, 2005) suggest that the results at the dyadic level do not hold until the entire portfolio of relationships is taken into account, making this an important avenue for further research.

Third, the results of this study also have implications for practice. We showed that long-term cooperative relationships do develop between at competitive marketplaces for IT services. As the reliance on relational elements in a bilateral exchange is growing, the need for the mechanisms of formal governance (e.g. formal terms and conditions, arbitration, rating systems) decreases and the parties become less dependent on the marketplace for further transactions. As the costs of carrying out exchange via online marketplace exceed the benefits, the established buyer-supplier dyads may leave the marketplace and embark on off-market exchange. To prevent buyer-supplier dyads from leaving, online marketplaces need to cater for "relational" exchange. They must address key characteristics of such exchange, such as it long-term nature; intensive information exchange and re-use of accumulated knowledge. In other words, the online marketplaces for IT services need to provide a collaboration platform for relational exchanges.

The present study comes with a number of limitations. First, we had to operate with a limited dataset, which put some constraints on our ability explain certain phenomena in the data, such as, for instance, an uneven distribution of IT project types (Web Programming vs Web Design and Development and Simple Websites) across difference clusters. Secondly, all projects in ego networks were analyzed in an

aggregated fashion, as a whole, despite the fact that they are sometimes conducted years apart. This results in a somewhat blurred picture of otherwise dynamic and evolving relationships.

One interesting direction for further research might testing the generalisability of the presented finding across other online marketplaces and service categories as well as across firms of larger sizes. Another potential direction is the study of the dynamics of ego networks evolution.

References

Bajari, P. L. & Tadelis, S. 2001. Incentives Versus Transaction Costs: A Theory of Procurement Contracts. Rand Journal of Economics, 32(2): 287-307.

Bensaou, M. & Venkatraman, N. 1995. Configurations of Interorganizational Relationships: A Comparison Between U.S. and Japanese Automakers. Management Science, 41(9): 1471-1492.

Bensaou, M. 1999. Portfolios of Buyer-Supplier Relationships. MIT Sloan Management Review, 40(4): 35–44.

Cannon, J. P. & Perreault Jr, W. D. 1999. Buyer-Seller Relationships in Business Markets. Journal of Marketing Research, November: 439-460.

Carmel, E. & Nicholson, B. 2005. Small Firms and Offshore Software Outsourcing: High Transaction Costs and their Mitigation. Journal of Global Information Management, 13(3).

Carr, S. M. 2003. Note on online auctions with costly bid evaluation. Management Science, 49(11): 1521-1528.

Carter, C. R., Kaufmann, L., Beall, S., & Carter, P. L. 2004. Reverse auctions - grounded theory from the buyer and supplier perspective. Transportation Research. Part E, Logistics & Transportation Review, 40E(3): 229.

Daly, S. & Nath, P. 2005. Reverse Auctions for Relationship Marketers. Industrial Marketing Management, 34(2): 157-166.

Dean, T., Brown, R., & Bamford, C. 1998. Differences in large and small firm responses to environmental context: strategic implications from a comparative analysis of business formations. Strategic Management Journal, 19(8): 709-728.

Dwyer, F. R., Schurr, P. H., & Oh, S. 1987. Developing Buyer-Supplier Relationships. Journal of Marketing, 52(April): 21-34.

Dyer, J. H. & Singh, H. 1998. The Relational View: Cooperative Strategy and Sources of Interorganisational Competitive Advantage. Academy of Management Review, 23(4): 660-679.

Ganesan, S. 1994. Determinants of Long-term Orientation in Buyer-Supplier Relationships. Journal of Marketing, 58: 1-19.

Goerzen, A. & Beamish, P. W. 2005. The Effect of Alliance Network Diversity on Multinational Enterprise Performance. Strategic Management Journal, 26(4): 333-354.

Griffith, D. A., Harvey, M. G., & Lusch, R. F. Social Exchange in Inter-organizational Relationships: The Resulting Benefits of Procedural and Distributive Justice. Journal of Operations Management, forthcoming.

Griffith, D. A., Harvey, M. G., & Lusch, R. F. 2006. Social Exchange in Inter-organizational Relationships: The Resulting Benefits of Procedural and Distributive Justice. Journal of Operations Management, 24(2): 85-98.

Groves, G. & Valsamakis, V. 1998. Supplier-Customer Relationships and Company Performance. The International Journal of Logistics Management, 9(2): 51-64.

Heide, J. B. 1994. Interorganizational Governance in Marketing Channels. Journal of Marketing, 58(1): 71-85.
Jap, S. D. 2002. Online reverse auctions: Issues, themes, and prospects for the future. Academy of Marketing Science. Journal, 30(4): 506.
Jap, S. D. 2003. An Exploratory Study of the Introduction of Online Reverse Auctions. Journal of Marketing, 67(3): 96-107.
Jap, S. D. & Anderson, E. 2003. Safeguarding Interorganizational Performance and Continuity Under Ex Post Opportunism. Management Science, 49(12): 1684-1701.
Kim, J. Y. & Altinkemer, K. 2006. E-lancing: A Tool for Yield Management in the IT Service Industry, Krannert School of Management, Working Draft.
Lambe, C. J., Spekman, R. E., & Hunt, S. H. 2000. Interimistic Relational Exchange: Conceptualization and Proposition Development. Journal of the Academy of Marketing Science, 28: 212-225.
McAfee, R. P. & McMillan, J. 1987. Auctions and Bidding. Journal of Economic Literature, 25(2): 699.
Morgan, R. & Hunt, S. 1994. The Commitment-Trust Theory of Relationship Marketing. Journal of Marketing, 58(4): 36-51.
Narayandas, D. & Kasturi, R. V. 2004. Building and Sustaining Buyer-Seller Relationships in Mature Industrial Markets. Journal of Marketing, 68(3): 63-77.
Noordewier, T., John, G., & Nevin, J. 1990. Performance Outcomes of Purchasing Arrangements in Industrial Buyer-Vendor Relationships. Journal of Marketing, 54(4): 80-92.
Nooteboom, B. 1993. Firm size effects on transaction costs. Small Business Economics, 5: 283-295.
Poppo, L. & Zenger, T. R. 2002. Do Formal Contracts and Relational Governance Function as Substitutes or Complements? Strategic Management Journal, 23(8): 707-725.
Punj, G. & Stewart, D. W. 1983. Cluster Analysis in Marketing Research: Review and Suggestions for Application. Journal of Marketing Research(20): 134-148.
Radkevitch, U. & van der Valk, W. 2005. Buying Business Services through Auctions: From a Transactional to a Relational Approach. Paper presented at the 14th annual IPSERA Conference, Archamps, France.
Radkevitch, U., van Heck, E., & Koppius, O. R. 2006a. Buyer commitment and opportunism in an electronic market for IT services, ERIM Report Series Reference No.ERS-2006-046-LIS. RSM Erasmus University. Rotterdam.
Radkevitch, U. L., van Heck, E., & Koppius, O. R. 2006b. Leveraging Offshore IT Outsourcing by SMEs through Online Marketplaces. To appear in the special issue of the Journal of Information Technology Case and Application.
Ring, P. S. & Van de Ven, A. H. 1994. Developmental Processes of Cooperative Interorganizational Relationships. Academy of Management Review, 19: 90-118.
Rottman, J. & Lacity, M. 2006. Proven Practices for Effectively Offshoring IT Work. Sloan Management Review, 47(3, Spring): 56-63.
Smart, A. & Harrison, A. 2003. Online reverse auctions and their role in buyer-supplier relationships. Journal of Purchasing and Supply Management, 9(5-6): 257-268.
Snir, E. M. & Hitt, L. M. 2003. Costly Bidding In Online Markets For IT Services,. Management Science, 49(11): 1504-1520.
Snir, E. M. & Hitt, L. M. 2004. Participation costs in IT service markets, Under review in Management Science.
Stump, R. L. & Heide, J. B. 1996. Controlling Supplier Opportunism in Industrial Relationships. Journal of Marketing Research, 33: 431-441.
Uzzi, B. 1997. Social structure and competition in interfirm networks: The paradox of embeddedness. Administrative Science Quarterly, 42: 35-67.
Wathne, K. H. & Heide, J. B. 2000. Opportunism in Interfirm Relationships: Forms, Outcomes, and Solutions. Journal of Marketing, 64(4): 36-51.
Williamson, O. E. 1985. The Economic Institutions of Capitalism: Firms, Markets and Relational Contracting. New York: The Free Press.

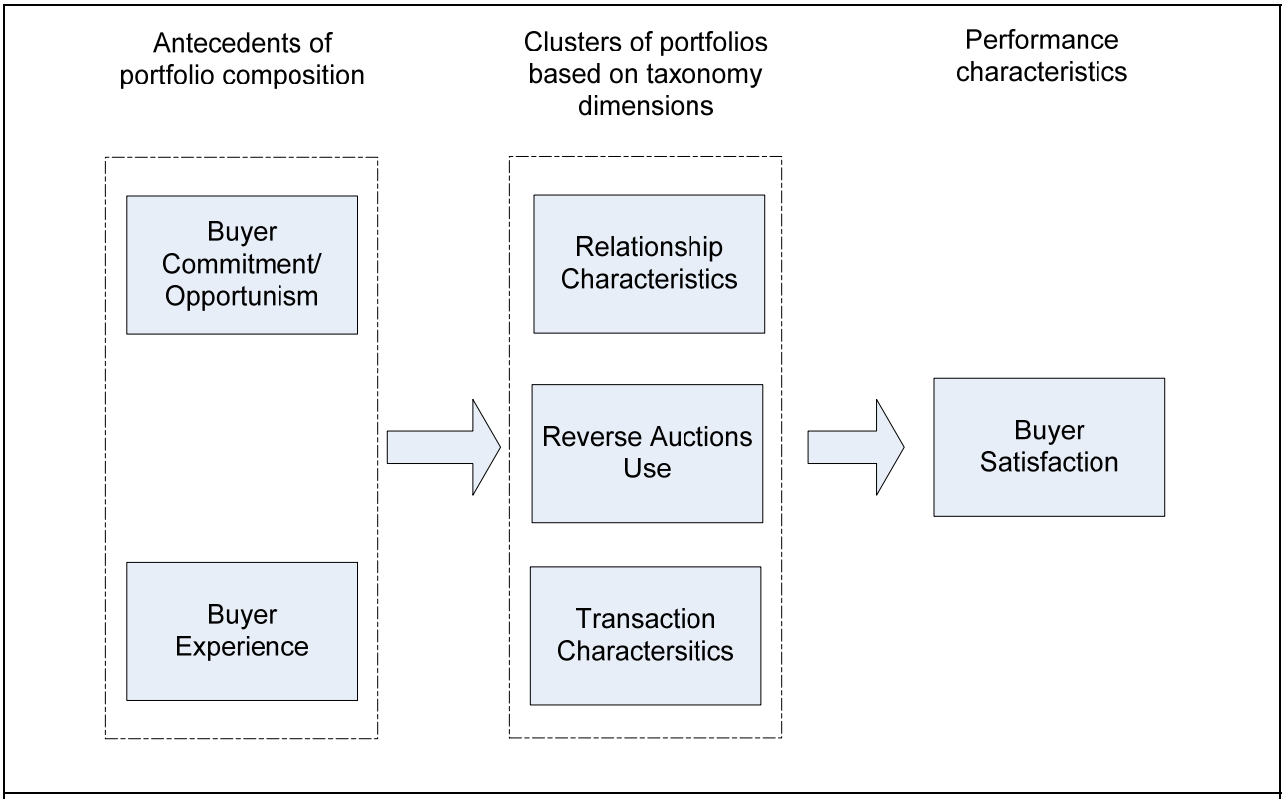

Figure 1. Buyer portfolio clusters determinants, antecedents and outcomes.

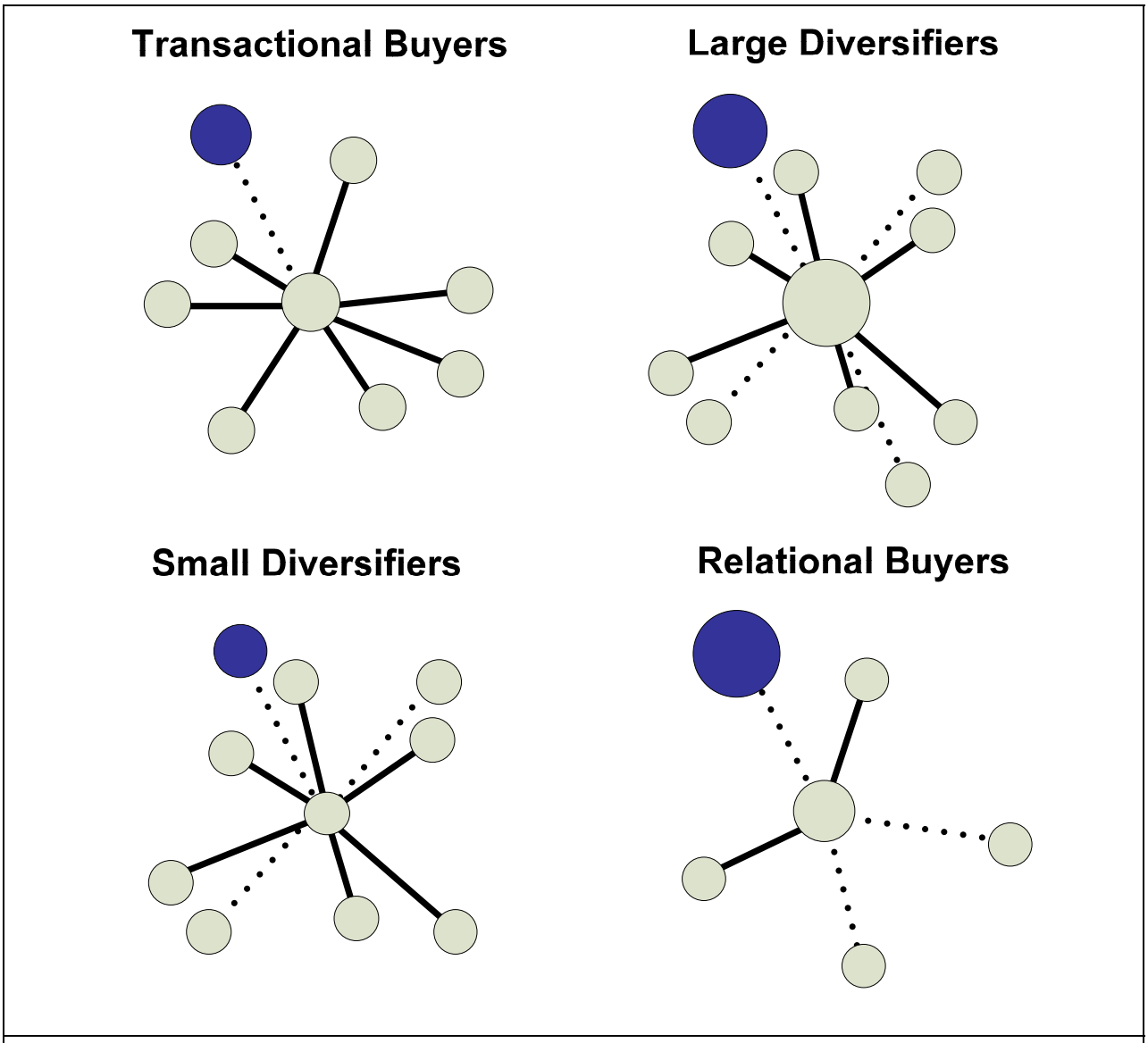

Figure 2. Four ego network clusters.

Table 1. Cluster dimensions, antecedents, outcomes – descriptive statistics					
	Min	Max	Mean	Median	St. Dev.
Share of projects per supplier with the highest number of transactions (%);	0.08	1.00	0.545	0.500	0.282
Duration of relationships with the most often used supplier (days).	0	1,439	483	434	332
Share of projects procured via open reverse auctions (%).	0	1.00	0.438	0.41	0.328
Portfolio size (USD)	1,066	52,380	10,684	7,302	10,256
Average project value (USD)	84	2,387	534	416	434
Average project length (days).	0	173	47.58	38.91	37.65
Number of awarded projects divided by number of posted projects*	0.40	1.00	0.82	0.86	.147
Overall number of awarded projects	21	210	68.91	51.50	46.17
Overall spent, USD	3,611	210,746	34,215	21,354	34,776
Duration of the presence at the marketplace (days)	120	2,353	1504	1,575	488
Average satisfaction rating	3.78	5.00	4.8673	4.9751	0.2264
Ratio: satisfaction with the most often used supplier/ average satisfaction	.97	1.32	1.0264	1.0008	0.0508

*Ratio awarded/posted – In our final dataset for 2,167 projects there were 2,142 auctions, making the overall awarded/posted ratio to be 1,012. This means that sometimes a buyer awarded projects to more than one supplier in a single auction. However, from the theoretical perspective we are interested here only in opportunistic buyers, who post projects without awarding them. Therefore, for the purpose of this research, to avoid distortion of data, awarded/posted ratios above 1 were replaced with "1" in 6 cases throughout the dataset.

Table 2. Correlations (Pearson)

	1	2	3	4	5	6	7	8	9	10	1
1. Share of projects per supplier with the highest number of transactions (%)											
2. Duration of relationships with the most often used supplier (days)	-.577**										
3. Share of projects procured via open reverse auctions (%)	-.683**	-.470**									
4. Portfolio size (USD)	-.059	.297**	-.225*								
5. Average project value (USD)	.070	.276**	-.168	.736**							
6. Average project length (days)	-.117	.136	.113	.121	.177						
7. Number of awarded projects divided by number of posted projects	.230*	.113	-.285**	.165	.080	-.110					
8. Overall number of awarded projects	-.310**	-.106	.026	.419**	.043	.099	.175				
9. Overall spent	-.129	.043	-.124	.696**	.452**	.039	.239*	.677**			
10. Duration of the presence at the marketplace (days)	-.293**	-.027	.284**	-.001	-.005	.117	-.251*	.107	-.031		
11. Average satisfaction rating	.393**	.258**	-.384**	.083	.040	-.233*	.196*	.014	-.089	-.104	
12. Ratio: satisfaction with the most often used supplier/ average satisfaction	-.398**	-.269**	.400**	-.129	-.160	.190	-.156	.010	.111	.133	-.

Table 3. Cluster dimensions, antecedents, outcomes, underlying variables and measurements		
Taxonomy dimensions	**Variables**	**Measurements**
Relationship characteristics	Share of projects per supplier with the highest number of transactions (%)	First, a supplier with the higher number of projects is located in buyer's ego network. Second, share of this supplier's projects in the ego network is calculated.
	Duration of relationships with the most often used supplier (days)	Calculated as a difference between the starting dates of the last and the first projects with the most used supplier.
Reverse auction use		
	Share of projects procured via open reverse auctions (%)	Calculation is straightforward.
Transaction characteristics		
	Portfolio size (USD)	Monetary volume of all projects in an ego network.
	Average project value (USD)	Average of project values in a ego network. Project value is operationalized as the price paid by the buyer to the supplier.
	Average project length (days)	Difference between the date when buyer's feedback for the project is assigned and the auction end date.
Cluster antecedents		
Buyer commitment/ opportunism		
	Number of awarded projects divided by number of posted projects	Calculation is straightforward.
Buyer experience		
	Overall spent (USD)	Monetary volume of all projects awarded by the buyer at the marketplace.
	Overall number of awarded projects	Calculation is straightforward.
	Duration of the presence at the marketplace (days)	Difference between the date of data collection and the date of buyer's registration at the marketplace.
Performance characteristics		
Buyer satisfaction		
	Average satisfaction rating	Rating available at the marketplace.
	Ratio: satisfaction with the most often used supplier/ average satisfaction	Calculation is straightforward.

Table 4. Dissimilarity ratio									
Number of clusters in a solution	2	3	4	5	6	7	8	9	10
Dissimilarity ratio	1.358	1.489	**1.510**	**1.646**	1.484	1.418	1.419	**1.564**	1.351

Table 5. 4-cluster solution					
	Transactional buyers	Relational buyers	Small diversifiers	Large diversifiers	Scheffe differences p<0.1
Share of projects per supplier with most projects, %	32	78	63	56	(1; 2,3,4) (2; 1,4)
Duration of relationships with the supplier with most projects	241	575	873	806	(1; 2,3,4) (2; 1,3,4) (3; 1,2)
Share of reverse auctions, %	70	16	46	33	(1; 2,3,4) (2; 1,3) (3; 1,2)
Portfolio size (USD)	7,884	9,692	6,223	35,888	(4; 1,2,3)
Average project value (USD)	397	504	379	1579	(4; 1,2,3)
Average project length (days)	48	30	105	66	(1; 3) (2; 3,4) (3; 1,2,4)
N	45	39	11	9	

Table 6. Antecedents and outcomes of cluster variables					
	Transactional buyers Mean (st. dev)	Relational buyers Mean (st. dev)	Small diversifiers Mean (st. dev)	Large diversifiers Mean (st. dev)	Scheffe differences p<0.1
Number of awarded auctions/ Number of posted projects	0.7673 (0.1531)	0.8718 (0.1677)	0.7682 (0.1342)	0.8589 (0.2011)	(1;2) (2;3)
Number of awarded projects	73.62 (47.18)	62.56 (43.99)	48.00 (21.09)	97.11 (62.37)	NS
Overall spent USD	27,538 (20,761)	34,719.44 (41,333)	16,009 (9,301)	87,670 (32,447)	(4; 1,2,3)
Duration of presence at the marketplace	1,595 (540)	1,330 (444)	1,599 (376)	1,683 (317)	(1; 2)
Average satisfaction	4.7755 (0.2917)	4.97 (0.0561)	4.8572 (0.2140)	4.8932 (0.1406)	(1; 2)
Ratio: satisfaction with the most often used supplier/ average satisfaction	1.0468 (0.0664)	1.0058 (0.0121)	1.0311 (0.0478)	1.0078 (0.0222)	(1; 2)
N (listwise)	45	39	11	9	

Publications in the Report Series Research* in Management

ERIM Research Program: "Business Processes, Logistics and Information Systems"

2007

India: a Case of Fragile Wireless Service and Technology Adoption?
L-F Pau and J. Motiwalla
ERS-2007-011-LIS
http://hdl.handle.net/1765/9043

Some Comments on the Question Whether Co-occurrence Data Should Be Normalized
Ludo Waltman and Nees Jan van Eck
ERS-2007-017-LIS
http://hdl.handle.net/1765/9401

Extended Producer Responsibility in the Aviation Sector
Marisa P. de Brito, Erwin A. van der Laan and Brijan D. Irion
ERS-2007-025-LIS

Logistics Information and Knowledge Management Issues in Humanitarian Aid Organizations
Erwin A. van der Laan, Marisa P. de Brito and S. Vermaesen
ERS-2007-026-LIS

Bibliometric Mapping of the Computational Intelligence Field
Nees Jan van Eck and Ludo Waltman
ERS-2007-027-LIS

Approximating the Randomized Hitting Time Distribution of a Non-stationary Gamma Process
J.B.G. Frenk and R.P. Nicolai
ERS-2007-031-LIS

Application of a General Risk Management Model to Portfolio Optimization Problems with Elliptical Distributed Returns for Risk Neutral and Risk Averse Decision Makers
Bahar Kaynar, S. Ilker Birbil and J.B.G. Frenk
ERS-2007-032-LIS

Optimal Zone Boundaries for Two-class-based Compact 3D AS/RS
Yugang Yu and M.B.M. de Koster
ERS-2007-034-LIS

Portfolios of Exchange Relationships: An Empirical Investigation of an Online Marketplace for IT Services
Uladzimir Radkevitch, Eric van Heck and Otto Koppius
ERS-2007-035-LIS

---

* A complete overview of the ERIM Report Series Research in Management:
https://ep.eur.nl/handle/1765/1

ERIM Research Programs:
LIS Business Processes, Logistics and Information Systems
ORG Organizing for Performance
MKT Marketing
F&A Finance and Accounting
STR Strategy and Entrepreneurship