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Knowledge-based E-procurement Systems to Negotiate Logistics Services

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Structured Abstract

Purpose

The paper discusses e-procurement of logistics services by negotiation and examines how the process performance is affected by the style that companies adopt to support this task and the complexity of the service description. Performance is evaluated in terms of both substantive and subjective outcomes. Several hypotheses are tested, which are derived from the existing literature and concern the impact that specific design parameters have on certain performance. The analysis, which considers also behavioral issues, is a first step to develop models of logistics services procurement and a knowledge base component of an intelligent e-procurement system.

Design/methodology/approach

Our research is based on laboratory experiments. Transactions were conducted on an ad-hoc designed business case and performed by students and junior researchers using a web-based platform. We adopted a 2×2 research design, whose experimental factors (considered as independent variables) were; the level of complexity used in describing the logistics service and the style adopted by buyers in conducting the negotiation. As dependent variables we assumed two substantive outcomes, directly measured, and four performances related to behavioral issues, operationalized through items adapted from the literature and assessed via a questionnaire. Results were analyzed using an explorative factor analysis and hypotheses

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tested via ANOVA.

Originality/value

The linkages between the features of the transaction environment and negotiation style, and the achieved performances have been widely investigated by scholars, especially in the last decade, when the pervasiveness of information and communication technologies put emphasis on the nexus between the choice of a specific market mechanism and the effects on actors' behavior. This study, however, is innovative in that it considers multi-attribute mechanisms and recurs to laboratory experiments, which allows different settings to be compared, by using the same business case and technological platform, thus avoiding biases due to features other than the setting themselves.

Practical implications

The aim of this study is to examine how the design of the system that companies use in procurement of logistics services and the adoption of a specific negotiation style affect the process performance. Based on our research, we provide companies with guidelines to enhance the overall performance, through a better design of e-procurement systems and the adoption of more effective negotiation styles.

Keywords

Negotiations, logistics services, e-procurement, laboratory experiments

1. Introduction

Most of the peculiarities of logistics services procurement arise from the nature itself of services, as opposed to physical goods: services are intangible and heterogeneous (i.e. they cannot be standardized), need simultaneous production and consumption, and are perishable (Lovelock, 1983). These features may be behind the firms' belief that defining, measuring, and controlling performances is more difficult for services than for goods. This may lead to inefficiencies and lack of control – the issue raised in the case of procurement (Fitzsimmons et al., 1998; Smeltzer and Ogden, 2002).

In addition, it should be mentioned that services are highly complex and affected by uncertainty. Complexity increases when buyers demand advanced services, including bundles or value-adding logistics solutions (e.g. integrated transportation and warehouse management, supply chain inventory management, and reverse logistics), thus requiring a high degree of customization (Andersson and Norrman, 2002).

Innovation in logistics services and the growing impact of logistics on competitive advantage is one of the reasons for the ongoing changes in the relationship between buyers and providers, which are moving from competitive to collaborative approaches. In competitive approaches, which are typically limited to the purchase of basic services, the focus of the relationship is transaction efficiency, thus price is considered the main leverage. Conversely, the procurement of logistics solutions involves collaboration, information and data sharing, risks and rewards sharing, and joint investments in facilities and equipment, namely third-party logistics relationships (Berglund et al., 1999; Skjoett-Larsen, 2000).

Companies should not choose a certain type of buyer-supplier relationship independently from the design of the system for the logistics services procurement (Bellantuono et al., 2008),

especially when procurement is supported by information and communication technology (e-procurement): in fact, ICT (i) adds complexity to the procurement system design and (ii) makes it more critical to manage inter-firm relationships.

This paper focuses on the choice of two key features of such systems: the negotiation style (e.g. cooperative vs. competitive) and the level of complexity adopted to describe the service itself (high vs. low). Both features have impact on the outcome achieved by the e-procurement process.

Exchange mechanisms are sets of rules, which specify the functioning of the market and the permissible behavior of its participants. The three standard mechanisms are: (i) catalogues, where requests and offers are posted; (ii) auctions, where one side automates the process during which participants from the other side compete against each other; and (iii) negotiations, where the participants bargain over the conditions of an exchange. One of these mechanisms (or a variation of them) is implemented in every e-marketplace.

In the field of procurement of advanced logistics services, both multi-attribute auctions and negotiations may be effectively adopted, as these exchange mechanisms are suitable to manage the various features of such services better than catalogues. Auctions are well-structured and can be described completely and unequivocally using a set of rules and formulae. Negotiations belong to a rich and ill-defined family of processes used for exchanging goods or services among buyers and sellers, and for resolving inter-personal and inter-organizational conflicts. Negotiations involve an exchange of information comprised of offers, counter-offers, and arguments with the purpose of reaching a consensus (Bichler et al., 2003). Recently, several researchers have investigated how to choose the most effective mechanism to manage the procurement of services, in particular logistics services. Bellantuono et al. (2012) examined how the exchange mechanism (multi-attribute auction vs. negotiation) that rules the transaction and the level of complexity by which the service is described affect the process performance, which is evaluated in terms of substantive outcome and behavioural issues. The analysis, conducted via a laboratory experiment, shows that both the exchange mechanism and the complexity of representation affect performance.

In addition to the mechanism selection, a key issue concerns the criterion or criteria according to which the e-procurement decision is made. A survey by Ferrin and Plank (2002) found that over 90% of purchasing managers based their decisions on both price and non-price variables (e.g. durability, service, lead-time, and trust). As most e-procurement decision problems are multi-attribute, companies need guidelines to properly identify e-procurement systems able to handle several decision criteria. In particular the performance offered by multi-attribute negotiations (and in general multi-attribute procurement decisions), when applied to e-procurement of logistics services should be investigated. However, the most recent survey on experimental auction research (Kagel and Levin, 2012) does not include any multi-attribute auction experiment. Furthermore, some scholars (Chen-Ritzo et al., 2005) found that the higher complexity of a multi-attribute auction mechanism consumes some of the efficiency gains over price-only auctions. Similar considerations could apply to multi-attribute negotiation. As a result, there is a need for investigating the trade-off between the description accuracy of the procured service (number of utilized criteria and associated complexity of the multi-attribute mechanism) and the e-procurement process performance.

This paper focuses on negotiations and investigates how the process performance in logistics service e-procurement is affected by the features of the system that is adopted to support this

task. In particular, the considered system handles multiple decision criteria to select the logistics provider and is characterized by the level of complexity adopted to describe the logistics service (i.e. number of attributes) and the negotiation style that the buyer adopts. The process performance is analyzed in terms of substantive and subjective outcome, trust, satisfaction with dealing, satisfaction with outcome, and perception of opportunism.

The remaining of the paper is organized as follows: Section 2 provides a short literature review to illustrate the constructs that define process performance, and states research hypotheses. Section 3 presents research methodology, in particular the protocol adopted to conduct the laboratory experiment as well as the measurement of constructs and their validation. Results are summarized in Section 4 and discussed in Section 5.

2. Literature review and research hypotheses

2.1 Constructs

The constructs taken into account in this study are introduced and described below.

Substantive and subjective outcomes

As in Oliver et al. (1994), we define negotiation outcomes as the products of a given bargaining episode. Following Thompson (1990), we also acknowledge a distinction between economic (or substantive) and social-psychological (or subjective) outcomes. The former refers to the objective allocations of the negotiated resources that result from a successful bargain (i.e. when an agreement is reached) and is typically operationalized in monetary terms, in terms of revenue individually claimed by negotiators (which measures the extent to which they achieve the best result for themselves from the transaction), joint payoff for both parties (which is a proxy of the overall efficiency of the transaction), or difference between individual revenues (which assesses the fairness of the exchange). Social-psychological outcomes are the subjective social perceptions held by negotiating parties following the encounter, and are affected by self-perception, perception of the counterpart, and perception of the context where the bargain occurs. Apparently, both kinds of outcomes directly affect satisfaction, albeit in a measure that depends on the specific bargain context (Oliver, 1993).

In this study, both substantive and subjective outcomes are treated as dependent variables (DVs), whereas the number of attributes and the buyer's negotiation style are the independent variables (IVs). Substantive outcomes are directly measured in two different ways: provider's revenue (i.e. what the provider earns from the exchange) and imbalance (i.e. the difference between buyer's and provider's revenues). Subjective outcomes, in turn, are obtained from the following questionnaire:

- I am satisfied with the results that I achieved.
- I achieved more than what I had expected.
- The outcome is better for the buyer than it is for the provider.
- The results I obtained are not favorable for my company.

Trust

Literature on procurement and supply chain management, while stressing the importance of trust in building effective buyer-supplier relationships (Kumar, 1996; Zaheer et al., 1998), states that developing the intended partner's trust is an important concern in partnership

management (Johnston et al., 2004). However, the concept of trust is not univocally defined (Gattiker et al., 2007). For instance, according to Doney and Cannon (1997), trust is a combination of perceived credibility and perceived benevolence. Cummings and Bromiley (1996) provide a more complex definition, which invokes the expectation that another group or individual (i) is honest, (ii) behaves according to explicit or implicit commitments, and (iii) renounces to take gain when there is a chance to do it at the counterpart's expense. It has been also stressed that the level of trust between two individuals or organizations is affected by the experience they had in past mutual relationships (Kim et al., 2008).

The above definitions help us to investigate trust by means of items, each focusing on it from a different perspective. In particular, we considered the following items adapted from Doney and Cannon (1997) to test the construct:

- I think that the buyer will keep the promises he/she makes to my company in the future.
- When making important decisions, the buyer considers my company's welfare as well as his/her own.
- My company trusts the buyer to keep our best interests in mind.

Satisfaction with dealing

Relationship management and the actors' satisfaction with relationship are important components of the relational outcomes. Relational success of an exchange can be measured by the actor's satisfaction with their relationship (Wong, 2000). Such a satisfaction requires that in buyer-supplier relationships the so-called arm's length arrangements are forsaken and replaced with strategies able to build strong relationships among partners (Gadde and Snehoda, 2000; Liu et al., 2010). Research on antecedents of satisfaction has shown that this may be affected by specific actions and behaviors that parties repeatedly adopt in dealing with their counterparts. This result holds for both buyer's (Humphreys et al., 2004) and supplier's satisfaction (Goffin et al., 2006; Ghijsen et al., 2010).

From the suppliers' perspective, satisfaction has been defined by Benton and Maloni (2005) as "the feeling of equity with the relationship no matter what power imbalances exists". The survey conducted by Ghijsen et al. (2010) within the automotive industry provides examples of variables – such as recommendations, information exchanges, threats or legalistic pleas. The authors adapt measures proposed by Benton and Maloni (2005) and Ping (1997) in order to discuss the roles these variables play in building supplier's satisfaction. In this research, we adopt the following items, based on Ghijsen et al. (2010):

- Dealing with this buyer benefits my company.
- This buyer is a good company to do business with.

Satisfaction with relationship

According to social exchange theory (Cropanzano and Mitchell, 2005), an exchange does not imply a simple re-allocation of resources and goods: before, during, and after the exchange, users indeed may evolve or establish certain relationships based on dependency and power (Emerson, 1976). Thus, the health of the relationships could impact the users and then lead to their satisfaction with the relationship (Wu and Yu, 2009).

We tested this construct by means of the following items:

- I had a good relationship with my counterpart.
- I would like to work with my counterpart in future.
- My counterpart was sincere.
- I enjoyed working with my counterpart.

Perception of opportunism

Williamson (1975) defines opportunism as “self-interest seeking with guile”, i.e. with “lying, stealing, cheating, and calculated efforts to mislead, distort, disguise, obfuscate, or otherwise confuse” (Williamson, 1985). Somewhat similarly, Macneil (1981) defines guile as “taking advantage of opportunities with little regard for principles or consequences”.

Following Jap (2003), we claim that “opportunism is not merely a form of distrust. Trust is a broad meta-construct with many facets and levels (Rousseau et al., 1998). Opportunism is more circumvented and behavioral in nature; it is observable by the supplier and grounded in specific actions and should create reduced attributions of trust”.

The concept of opportunism has been widely discussed in the field of buyer-supplier relationships (Brown et al., 2000). Indeed, although both parties would make a profit, in fact they pursue different conflicting objectives: buyers aim at reducing price, increasing quality and charging their counterpart for risks due, for instance, to units unsold or late deliveries. In contrast, suppliers wish to maximize sales, irrespective of buyers’ actual requirements, obtain assurances on minimum purchases, transfer increases in labor or raw materials costs, and so on. These conditions breed discord and suspicion, and make parties agree on complex coordination schemes so as to reduce their vulnerability toward counterpart’s opportunistic behavior. Unfortunately, contracts cannot include rules to manage all possible cases, thus parties have to cope with opportunism and hold-up problems (Kim and Mahoney, 2010).

In this paper we focus on the provider’s perception of opportunism, namely the suspicion that the buyer behaves opportunistically at his expense. The items used to test this construct are the same as in Carter and Stevens (2007):

- In future interactions, I believe that the buyer would be unwilling to accept responsibility for his/her mistakes.
- In future interactions, I believe that the buyer would try to “nickel and dime” my company.

2.2 Research hypotheses

Our research goal is to identify guidelines for companies that need to select or design systems for logistics services e-procurement. We then propose several research hypotheses, which concern the impact that specific design parameters (the level of complexity adopted to describe the service and the buyers’ negotiation style) have on certain performances, either related to substantive outcome (i.e. the profit that logistics providers gain and the way in which the buyer and the provider share the utility coming from the transaction) or provider’s behavioral issues (subjective outcome, trust, satisfaction with dealing, and perception of opportunism). The possible impacts of two independent (design parameters of the negotiation) on 7 dependent variables (performance) result in 14 hypotheses, whose conceptual model is depicted in Figure 1:

H1. The higher the buyer’s competitiveness, the lower will be the provider’s revenue.

- H2.** The higher the complexity of representation, the lower will be the provider’s revenue.
- H3.** The higher the buyer’s competitiveness, the higher will be the imbalance.
- H4.** The higher the complexity of representation, the higher will be the imbalance.
- H5.** The higher the buyer’s competitiveness, the higher will be the provider’s perception of opportunism.
- H6.** The higher the complexity of representation, the higher will be the provider’s perception of opportunism.

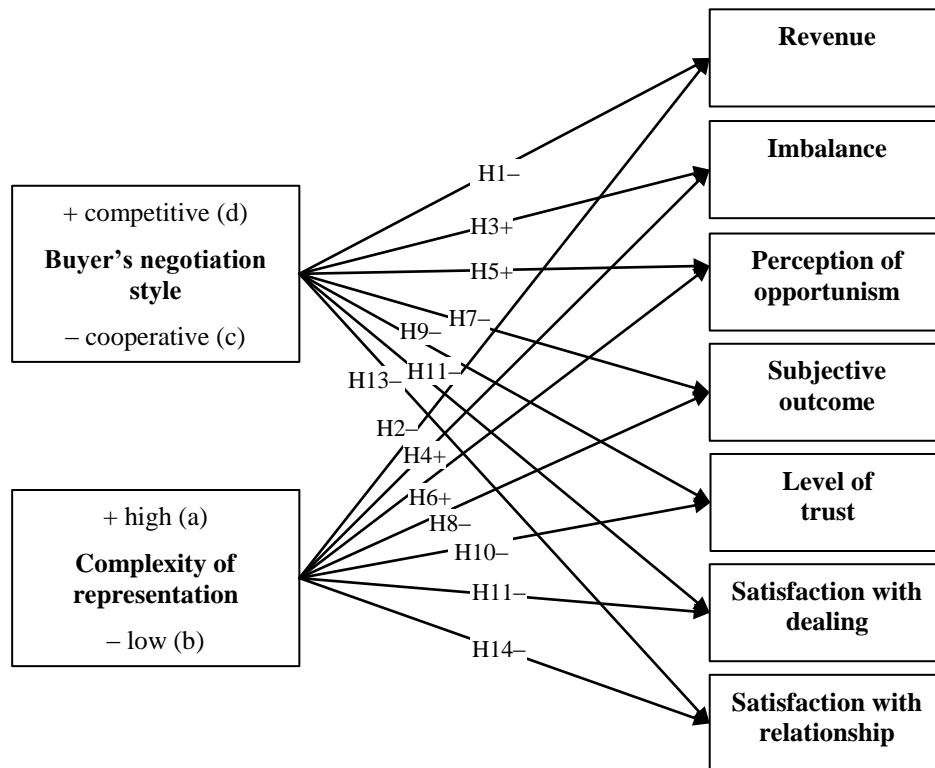


Fig. 1. Conceptual model.

- H7.** The higher the buyer’s competitiveness, the lower will be the provider’s subjective outcome.
- H8.** The higher the complexity of representation, the lower will be the provider’s subjective outcome.
- H9.** The higher the buyer’s competitiveness, the lower will be the provider’s level of trust.
- H10.** The higher the complexity of representation, the lower will be the provider’s level of trust.
- H11.** The higher the buyer’s competitiveness, the lower will be the provider’s satisfaction with dealing.
- H12.** The higher the complexity of representation, the lower will be the provider’s satisfaction with dealing.
- H13.** The higher the buyer’s competitiveness, the lower will be the provider’s satisfaction

with relationship.

H14. The higher the complexity of representation, the lower will be the provider's satisfaction with relationship. Since hypotheses H₁ to H₄ relate to substantive outcomes, they may be tested considering the actual outcomes of each instances. On the contrary, hypotheses H₅ to H₁₄ concern behavioral issues, thus they may be tested considering each buyer-provider dyad in each instance.

3. Methodology

Our research utilized laboratory experiments, which are a specialized form of field experiment that usually involves students acting in an environment created for research purposes (Colquitt, 2008). Thanks to small monetary or non-monetary rewards, participants are induced to adopt "smart" decisions, namely to maximize their own payoff, thus optimizing behavior. This increases their compliance with the experiment aim, and reduces the risk of bias. The use of students instead of experienced practitioners is common in experimental design (Naquin and Paulson, 2003; Gattiker et al., 2007) and assures that results cannot be explained through participants' work experience with e-procurement (Carter and Stevens, 2007).

3.1 Design

Our hypotheses were tested by adopting a 2x2 research design, whose experimental factors were the level of complexity in describing the service and the buyers' negotiation style. For both factors – considered as independent variables – we took into account two values, namely two vs. three service attributes for the former, and competitive vs. cooperative negotiation style for the latter. All variables were completely crossed, thus resulting in four experimental conditions (Table 1). Each experimental condition was tested on 7 instances.

Table 1. Research design.

		Complexity of the representation	
		High (3 attributes) and competitive	Low (2 attributes) and competitive
Buyer's negotiation style	High (3 attributes) and cooperative	High (3 attributes) and cooperative	Low (2 attributes) and cooperative
	Low (2 attributes) and cooperative	High (3 attributes) and cooperative	Low (2 attributes) and cooperative

3.2 Participants

The sample consisted of students enrolled in courses at an Italian University. The role of bidders was played by second and third-year undergraduate students in Management Engineering. There were 112 participants acting as bidders, 54.5% of which were female and 97.3% Italian citizens. 84.8% participants were between 21 and 25 years old, while 15.2% participants were under 21 years old. Students' participation was voluntary, but they were awarded an extra credit. To motivate conscientious behavior during the experiment, participants were also informed that the best 25% of performers would double their extra

credit.

Buyers were selected among graduate students and junior researchers in Management Engineering. To make their tactics similar and in accordance with the archetypal negotiation styles (collaborative or competitive), one week before the experiment they received detailed instructions on the main differences between negotiation styles and the way to conform to one or the other, such as the time and way to formulate the first offer, the language and lexicon to use during the bargain, the criteria for formulating or accepting an offer, the extent to which they had to justify their positions, and so on. Then, buyers' attitude to behave cooperatively or competitively was tested via the Thomas-Killman Conflict Mode Instrument (Shell, 2001), a bargaining style assessment tool with 30 questions to verify individual attitudes and behaviors. At the end of this preliminary phase, we selected three buyers having a competitive attitude and three having a cooperative one and assigned them to experimental conditions accordingly. Before negotiating, they tried the platform with a trial session set up on purpose.

3.3 Procedure

Transactions were entirely performed on a web-based platform named InterNeg Virtual Integrated Transaction Environment (INVITE), hosting a system for conducting negotiations (InterNeg Multi-Bilateral Negotiation System – IMBINS) (Strecker *et al.*, 2006; Kersten *et al.*, 2012).

Transactions were conducted in a computer laboratory, in consecutive sessions, and they lasted two hours each, including the preparation time. Participants at the buyer-side were assigned to the experimental condition according to their behavioral attitude as emerged by the Thomas-Killman Conflict Mode Instrument, whereas participants at the bidder-side were randomly matched up in groups of four. Within each instance, identities were unknown to each other. At the beginning of every session, the facilitator seated participants at the computer terminals far from each other to prevent them from communicating or peeping, and briefly explained the goal of the experiment and its rules. Then, he gave the participants a folder containing their log-in credentials for the platform, the system guide, some general notes on negotiations, and the description of the case, including both public and private information (see Section 3.4 for details). Participants were asked to read the material. After 25 minutes, participants were administered a quiz to ascertain their comprehension of the case: if they gave a wrong answer, the system did not allow them to proceed. Then, their expectations on the task, behavior, and outcomes, and a subjective assessment of the case understanding were checked through a pre-questionnaire.

The interaction in itself lasted 50 minutes at most: during this phase, the participants submitted bids on behalf of their hypothetical companies, each having different features and priorities. If an agreement was reached, the corresponding transaction ended in advance. At the end, all the participants were asked to complete the final feedback to capture their reactions concerning some items, and leave comments. A short debriefing closed each session.

3.4 Business case

For all the experimental conditions the same procurement case was adopted: Milika, a producer of perishable goods (the buyer) is seeking a logistics service provider who would provide transportation from a single depot to a large number of customers. The buyer wants to sign a contract with a single provider for one year, with a possibility of renewal. Milika assures

the minimum quantity of goods to be transported. The contract consists in defining some attributes. In two-attribute transactions they are: (i) the standard rate of transportation, i.e. the amount per unit that the buyer pays to the provider; and (ii) the penalty for delay in providing customers with the requested goods on time. In three-attribute transactions, there is also (iii) the rush rate for unexpected delivery, i.e. the amount per unit that the buyer pays to the provider for rush orders, requested by customers, to transport the good on an ad-hoc basis. The possible ranges for each attribute are known to every participant.

To select one service provider, the producer recurs to a negotiation and invites four different companies with a proven record to participate. Therefore, four sales managers participate in the transaction on behalf of their own logistics service company. Participants are told that the company they represent estimated a revenue function based on the problem attributes. The revenue value corresponding to each configuration of the attribute values can be easily computed using a simple calculator embedded in the case description. In order to simplify comparison of different offers or bids, the revenue is represented as ratings in the interval (0, 100). Ratings are secret and the higher the rating, the better the contract for the participant.

Every participant knows that if he/she accepted a contract below a given break-even rating, the firm he represents would incur losses. Every participant is also given reservation values for the attributes. The revenue formulae, as well as reservation and breakeven values, may be different among providers.

3.5 Measures

As discussed in Section 2.1, 7 constructs (revenue, imbalance, subjective outcome, trust, satisfaction with dealing, satisfaction with relationship, and perception of opportunism) have been taken into account. The first and the second constructs can be directly measured: the former has been operationalized in terms of providers' profit, defined as the difference between the rating that the provider reaching the agreement actually achieves by the contract and his break-even rating. Based on such a definition, we can compare results, which come from sellers who have different break-even ratings. The imbalance has been operationalized in terms of difference between the buyer's and the provider's revenues.

The other five constructs, which cannot be directly measured, are assessed by means of the items mentioned in Section 2.1 (Table 2). These items have been put into questions and included in the questionnaire, which has been administered at the end of the transaction. Answers were expressed in terms of scores along a seven-point Likert scale (from "strongly disagree" to "strongly agree").

Table 2. List of the constructs and related items.

Provider's revenue		<i>(directly measured)</i>
Imbalance		<i>(directly measured)</i>
Subjective outcome	OUT ₁	I am satisfied with the results that I achieved.
	OUT ₂	I achieved more than what I had expected.
	OUT ₃	The outcome is better for the buyer than it is for the provider.
	OUT ₄	The results I obtained are not favorable for my company.
Trust	TRU ₁	I think that the buyer will keep the promises he/she makes to my company in the future.
	TRU ₂	When making important decisions, the buyer considers my company's welfare as well as his/her own.
	TRU ₃	My company trusts the buyer to keep our best interests in mind.
Satisfaction with dealing	DEA ₁	Dealing with this buyer benefits my company.
	DEA ₂	This buyer is a good company to do business with.
Satisfaction with relationship	REL ₁	I had a good relationship with my counterpart
	REL ₂	I would like to work with my counterpart in future
	REL ₃	My counterpart was sincere
	REL ₄	I enjoyed working with my counterpart
Perception of opportunism	OPP ₁	In future interactions, I believe that the buyer would be unwilling to accept responsibility for his/her mistakes.
	OPP ₂	In future interactions, I believe that the buyer would try to "nickel and dime" my company.

3.6 Validity and reliability

To examine the existence of underlying constructs correlated to the items, we used the Exploratory Factor Analysis, extracting factors through *weighted least-squares method* and Kaiser's rule, and using *direct oblimin rotation method*. As the research hypotheses can be referred to the entire sample as well as to specific subsets of it (obtained through selecting data according to the desired values of the independent variables), distinct analyses have been conducted on the whole sample of respondents (28 experiment instances), as well as in subsets obtained considering only instances with (a) three or (b) two attributes, and with (c) cooperative or (d) competitive buyers. Each subset consists thus in 14 instances.

This study is part of a wider research, which analyzed constructs (and related items) that have not been described above, as they are outside the scope of this paper. However, all the factor analyses refer to the entire set of items (dependent variables).

Table 3. Results of explorative factor analysis and reliability analysis on the five sets of data.

Set	Factors (<i>loadings</i>)	Mean	St. dev.	α
All data	Perception of opportunism (<i>OPP1</i> 0.829, <i>OPP2</i> 0.798)	3.20	0.94	0.743
	Positive attitude toward the dealing (<i>TRU1</i> 0.714; <i>TRU2</i> 0.797; <i>TRU3</i> 0.699; <i>DEA1</i> 0.850; <i>DEA2</i> 0.739)	2.65	1.01	0.878
Subset (a)	Perception of opportunism (<i>OPP1</i> 0.800; <i>OPP2</i> 0.816)	3.43	1.00	0.794
	Acceptance of the dealing (<i>TRU1</i> 0.734; <i>TRU2</i> 0.816; <i>TRU3</i> 0.643; <i>DEA1</i> 0.879; <i>DEA2</i> 0.753; <i>OUT4</i> 0.686)	2.70	0.96	0.890
Subset (b)	Perception of opportunism (<i>OPP1</i> 0.733; <i>OPP2</i> 0.766)	3.04	0.91	0.703
	Positive attitude toward the relationship (<i>TRU1</i> 0.844; <i>TRU2</i> 0.690; <i>TRU3</i> 0.730; <i>REL2</i> 0.698; <i>REL4</i> 0.756)	2.64	1.02	0.871
Subset (c)	Perception of opportunism (<i>OPP1</i> 0.967; <i>OPP2</i> 0.663)	3.28	1.08	0.779
	Acceptance of the dealing (<i>TRU1</i> 0.733; <i>TRU3</i> 0.739; <i>DEA1</i> 0.901; <i>DEA2</i> 0.684; <i>OUT4</i> 0.686)	2.71	1.04	0.873
Subset (d)	Perception of opportunism (<i>OPP1</i> 0.615; <i>OPP2</i> 0.801)	3.03	0.78	0.684
	Convenience of the relationship (<i>OUT1</i> 0.775; <i>OUT2</i> 0.939; <i>REL1</i> 0.789; <i>REL3</i> 0.643)	2.53	1.12	0.875

Results show that in all factor analyses none of the emerging factors are correlated with any of the items associated with the other constructs that are not investigated here, whereas a factor is loaded only by the items associated with the construct perception of opportunism. Furthermore, items related to the other four constructs load in different ways in the five sets: in the whole set of data, the constructs trust and satisfaction with dealing collapse into one factor, which we name positive attitude toward the dealing. In subsets (a) and (c), the constructs converge with an item associated to subjective outcome: we name the resulting factor as acceptance of the dealing. In the subset (b), a different factor emerges, named positive attitude toward the relationship and deriving from trust and satisfaction with relationship. Finally, in the subset (d), the analysis reveals another factor – that we call *convenience of the relationship* – which is loaded by some items associated to *subjective*

outcome and satisfaction with relationship.

Table 3 illustrates results of the factor analyses for each set of data. The table includes the list of items that load every factor, their loadings, mean, and standard deviation of the factor scores, and the Cronbach's alpha. The latter has been adopted to test the reliability of factors: since all the coefficients but one – i.e. the one associated with the perception of opportunism in the analysis related to subset (d) – are larger than 0.700, which is assumed as cut-off value (Nunnally, 1978), the existence of an adequate internal consistency is proven (Hair *et al.*, 2010). Considering that the only exception indicated a marginally significance (0.684), we can assume that every factor was reliable.

Table 4. Hypotheses tested in the entire set of data and in the four subsets.

Dependent variable	Independent variable	All data	Subset (a)	Subset (b)	Subset (c)	Subset (d)
Revenue	negotiation style	H1	(2)	(2)	(1)	(1)
	complexity of representation	H2	(1)	(1)	(2)	(2)
Imbalance	negotiation style	H3	(2)	(2)	(1)	(1)
	complexity of representation	H4	(1)	(1)	(2)	(2)
Perception of opportunism	negotiation style	H5	H5a	H5b	(1)	(1)
	complexity of representation	H6	(1)	(1)	H6c	H6d
Subjective outcome	negotiation style	(3)	(3)	(3)	(1)	(1)
	complexity of representation	(3)	(1)	(1)	(3)	(3)
Trust	negotiation style	(3)	(3)	(3)	(1)	(1)
	complexity of representation	(3)	(1)	(1)	(3)	(3)
Satisfaction with dealing	negotiation style	(3)	(3)	(3)	(1)	(1)
	complexity of representation	(3)	(1)	(1)	(3)	(3)
Satisfaction with relationship	negotiation style	(3)	(3)	(3)	(1)	(1)
	complexity of representation	(3)	(1)	(1)	(3)	(3)
Positive attitude toward the dealing	negotiation style	H15				
	complexity of representation	H16				
Acceptance of the relationship	negotiation style		H17a			

Positive attitude toward the relationship	negotiation style	H18b	
Acceptance of the relationship	complexity of representation		H19c
Convenience of the relationship	complexity of representation		H20d

(1) Hypothesis that does not make sense. (2) Insufficient amount of data. (3) Hypothesis disregarded after the Explorative Factor Analysis.

4. Results

As a consequence of the Explorative Factor Analysis, in the entire set of data, hypotheses H1-H6, may be tested. Moreover, hypotheses H9 and H11, as well as H10 and h12 respectively collapse into:

H15. The higher the buyer’s competitiveness, the lower the positive attitude will be toward the dealing.

H16. The higher the complexity of representation, the lower the positive attitude will be toward the dealing.

Other hypotheses must be disregarded.

The factor analysis allows us to test some hypotheses in the four subsets. In doing it, we could not conduct the test on hypotheses H1 to H4, having the substantive outcomes (i.e. revenue and imbalance) as dependent variable, due to the limited amount of data (only one for each instance).

In the subsets (a) and (b), hypothesis H5 may be taken into account. Further hypotheses result from the Explorative Factor Analysis: namely, for the subset (a):

H17a. The higher the buyer’s competitiveness, the lower will be the acceptance of the dealing; and for the subset (b):

H18b. The higher the buyer’s competitiveness, the lower the positive attitude will be toward the relationship.

The other hypotheses do not make sense or must be disregarded due to the factor analysis.

In the subsets (c) and (d), hypothesis H6 may be taken into account. Moreover, for the subset (c) an additional hypothesis derives from the factor analysis, i.e.:

Table 5. Results of ANOVA. Significant results are in bold.

Set	Hypothesis	Total variance		Within-group variance			Between-group variance		F	p
		Sum of	d.f.	Sum of	d.f.	Mean	Sum of	d.f.		
<hr/>										

		squares		squares		squares		squares		squares	
all	H1	6020.96	27	4927.21	26	189.51	1093.75	1	1093.75	5.77	0.02
all	H2	6020.96	27	5698.64	26	219.18	322.32	1	322.32	1.47	0.24
all	H3	12233.00	27	9472.86	26	364.34	2760.14	1	2760.14	7.58	0.01
all	H4	12233.00	27	11341.43	26	436.21	891.57	1	891.57	2.04	0.16
all	H5	96.57	109	95.57	108	0.88	0.99	1	0.99	1.12	0.29
all	H6	96.57	109	96.13	108	0.89	0.44	1	0.44	0.50	0.48
all	H15	110.36	109	110.35	108	1.02	0.01	1	0.01	0.01	0.94
all	H16	110.36	109	109.15	108	1.01	1.21	1	1.21	1.20	0.27
(a)	H5a	52.60	53	52.58	52	1.01	0.03	1	0.03	0.03	0.87
(a)	H17a	48.45	53	48.02	52	0.92	0.43	1	0.43	0.47	0.50
(b)	H5b	45.54	55	43.14	54	0.80	2.40	1	2.40	3.01	0.09
(b)	H18b	56.73	55	56.18	54	1.04	0.55	1	0.55	0.53	0.47
(c)	H6c	64.07	55	62.05	54	1.15	2.02	1	2.02	1.76	0.19
(c)	H19c	59.30	55	58.16	54	1.08	1.07	1	1.07	1.00	0.32
(d)	H6d	32.62	53	32.57	52	0.63	0.05	1	0.05	0.08	0.77
(d)	H20d	66.10	53	65.65	52	1.62	0.45	1	0.45	0.36	0.55

H19c. The higher the complexity of representation, the lower the acceptance of the dealing, whereas for the subset (d) the additional hypothesis is:

H20d. The higher the complexity of representation, the lower will be the convenience of the relationship.

As shown by Table 4, to sum up we have 16 hypotheses (eight for the set ALL, and two for each subset) to be tested via analysis of variance (ANOVA). Table 5 summarizes the results of the

ANOVA. Hypotheses for which $p < 0.10$ (in bold) are assumed statistically significant, i.e. the corresponding null hypothesis ($H_0: \mu_1 = \mu_2$) is rejected. For these, Table 6 reports mean and standard deviation of the two groups, defined by varying the value of the independent variable.

Table 6. Mean and standard deviation of dependent variables for statistically significant hypotheses.

Set	Hypothesis	Dependent variable	Independent variable			
			name	value	mean	st. dev.
All data	H₁	Revenue	Negotiation style	cooperative	15.29	13.13
				competitive	2.79	14.38
All data	H₃	Imbalance	Negotiation style	cooperative	40.57	17.57
				competitive	60.43	20.49
(b)	H_{5b}	Perception of opportunism	Negotiation style	cooperative	2.84	0.86
				competitive	3.25	0.92

Results do not show any statistically significant evidence that the complexity of representation affects the dependent variables. On the contrary, it is strongly proven the influence of the buyer’s negotiation style on both the substantive outcomes, namely the revenue and the imbalance. As to the former, results show that if the buyer behaves competitively, he may reduce the revenue for the provider. Specifically, when the buyer moves from a cooperative to a competitive behavior, the mean supplier’s revenue rating diminishes from 15.29 to 2.79. As to the imbalance, the adoption of a competitive behavior increases the difference between the buyer’s and the provider’s revenue ratings. Specifically, the mean difference, which is 40.57 in case of cooperative buyer’s behavior, grows up to 60.43 when the buyer behaves competitively.

Moreover, the analysis reveals with a moderate statistical significance that when the complexity adopted in representing the service is low (subset b), the negotiation style may exert an influence on the providers’ perception of opportunism. Explicitly, if the transportation service is represented by means of two attributes instead of three, the providers perceive a higher opportunism in the buyer if the latter adopts a competitive negotiation style. It is interesting to highlight that there is no evidence of such a result in case the service is represented by means of three attributes (high complexity).

5. Discussion and implications

This study addressed e-procurement of logistics services. Its aim was to examine how performance is affected by (i) the design of the system that companies use and (ii) the negotiation style that their representatives adopt during the bargain. Performance is evaluated in terms of both substantive outcomes and outcomes related to behavioral and perceptual

issues.

Especially in the last decades, the pervasiveness of information and communication technologies put emphasis on the nexus between the choice of a specific market mechanism and the effects on actors' behavior. Although the linkages between procurement system and performance have been widely investigated, this study is innovative in that it compares different procurement conditions via laboratory experiments, by making use of the same business case, technological platform, and experiment protocol, thus avoiding biases due to features other than the experimental conditions themselves.

We focused on two key dimensions to describe the system, i.e. (i) the level of complexity by which the service itself is described and (ii) the buyers' negotiation style. As dependent variables we measured two substantive outcomes (i.e. the profit that logistics provider gains and the difference between buyer's and provider's revenues) and other performances related to behavioral issues, i.e. subjective outcome, trust, satisfaction with dealing and relationship, and perception of opportunism.

The analysis gave us no evidence that the complexity adopted in representing the logistics service (i.e. the usage of many or few attributes to describe it within the negotiation and set the terms of the procurement) affects process performance. On the other hand, the negotiation style adopted by buyers plays a key role in determining the substantive outcomes. Specifically, if the buyer behaves cooperatively, the provider's revenue increases and the difference between buyer's and provider's revenues (what we name imbalance) decreases. By jointly considering the provider's revenue and the imbalance, it may be also observed that, if the buyer switches from a competitive to a cooperative negotiation style, (i) the sum of revenues achieved by buyer and provider increases, however (ii) not only the latter gets the whole extra-revenue, but he even subtracts a quota of the buyer's revenue. To sum up the adoption of a cooperative negotiation style is beneficial for the system, for the provider, but not for the buyer. As a result, the buyer might adopt a cooperative negotiation style only if the lower revenue is balanced by non-monetary rewards, e.g. related to building a strategic relationship with her logistics provider.

Furthermore, the analysis has shown that, when the service is described in an easier way (i.e. by using fewer attributes), if the buyer adopts a cooperative negotiation style the provider's perception of opportunism in the counterpart's behavior decreases. We then suggests that, as long as logistics services do not require a complex description, buyer companies should adopt a cooperative negotiation style if they want not to be perceived as opportunist by their provider.

Limitations of this study can be summarized as follows. First, the participants to the laboratory experiment were students and young researchers rather than experienced buyers and sellers: although this option is common in the social sciences literature, the debate on the way it may impel generalizability of results is still open (Levitt and List, 2007; Falk and Heckman, 2009). However, giving an ultimate answer to this question is outside the scope of this paper: we are aware that the choice to test the hypotheses by building an ad-hoc case and administering it to students and academics in a laboratory environment, instead of making a survey within practitioners, might affect the external validity of results; nonetheless, we are confident that the control of the decision environment allows the investigated causal relationships to be isolated from exogenous perturbations. Additionally, we are conscious that the experiment size – 112 participants acting as buyers and six as sellers, which result in 28 experiment instances –

limits the explanatory power of results. Ours must then be considered an exploratory study and further research is needed to replicate it on a larger scale.

Furthermore, due to the scale of the experiment, we could analyze performances (particularly the outcomes related to behavioral and perceptual issues) only under the provider's point of view: it would be useful to complement the analysis under the buyer's perspective as well.

Possible extensions may include the analysis of negotiation styles other than cooperative and competitive, and the account of additional issues, such as the variation of the number of potential logistics providers (in our case assumed to be equal to four). Finally, different negotiation types and platforms to conduct transactions may be considered.

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