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2010

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Emerald Group Publishing Limited

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Supply Chain Management, v.15, no.1, 2010, pp. 21-42  
<https://hdl.handle.net/10945/38018>

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# Enhancing reverse auction use theory: an exploratory study

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### Abstract

**Purpose** – The purpose of this paper is to explore how a sourcing professional arrives at a decision to use an electronic reverse auction (eRA) to source a particular requirement by examining eRA appropriateness.

**Design/methodology/approach** – Past eRA research findings are synthesized into a summary table. From a comprehensive review of the literature, theories of technology adoption, social influence, referent-dependence theory, and planned behaviour are discussed and synthesized into a model that explains the antecedents of eRA appropriateness. A case study methodology using structured interviews resulted in a refined model that sheds light on some of the controversial findings regarding electronic reverse auction appropriateness.

**Findings** – Expected savings, buyer confidence, and prior eRA sourcing satisfaction are identified as new constructs that help explain the decision to source via eRAs. Additionally, perceived eRA appropriateness is proposed as a new construct that mediates the influence of external, strategy factors on the decision to source via eRAs.

**Research limitations/implications** – Recent literature suggests that the benefits of reverse auctions are overstated and reverse auctions constitute a fundamentally coercive use of buyer power. Reconciling the conflicting supplier perceptions of reverse auctions as use of coercive power with buyer perceptions of cost savings requires an explanation for the factors that lead to the decision to source via eRAs.

**Practical implications** – The modern competitive supply chain environment entices businesses to explore all avenues for cost savings. Explaining the drivers of reverse auction use illuminates the advantages and pitfalls of reverse auctions as a strategic sourcing venue.

**Originality/value** – From an extensive review of the eRA literature and eight case studies, the authors propose a model that integrates and extends previous eRA research. Key insights from the model are the mediating effect of perceived eRA appropriateness and the integration of individual level variables with the strategic decision to source via eRA. Additionally, a table is provided summarizing the findings from relevant eRA research that reveals key insights into the phenomenon.

**Keywords** Auctions, Sourcing, Purchasing

**Paper type** Research paper

### Introduction

An electronic reverse auction (eRAs) is a special case of procurement that has received increased attention in the academic and practitioner literatures in recent years. The proliferation and use of eRAs is occurring in an era of globalized competition and decreased governmental regulation that has created an environment that no longer favours individual firms and dyads (Farmer, 1997; Tan,

2001). That is, dyadic relationships reside in a larger network of exchange relationships (Anderson *et al.*, 1994; Rindfleisch and Moorman, 2001) that often rely on norms rather than contracts to tie them together (Dwyer *et al.*, 1987; Heide and John, 1992). These inter-organisational networks have proliferated as an alternative between open market and integration, particularly at the international level (Granovetter, 1985; Thorelli, 1986). Procurement practices are evolving from operational purchasing (“local optimization”) to integrating and coordinating sourcing strategies on a global scale and across the supply chain (Trent and Monczka, 2003). Among the most important motivations for the shift to global versus domestic sourcing is the per unit cost savings (Trent and Monczka, 2003). The shift to global sourcing opens markets to more competition that can put pressure on local prices. This is particularly true

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Supply Chain Management: An International Journal  
15/1 (2010) 21–42  
© Emerald Group Publishing Limited [ISSN 1359-8546]  
[DOI 10.1108/13598541011018102]

when firms choose to use eRAs where many competitors compete for the business of one buyer (Emiliani, 2004).

From the buyer's perspective, reverse auctions offer a compelling case for their use. Per unit cost reductions range from 5–40 percent (Tully, 2000), with typical gross savings of 15–20 percent (Cohn, 2000) – a significant reduction in light of the fact that manufacturers typically spend 55 percent of their revenue on purchased goods and services (Monczka *et al.*, 2002). Presuming a 20 percent gross margin, every dollar of reduction in purchased materials and services costs is the equivalent of five dollars in top line sales, a fact increasingly appreciated by leading global corporations (Emiliani, 2000).

Usage of eRAs is not expected to cease; in fact, usage is expanding. In July 2008, the United States government's Office of Federal Procurement Policy issued a memorandum to each department's chief acquisition officer encouraging the use of eRAs where appropriate. This emphasis coupled with recent success stories – such as the Department of Homeland Security's 8.7 million dollar savings (9.2 percent of spend) over 525 bidding events (Ely, 2008) and the US Air Force's 395 thousand dollar savings (21 percent of spend) on one procurement conducted in the Middle East (McCree, 2008) – suggests increased usage of the tool in the federal sector.

Critics of eRAs suggest that findings supporting per unit price reductions fail to take into account all of the costs that are incurred across the supply chain (Chen *et al.*, 2005) and, therefore, contend that the savings are overstated (Emiliani and Stec, 2002a, 2002b, 2004, 2005b). Furthermore, critics hypothesize that reverse auctions represent a fundamentally coercive use of buyer market power that undermines long term business success (Giampietro and Emiliani, 2007). The continued demand for eRA sourcing (Schoenherr and Mabert, 2007; Schoenherr, 2008) necessitates that sourcing professionals understand how to best use the tool – with particular cognizance of the tool's potential pitfalls.

One explanation for the tension between the perceived benefits and costs (economic and social) to buyers and sellers is that research in this area is still evolving (Arnold *et al.*, 2005). Furthermore, only a few studies have explored antecedents to the perception of appropriateness and use of business-to-business electronic markets (Beall *et al.*, 2003; Joo and Kim, 2004; Kaufmann and Carter, 2004; Wagner and Schwab, 2004) with mixed results. More specifically, organizational and buyer cognition factors have largely been ignored. Thus, the question of “Why do sourcing managers choose to use eRAs?” has yet to be answered in a complete manner.

The purpose of this research is to explore the question of “Why do sourcing managers choose to use eRAs?” More specifically, we review the literature and develop a model that includes external and strategic factors (e.g., competition and expected savings) and internal and human factors (e.g., social influence and prior eRA satisfaction). This model extends extant literature by integrating previously supported strategic factors as well as less researched buyer cognition factors. We argue that factors related to sourcing strategy indirectly influence the sourcing manager's decision to use eRAs through perceived eRA appropriateness. That is, we posit that a sourcing professional must answer the question, “Is an eRA appropriate?” as a part of his/her decision of whether or

not to use an eRA. Thus, the model takes into account external and strategic factors that influence a sourcing professional's view of whether or not an eRA is appropriate for a particular sourcing situation. In addition, we account for internal and social factors that influence a sourcing professional's decision to use eRAs. For example, the decision to source via an eRA may be driven by a top manager's directive more than by the market conditions. That is, a sourcing professional may view a situation as inappropriate for an eRA but choose to use an eRA because of a directive from upper management.

The remainder of this paper is organized as follows. We first discuss the process we used in completing our literature review. We then describe the methodology for a qualitative pilot study. Based upon a literature review and subsequent empirical insights garnered from a qualitative pilot study, we develop a model that distinguishes between factors that affect a sourcing professional's view of eRA appropriateness from other direct effects on the actual decision to use eRAs. Theoretical and practical implications are offered and we close with limitations and recommendation for future research. The contributions of this research are as follows. First, the previously mentioned conceptual model is proposed and research propositions are proposed that guide future research into the antecedents of eRA use. Second, we provide an extensive summary of extant eRA research (Appendix Table AI) that yields interesting insights into the eRA phenomenon.

## Methodology

As a theory-building effort, this research examined extant research and sought empirically inspired insights into the antecedents of eRA use. This two-stage method follows published guidance on theory development that necessarily precedes – and justifies subsequent investment into – the development of survey-based research (Ellram, 1996). The extant literature resulted in the development of a preliminary model for antecedents of eRA use that was used to guide the subsequent qualitative pilot study. The research provided confirmation of the model and additional insights into previously undiscovered antecedents of eRA use. A brief description of this two-stage research methodology follows.

## Literature review

When developing a model, there are several concerns. One is comprehensiveness – choosing the most salient factors or, at a minimum, highly relevant factors (Whetten, 1989). A second is parsimony – developing a model that contributes to the literature but is not over-specified (Whetten, 1989). One must also ask the question: Does this model lend itself well to future empirical testing? Therefore, our approach was to conduct a thorough search of the academic literature to identify the most comprehensive, yet parsimonious, set of antecedents to eRA usage decisions.

We applied the following process. First, we conducted database searches using ABI Inform/ProQuest, EBSCO Host, and Science Direct using search terms such as “electronic reverse auction”, “e-procurement”, “bidding event”, “e-sourcing”, and “online bidding.” Next, we traced references from these articles (Webster and Watson, 2002). We continued this process until reaching saturation – the point

at which continued searches yielded no additional studies addressing antecedents to eRA use. Our search identified 27 articles that either suggested or directly identified antecedents of eRA use (see Appendix Table AI). Of these, 14 articles were empirical studies and the remaining 13 were conceptual studies. Due to the nascent state of eRA research (Beall *et al.*, 2003; Joo and Kim, 2004; Kaufmann and Carter, 2004; Wagner and Schwab, 2004), we chose to include all studies that addressed antecedents of eRA use. While not appropriate for mature literatures, this method prevented the introduction of selection bias by the researchers (Tranfield *et al.*, 2003). The unit of analysis for our review and subsequent model was the individual sourcing professional in an individual procurement transaction. We narrowed the focus of our framework to the research problem – explaining eRA use. As each antecedent emerged from the literature review or from interviews with informants, we further researched the underlying theories explaining why the antecedent became an important factor in the sourcing professional's choice to use an eRA. Explaining why each factor is logical, and placing it in the context of established theory, gives credence to the theory of eRA usage (Whetten, 1989). Explaining why is an essential element of theory (Sutton and Staw, 1995). Factors clearly emerged when either they were repeated across multiple studies or patterns of similar concepts were identified from discussions with multiple informants.

From the literature review, other contextual insights emerged leading to the categorization found in Appendix Table AI. For instance, the controversy of whether eRAs are useful or harmful to industrial exchange emerged; thus, we categorized studies as supportive, neutral, or opposed to eRA use. Additionally, some articles focused on eRA outcomes whereas others addressed circumstances where eRAs were used. Thus, we classified studies by antecedents and consequences. Finally, we catalogued whether studies were empirical or conceptual and their principle methodology employed – quantitative or qualitative. We also noted the key findings from each study.

### Pilot study sample development

While the state of eRA knowledge is growing, our understanding of why sourcing professionals choose to use eRAs in certain circumstances (but not others) is embryonic. A qualitative approach is appropriate in this situation since it can explain how and why something is being done (Naslund, 2002; Mangan *et al.*, 2004). Qualitative analysis of data derived from depth interviews provides “thick descriptions” that can reveal complexity (Miles and Huberman, 1994). Further, qualitative data is highly suited to exploring new phenomena and developing new theory (Miles and Huberman, 1994; Carter *et al.*, 2004).

We cast a wide net in selecting diverse eRA users with hopes of identifying contextual effects and broadening the generalizability of findings (Naslund, 2002). The use of several criteria narrowed our pilot study to eight depth interviews – enough to provide initial evidence for our propositions and, in some cases, to develop new propositions (Miles and Huberman, 1994; Naslund, 2002). First, we sought representation from government and non-government users since government use is growing and its use is underrepresented in the literature. We also sought diversity

within each group – large and small organizations. Additionally, we interviewed eRA users with high and low eRA experience, and those with a range of eRA involvement such as company e-sourcing managers and organizational directors. We also captured the perspective of sophisticated and basic users. Basic users restrict eRA use to simple commodities where price is the predominant award criterion; whereas, sophisticated users source services and evaluate non-price factors. Finally, since eRAs are somewhat controversial, we sought proponents and opponents (see Table I).

Due to limited time available with informants, we focused our study by *a priori* specification of constructs (Miles and Huberman, 1994) based on the comprehensive literature review. This enabled us to discuss each construct in detail with informants and develop measurement scales for them more accurately (Miles and Huberman, 1994). However, keen to the potential for bias, we remained alert for disconfirmation evidence and the emergence of additional antecedents to eRA appropriateness. Appendix Table AII displays proposed measures of the ten constructs that can be used for subsequent quantitative data collection and analysis. For the latent constructs, different items were developed to capture the complete meaning of the construct and to ensure reliable measurement (Churchill, 1979). The multiple aspects of a construct were identified either from existing scales (for existing constructs) or from the interview data from informants (for new constructs).

### Pilot study data analysis

We followed the following processes to ensure external validity, reliability, and construct validity (Miles and Huberman, 1994). To ensure external validity, we used a multiple-interview approach to replicate data and identify patterns (Miles and Huberman, 1994). To ensure reliability, or consistency, we conducted in-depth, semi-structured telephone interviews with informants using an interview protocol. Conversations were recorded and transcribed. Interview summaries were developed and sent to informants following each interview to solicit feedback ensuring accuracy and reliability (Miles and Huberman, 1994). To ensure construct validity, we utilized multiple sources of qualitative data (Naslund, 2002) including semi-structured interviews, internal organizational policies and guidelines, emails, and a written questionnaire. By triangulating the policies and guidelines with the findings from the interviews (Miles and Huberman, 1994) and written responses to the questionnaires across multiple informants, we corroborated the evidence to arrive at valid findings (Miles and Huberman, 1994). We also corroborated analysis across multiple researchers (Mangan *et al.*, 2004; Naslund, 2002).

After collecting data from eight interviews, we constructed a cross-case meta-matrix (Miles and Huberman, 1994) of antecedents. A cross-case methodology is applicable to both comprehensive study and analysis of individual informant data (Miles and Huberman, 1994, p. 28). This matrix showed the replications and helped identify patterns between subjects. Pattern matching is a preferred qualitative technique, and can bolster internal validity. In addition to between-case replicability, we explored isolated patterns within subject demographics. Finally, we investigated a key rival explanation associated with eRA use – whether eRA appropriateness is a



Table I

Organization	Size <sup>a</sup>	Position	Informant's direct experience <sup>b</sup>	Antagonist (Protagonist)	Sophisticated (basic) user <sup>c</sup>
500 Fortune 500 Private Co.	Large	e-Sourcing Manager	100 +	P	S
US Department of Defence Service A	Large	Commodity Director	30	P	S
US Department of Defence Service B	Small	Purchasing Manager	34	P	B
US Department of Defence Service A	Large	Contract Specialist	30-50	P	B
US Department of State	Large	Contracting Policy Analyst	1	P	S
US Department of Homeland Security	Large	Contracting Officer	500	A	B
	Large	Director	0	P	S
	Large	Contract Specialist	70	P	B

Notes: <sup>a</sup>Large = Annual Revenue/Budget > \$1B; <sup>b</sup>Number of eRAs in which the informant was directly involved; <sup>c</sup>Basic users restrict eRA use to simple commodities where price is the predominant award criterion; whereas, sophisticated users also source services and evaluate non-price factors

dichotomous or continuous construct. That is, we examined whether there are degrees of appropriateness. Results are integrated into the ensuing discussions.

As we analyzed the data, two classifications of salient factors emerged. First were constructs pertaining to sourcing strategy including attractiveness, specificity, category of spend, competition, and expected cost savings. The second classification related to the individual sourcing manager who makes the decision on whether or not to use an eRA. These factors included social influence, buyer confidence, and prior eRA sourcing satisfaction.

Given these two classifications of factors, we developed a model that integrates both the strategy-related phenomenon as well as social and human factors affecting an individual sourcing manager's decision to use an eRA for sourcing specific requirements based on the following arguments. First, a reverse auction is an appropriate sourcing method in certain circumstances, but inappropriate in others. Thus, we propose that the relationship between strategic factors and the decision to use eRAs is mediated by perceived eRA appropriateness. Second, we argue that the sourcing manager's tendency to use eRAs is influenced separately from strategic factors. These factors include the effect of intra-firm leadership, the buyers' need for pricing confidence, and prior eRA sourcing satisfaction.

Given our concerns with construct relevance and parsimony, we argue that the model is composed of relevant variables for the following reasons. To begin with, the strategic factors are an important component when a firm and/or manager develop a sourcing strategy. These factors would be important to consider regardless of whether one is using an eRA, negotiated procurement, or any other sourcing approach. Furthermore, the individual and social constructs are likely to influence a manager's decision-making process and, therefore, are important to understand in the context of eRAs. In the interest of parsimony, we have chosen to limit our model and discussion to these two categories of constructs.

In the following section, we first introduce the ultimate outcome (i.e. decision to use eRA) and the mediating construct of perceived eRA appropriateness. We then discuss the relationships between these constructs and their antecedents.

## Findings

### *Decision to source via eRA*

The individual sourcing manager's strategic and deliberate decision to procure products or services by means of a reverse auction constitutes the decision to source via reverse auction. Sourcing managers consider the advantages, disadvantages, opportunities and risks of eRA sourcing as applied to each specific procurement action. This is a "go/no-go" decision; either the eRA will be used or it will not. The decision to source via eRA includes any use of eRA, whether the eRA comprises the entire sourcing process (e.g. "pure electronic auctions") or a fraction of the sourcing process where the eRA complements other traditional sourcing processes (e.g. "auction integrated") (Arnold *et al.*, 2005; Kaufmann and Carter, 2004). It is important to note here that we focus on the individual's decision to/not to source via eRA for a given sourcing scenario. The following discussion elucidates factors that influence this decision.

### *Perceived eRA appropriateness*

Perceived eRA appropriateness is similar to the concept of strategic fit (Baker *et al.*, 1999; Xu *et al.*, 2006). Strategic fit is a concept which suggests that a firm's performance is enhanced when its strategy fits with the industry structure and environment (Xu *et al.*, 2006). Thus, when a firm carries out a strategy that is consistent with or appropriate for conditions in the marketplace and firm resources, it is more likely to succeed. We define perceived eRA appropriateness as a sourcing professional's assessment of the degree of fit between the strengths afforded by the eRA tool and the sourcing strategy components. That is, sourcing strategy factors affect a sourcing professional's perception of whether or not an eRA is an appropriate option for the firm. If, for example, for a given procurement competition is ample, the requirement is attractive to prospective suppliers, the spend is categorized as non-critical or leverage, the requirement is specific, and the expected savings warrant the efforts of building and conducting an eRA, we posit that the perception of eRA appropriateness will be high. The greater the perception of appropriateness, the higher the possibility a sourcing professional will make a decision to use eRAs.

To support this proposition, we first had to explore whether appropriateness is a dichotomous or a continuous construct. Hence, are there degrees of appropriateness or is a requirement either appropriate for eRA sourcing or not?

When we asked pilot study informants of their perspective, the unanimous response was that there are shades of appropriateness. In fact, we collected a decision rubric from one Fortune 500 firm that included this question for sourcing professionals deciding whether to use an eRA; “Regarding the suitability of a product for reverse auction . . . use a scale of 0 to 5 to indicate degree of fit for the commodity to be eAuctioned.” We also collected guidelines from another Fortune 500 firm listing the criteria for (in their words) appropriateness. Given the overwhelming evidence and no disconfirming data, we conclude that:

*P1.* Perceived eRA appropriateness is positively related to a decision to source via eRA.

### Sourcing strategy and perceived eRA appropriateness

Extant literature presents a complex picture of procurement sourcing strategy. In general, sourcing strategy consists of a comprehensive plan that determines what to purchase, from whom, how to purchase, and when to purchase. It also includes an assessment of elements such as the category of spend, competition, the nature of demand, and selection criteria (Kraljic, 1983). We posit that strategy factors help shape a sourcing professional’s decision to use an eRA by affecting the professional’s assessment of (perceived) eRA appropriateness. The remainder of this section focuses on antecedents of perceived eRA appropriateness.

#### Attractiveness

Since the purpose of eRAs is competitive bidding, procurement transactions must attract adequate competition – suppliers that are eager to win the business. Firms that seek to increase efficiency and/or effectiveness through the use of eRAs should consider the dollar volume of the auction as well as the (excess) inventory and production capabilities of suppliers (Kaufmann and Carter, 2004; Smeltzer and Carr, 2003). All pilot study informants believed that eRAs are appropriate where suppliers have either excess inventory or production capacity. One described this situation as a “win-win” since the buyer benefits from a lower price and the supplier is able to offload unwanted inventory. Furthermore, all but one informant (a basic user who did not experience much savings after accounting for the auction service provider’s fee) believed that a larger purchase volume increases eRA appropriateness. Therefore:

*P2.* Attractiveness is positively related to perceived eRA appropriateness.

#### Specificity

Reverse auctions require a thorough and unambiguous identification of all requirements for the product or service (Beall *et al.*, 2003; Mabert and Skeels, 2002; Schrader *et al.*, 2004; Smeltzer and Carr, 2002; Talluri and Ragatz, 2004; Wagner and Schwab, 2004), a characteristic termed “specificity” by Kaufmann and Carter (2004). All eight pilot study subjects agreed that a well defined requirement that can be priced as firm-fixed price and lacks ambiguity and misinterpretation makes an eRA an appropriate sourcing tool. In fact, one informant who complained of her organization’s use of eRAs because it invited less responsible suppliers, stated: “If the requirement is well defined, then the [buyer] is

covered.” The buyer must clearly express the need and each supplier’s interpretation of the need must match that of the buyer. Achieving optimal specificity requires that the buyer fully understand the internal customer’s purchasing requirement, usually embodied by key characteristics of the product or service such as volume, where and when, purpose, physical characteristics, transportation requirements, storage details, the major cost drivers of its production, manufacturing techniques, specialized labour requirements, service frequency, quality standards, inspection requirements, required delivery dates, performance metrics including minimum performance thresholds, production lead times, and contribution to profitability. Specificity is an important driver of perceived eRA appropriateness because it allows buyers and sellers to make “apples-to-apples” comparison of bid prices. Therefore, it is posited:

*P3.* Specificity is positively related to perceived eRA appropriateness.

#### Category of spend

Buyers use market intelligence and total-cost-of-ownership analysis to populate the strategic sourcing matrix (Kraljic, 1983). This matrix evaluates products or services in terms of their criticality and supply difficulty. While the matrix appears in many forms, strategic sourcing matrices generally categorize spend as one of four types: non-critical, leverage, bottleneck, or strategic. Each of these buckets carries associated supplier evaluation, contracting, and post-award management strategies.

A criticism of eRAs is that it tends to focus on price because, in many cases, non-price factors that may drive total ownership costs may outweigh price considerations. However, eRAs also have the flexibility to extend beyond their traditional price selection focus (Schrader *et al.*, 2004) and integrate with other aspects of the purchasing process. For example, when purchasing “leverage” spend, eRAs may be used to determine price while other terms of the agreement are determined in face-to-face negotiations. In this “auction-integrated sourcing process” (Kaufmann and Carter, 2004), the buyer uses the eRA to determine the price, but is able to consider other non-price factors such as technical capabilities, past performance, experience, and proposal risk. Thus, eRAs are not prohibited for sourcing arrangements requiring closer relations with suppliers and, therefore, eRA use and supplier collaboration are not mutually exclusive (Hartley *et al.*, 2004).

Critical items and services with a complex supply market characterize the strategic category of spend. The general consensus is that buyers should not source strategic spend via eRAs (Beall *et al.*, 2003; Kaufmann and Carter, 2004) because agreements with suppliers of strategic items and services are typically manifested in partnerships, long-term contracts, and strategic alliances built on relational norms of mutuality, flexibility, and solidarity – key facets developed over time. When sourcing strategic requirements, a lower price – the strength of eRAs – is often less important in the selection decision than non-price factors. This was confirmed in most of the interviews. Whereas one informant each expressed willingness to source “strategic” and “bottleneck” spend via eRA, most indicated they would limit eRA use to “non-critical” and “leverage” spend. Therefore, we posit:

P4a. There is a positive relationship between non-critical and leverage requirements and perceived eRA appropriateness.

P4b. There is a negative relationship between strategic requirements and perceived eRA appropriateness.

#### Competition

One of the key drivers of whether or not an organization should use a reverse auction is based on the level of supplier competition for an organization's business. That is, there must be a sufficient number of suppliers willing to compete in the reverse auction in order to make it an effective element of one's strategy (Beall *et al.*, 2003; Carter *et al.*, 2004; Guillemaud *et al.*, 2005; Hartley *et al.*, 2004; Kaufmann and Carter, 2004; Mabert and Skeels, 2002; Sashi and O'Leary, 2002; Wagner and Schwab, 2004). Pilot study informants believed that when there is greater competition, eRAs will be more effective; thus, the amount of available competition among suppliers influences their view of eRA appropriateness. Therefore:

P5. Competition among suppliers is positively related to perceived eRA appropriateness.

#### Expected savings

The pre-auction expected net cost savings of sourcing via a reverse auction represents the expected savings construct. Here, expected savings refers to the estimated savings from the auction less the cost of conducting the eRA. Business case analyses and quantitative evaluations of alternatives (Brannock, 2004) guide many business decisions involving financial effects. This calculated decision support is explained by a phenomenon that is quite similar to eRA use – technology acceptance. Davis (1989) widely supported (Lee *et al.*, 2003) technology acceptance model holds that one of the constructs that predicts technology use behaviour is perceived usefulness. Perceived usefulness represents “the degree to which a person believes that using a particular system would enhance his or her job performance” (Davis, 1989, p. 320). Where perceived usefulness of eRAs is high, use of the tool is expected to be high. A sourcing professional is likely to look beyond simple product-cost savings but also consider other transaction costs savings (e.g., negotiation costs) in determining eRA appropriateness. When overall eRA savings are expected to be high, our informants reported that the amount of expected savings makes eRAs an appropriate sourcing tool. One executive informant expressed: “I have been very, very pleased . . . about the savings we have accrued with reverse auctions. It runs anywhere from 8-15 percent, and something over and above what we used to get, and so savings is obviously a main factor in [choosing to source using] reverse auctions.” Stated formally:

P6. Expected savings is positively related to perceived eRA appropriateness.

#### Human factors

The decision to use eRAs is made by individual decision-makers, often sourcing professionals. Thus, an integrative model should consider not only firm strategy, but also factors that influence the individual's decision to use eRAs. These are the factors that have an influence independent from whether

the external and strategy factors are appropriate for eRA use. A sourcing manager may determine that a buy is ideally suited to eRA use but still use another procurement method, or conversely an eRA may be used despite its incongruence with the purchase scenario. Specifically, we focus on three key factors: social influence, buyer confidence, and prior eRA sourcing satisfaction.

#### Social influence

Several researchers have written about how senior leaders drive eRA use (Beall *et al.*, 2003; Carter *et al.*, 2004). “If formal leaders are committed to the e-sourcing . . . process, there is a greater likelihood of rapid adoption and full utilization” (Flynn, 2004, p. 6). In the context of eRAs, leadership behaviours might include:

- setting aggressive annual and quarterly dollar-value goals or percentage-of-spend goals for eRA sourcing;
- apportioning funds and establishing a contract with an eRA service provider for auctioning services, the auctioning software, or auctioning consulting services (often termed market making);
- staffing an e-sourcing manager to coordinate and orchestrate bidding events and to train suppliers and internal customers;
- integrating eRAs into the firm's documented procurement processes and project plans; and
- financially or otherwise rewarding those sourcing managers who meet or exceed eRA sourcing objectives.

The concept of leadership influence falls under the broader concept of *social influence*. Social influence is “defined as the degree to which an individual perceives that important others believe he or she should use the [eRA]” (Vankatesh *et al.*, 2003, p. 451). Social influence is rooted in the theory of reasoned action (Fishbein and Ajzen, 1975) that posits the role of subjective norms in affecting behavioural intentions. Essentially, when faced with a choice, a decision-maker considers what referent others might think about the choice (favourable or unfavourable). This role of social influence becomes important because organizational leaders are not the sole referent others; suppliers may also be included. Hence, when contemplating eRA use, buyers may consider how eRA use will be perceived by the supply base – a perception that could be negative. However, when leaders take an active role in driving eRA use, according to our informants, it is likely that sourcing professionals will yield to those that have the ability to reward and punish behaviour. One informant put it this way: “That's part of management. They'll make the decisions on those and it doesn't mean they are always right, but it means they are made.” When top managers have bought into the idea that eRAs are a means of lowering purchase prices, they may strongly push the use of eRAs. Therefore it is posited:

P7. Social influence to source via eRA is positively related to the decision to use eRAs.

However, it is important to note that whereas leaders may influence a buyer to use an eRA, all pilot study informants made it clear that neither supervisors nor other organizational leaders can affect their assessment of whether an eRA is appropriate. For this reason, we show a direct effect on the decision to source via eRA rather than a mediated effect



through eRA appropriateness. When asked about the impact of leader persuasion on perceived appropriateness, one informant explained: “I do not believe I could be persuaded, only because I have had hands on experience and have developed my own opinion of the tool.”

#### Buyer confidence

The second human factor involved in determining reverse auction appropriateness is the concept of buyer confidence. Buyer confidence refers to the degree to which a buyer (i.e. a sourcing professional) believes that he or she is able to obtain the best value in a sourcing event. Our informants unanimously believed they are accountable to their organizations to secure products and services that provide value at fair and reasonable prices. In addition to price, sourcing professionals rely on assessed value in making purchase decisions (Anderson *et al.*, 2000). As Anderson and Narus (1988, p. 54) wrote, “Value in business markets is the worth in monetary terms of the economic, technical, service, and social benefits a customer firm receives in exchange for the price it pays for a market offering.” Also, “A buyer needs to convince the financial management that prices are the best possible, whilst simultaneously demonstrating to the manufacturing team that quality and delivery are not being compromised” (Griffiths, 2003, p. 190). Assessed value considers competing suppliers’ offering and prices. Here,  $(Value_s - Price_s) > (Value_a - Price_a)$ , where *s* represents the value and price of the supplier, and *a* represents the value and price of the next best alternative. This difference represents the buyer’s incentive to purchase. This assessment of value is based on reference-dependent theory, “the notion that individuals define alternatives that they consider as gains and losses relative to a reference point, rather than in an absolute sense” (Anderson *et al.*, 2000, p. 311).

Sourcing professionals typically struggle to quantify value monetarily because of ignorance of the true cost structure for their own company as well as that of their suppliers (Emiliani, 2004). This leads to heavy reliance on price comparisons (Anderson *et al.*, 2000). Hence, absent sufficient competitive quotes as a basis of price comparison, assurance of attaining the best value is difficult. Sourcing professionals are also typically risk averse (Bloch and McEwen, 2002; Nelson *et al.*, 2001; Wilson, 1971), preferring “an alternative whose outcome is known with certainty over one having an equal or more favourable expected value but whose outcomes are probabilistic (Puto *et al.*, 1985, p. 90).” Given that many purchasing decisions are surrounded by uncertainty and the risk of substantial consequences (Puto *et al.*, 1985), the sourcing professional is in a peculiar fix. Because price comparisons are a benefit of eRAs, many sourcing professionals may place confidence in the ability of eRAs to provide true market prices (Schoenherr and Mabert, 2007). All of our informants expressly confirmed this. In fact, one informant expounded: “I don’t feel like I get a good deal if it’s outside of [the eRA].” Notwithstanding, three of the four informants that were eRA users (not executives or managers) believed that when not sourcing via eRA, determining the true market price of some products/services is difficult. One sophisticated user commented: “Depending on the product, it could be very difficult.” We posit that the confidence in value afforded by the eRA is positively related to the decision to use eRAs. Stated formally:

P8. There is a positive relationship between buyer confidence and a decision to source via eRA.

#### Prior eRA sourcing satisfaction

Research has shown significant relationships between past behaviour and future behaviour (Ouellette and Wood, 1998; Albarracín and Wyer, 2000). This relationship is mediated by outcome-specific cognitions, attitudes, and intentions. Once behaviour is engaged, people assess consequences then form attitudes that influence future behaviour. These findings support Ajzen’s (1991) theory of planned behaviour. Therein, behavioural beliefs (e.g., consequences), normative beliefs (subjective norms), and control beliefs (facilitators or impediments to performance) are considered by people contemplating a course of action. Furthermore, Fazio and Zanna (1978, p. 228) found that people “who formed their attitudes through direct experience held those attitudes more confidently and behaved more consistently with those attitudes than did [people] who formed their attitudes through indirect experience”. These links from social psychology are evidenced in consumer behaviour such as repeat purchasing and brand loyalty (Oliver, 1997). These basic cognitive processes likely affect sourcing managers’ decisions.

An additional consideration draws on social influence theory and is identified in the technology acceptance literature. The role of leaders’ establishment of mandatory system use has been found to diminish over time (Vankatesh *et al.*, 2003). In subsequent system use, individuals place greater consideration on their own experiences. This is important when considering a key contribution of this paper – the role of perceived eRA appropriateness. Hence, where an eRA tool is an appropriate fit to the sourcing strategy, outcomes should be favourable – and more closely resemble expectations. This positive feedback from experience should continue to motivate individuals to use eRAs, even in voluntary usage situations. During the interviews, pilot study informants verified that past success is likely to affect future eRA sourcing decisions – regardless of whether eRA use is mandatory, encouraged, or discretionary.

Likewise, dissatisfaction with the results of prior bidding events will likely lead to discontinued eRA use (Emiliani, 2005). Sources of dissatisfaction may include:

- savings lower than expectations (Kaufmann and Carter, 2004);
- selecting an unqualified or underperforming supplier;
- bid event technical difficulties; and
- issues related to auctioning items or services not conducive to eRAs.

Based on our findings, we posit that satisfaction has a direct effect on the decision to use eRAs. Stated formally:

P9. Prior eRA sourcing satisfaction is positively related to the decision to source via eRA.

## Contributions

Our grounded research provides several valuable contributions to the discussion of eRAs. First, based upon the literature and empirical insights from the pilot study, a



model (Figure 1) is presented that describes the antecedents to a sourcing professional’s decision to use an eRA. This model represents the synthesis of previously published and new insights into the individual eRA decision. The model distinguishes the more objective set of constructs from those that are more subjective. The objective set of constructs (i.e. external, strategic) are posited to influence a sourcing professional’s view of whether or not an eRA is appropriate for a particular sourcing scenario. Based on our model, if a company’s managers decide to use eRAs based on external and strategic factors, then it is important for managers to clearly specify the conditions under which an eRA should be utilized. The internal and human factors we identify are posited to directly influence a sourcing professional’s decision to use an eRA. Senior managers choose to adopt eRA technology and vendors for many reasons such as:

- reducing the purchase price of sourced goods;
- improving purchasing efficiency; and
- increasing overall owner’s equity (private sector) or maximizing tight budgets (government sector).

When top executives buy-in to the use of eRAs, they are likely to influence sourcing professionals to use RAs irrespective of whether (from a strategic view) an eRA is

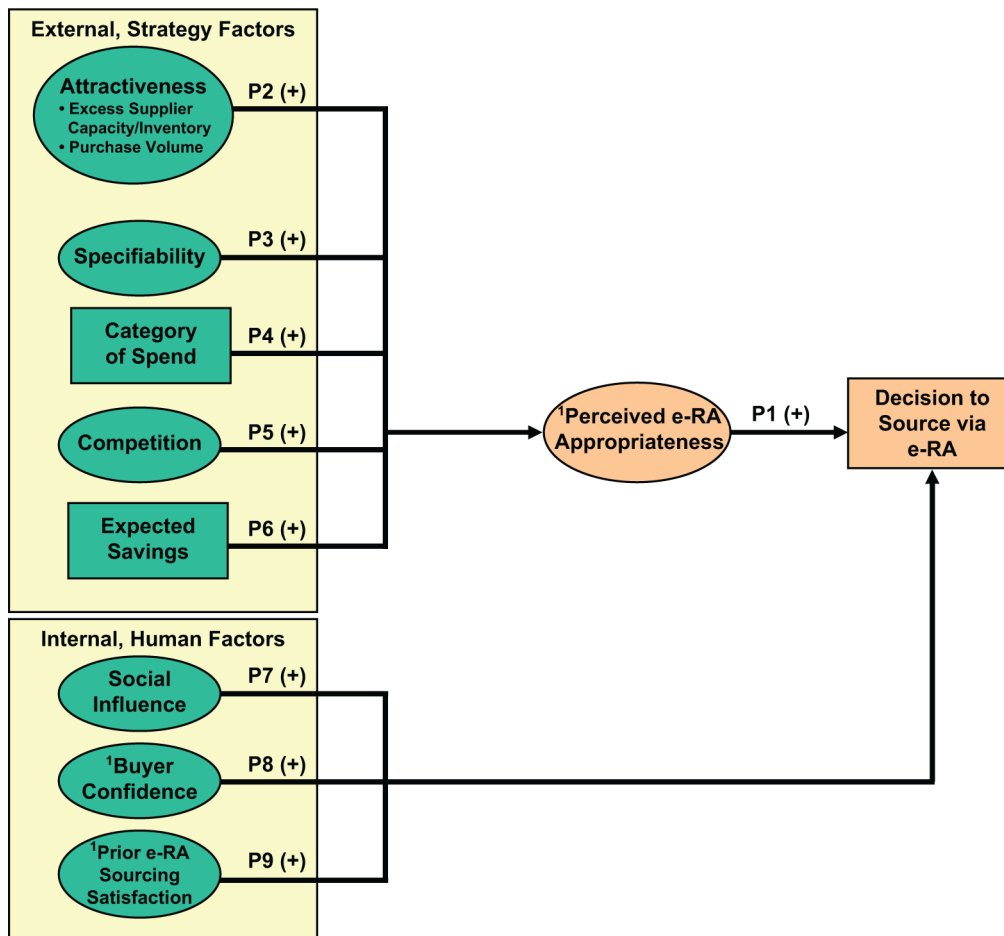
appropriate. Therefore, if top managers take a more strategic view, then they must be careful not to over-influence sourcing professionals’ decisions when eRAs may not be appropriate.

Buyer confidence and previous eRA sourcing satisfaction may also directly affect a sourcing professional’s decision to use an eRA. Specifically, when buyers have had positive experiences with eRAs and believe that an eRA will provide the best value, then they are more likely to choose an eRA over other methods. While this finding appears obvious, our study is the first to identify and confirm the effect with empirical data.

This set of propositions proposes to explain the phenomenon of eRA utilization in procurement. While several studies have documented and empirically supported antecedents, we provide a more complete picture of eRA utilization by integrating and extending previous research. Our integrated model is offered to the practitioner and researcher communities as a modest enhancement to the eRA body of knowledge, and hopefully will lead to improved insights in both milieus.

We also contribute a comprehensive summary of the extant eRA literature in Appendix Table AI. This table reveals key insights regarding the state of research addressing the antecedents of eRA use such as:

Figure 1 Conceptual model



Note: <sup>1</sup>Represent new contributions to existing e-RA theory

- eRA research is mostly qualitative with almost half being conceptual; and
- while eRA use is depicted as controversial, few researchers clearly oppose its use as a legitimate sourcing tool.

Additionally, this summary may serve future researchers as a starting point for their research.

### Implications for practitioners

Our review focused on an individual sourcing transaction and its orchestrator (i.e. a sourcing professional) as the unit of analysis. However, in order to be successful, the literature suggests that practitioners must understand how eRAs fit in the broader context of effective supply chain management. Simply stated, an eRA is only a pricing tool. It is a means to an end – not the end itself. In order to be employed effectively in an overall supply chain strategy, its user must understand how his or her eRA-assisted transaction contributes toward the firm's supply chain goals. Controversy persists that an eRA is solely a margin-squeezing tool myopically – and perhaps opportunistically – applied. This position contends that the eRA user considers only the immediate transaction between a buyer and supplier. However, evidence suggests (Schoenherr and Mabert, 2007) that eRAs and conventional supply chain management are not mutually exclusive. E-RA use can be integrated into supply chain strategy where global (versus local) optimization is paramount for a firm's sustained competitive advantage. Practitioners must exercise caution to ensure that where buyer-supplier relationships become more important than transaction price in their impacts on total costs (i.e. all but non-critical spend), supplier selection decisions are not solely determined by eRA results. Hence, for these more sophisticated relationships, the eRA-determined price should be but one selection factor among other non-price factors (e.g. total costs of ownership, quality, past performance, experience, technical capabilities, etc.). This broad understanding complements the application of our model in determining eRA appropriateness.

The model presented here identifies those factors likely to shape a sourcing professional's perception of eRA appropriateness. If a manager wants to promote the use of eRAs, the model suggests that elements of the sourcing strategy as well as the goals and objectives (and rewards) for buyers must be aligned such that eRAs will be utilized. Furthermore, managers must also recognize that individual factors and experiences may influence eRA use. Sourcing managers seeking to expand eRA use should consider evaluating employment candidates' experiences with eRAs since eRA satisfaction may override appropriateness leading to a decision to use an eRA.

### Implications for researchers

Emiliani (2004, p. 71) called for "additional research to improve practitioner and academic knowledge of the domain of successful application for online reverse auctions." We have taken the first step toward facilitating such knowledge discovery by proposing a parsimonious, integrated model of eRA use that lends itself well to empirical testing.

Our contributions, though modest, advance the state of the art of knowledge formation in eRA use in two ways. First, we provide a review of the extant literature on eRA use in

Appendix Table AI. Second, backed by qualitative inquiry, we posit that the relationship between sourcing strategy factors and the decision to use eRAs is mediated by perceived eRA appropriateness and that several individual level factors influence a sourcing manager's decision to use eRAs. If we are to advance our knowledge and provide guidance to industry, it is important to understand how sourcing strategy and individual level variables determine one's choices.

### Limitations and directions for future research

One limitation is that we have primarily focused on eRA use rather than factors that lead to successful eRAs under various internal procurement conditions and external market circumstances. For example, whether eRAs yield equivalent utility under inflationary economies is undetermined. A recent conversation with one eRA service provider and recent research suggests that during inflationary cycles, eRA use has and will likely persist as an effective cost avoidance mechanism (Schoenherr and Mabert, 2007). Nonetheless, contingency approaches to eRA use should be empirically explored.

A second limitation is that we have focused on a relatively limited set of potential antecedents of eRA use. While this is a limitation, we argue that the factors we chose are highly relevant and that our model lends itself well to future empirical testing. That said, future research should incorporate other salient antecedents. Research on eRAs is, and will likely continue to be, important. As eRA technology advances, changes in capabilities may influence both appropriateness as well as the sourcing professional's experiences with eRAs. Thus, in addition to examining antecedents, future research should also seek to identify potential moderators. For example, all informants but one believed that eRAs offer an ability to achieve a true market price better than non-eRA means. The one exception may be buyers highly skilled in price analysis and negotiation; thus, buyer skills may be an interesting moderator to explore.

Another facet of eRA use ripe for further research involves the extent of integration into any particular source selection. Although as previously mentioned, using an eRA to source goods or services is a go/no go decision, the extent to which the eRA encapsulates the entire sourcing process varies from purchase to purchase. Based on previous research (Kaufmann and Carter, 2004) and our preliminary data, factors expected to drive a decision to integrate an eRA into a broader source selection (versus a pure e-auction) include: specificity, the predominance of price in the supplier selection decision, the market niche of the eRA service provider, buyer skills, and the criticality of the goods or services. Pure e-auctions are sufficient where:

- the requirement can be completely defined to the point of complete, common understanding among all bidders; and
- bid prices provide all the information a buyer needs to make a selection decision (Kaufmann and Carter, 2004).

Our research unveiled at least one eRA service provider that prefers to operate in this niche market of pure e-auctions; thus, the procuring organization's choice of eRA service provider could impact whether eRAs will be integrated into broader source selections. Additionally, we found that some buyers who use eRAs exclusively in this niche are not sufficiently skilled to integrate eRAs into a broader source

selection (i.e. to integrate eRA-determined prices into evaluations of non-price factors such as past performance and technical capability). Thus, buyer skills may affect the extent to which eRAs are integrated. Finally, the criticality of the goods or services determines the extent of eRA integration. Goods and services that are highly critical to the procuring organization's mission or profitability are likely to involve the evaluation of non-price factors (in addition to price) in order to mitigate supply risk. As eRA use diffuses, more sophisticated integration is inevitable. Much is at stake for buyers, suppliers, and eRA service providers; therefore, any fog that further research can clear should facilitate progress.

## Summary

In summary, the eRA tool development and employment comprises a significant advancement in the realm of corporate procurement. Its ability to close the gap between prices paid and true market prices assures continued use. Sourcing professionals have the option of using eRAs in many procurement situations. We suggest that there are situations where eRA use is appropriate and many where it is not. We also suggest that the factors that drive the decision (not) to use eRAs go beyond rational, more objective factors and include several internal and human factors. If eRAs are to be utilized, managers must take care to consider both sets of factors so that eRAs are used appropriately and for the right reasons. This model both integrates and extends the works of previous researchers. Key contributions include:

- the mediating effect of perceived eRA appropriateness;
- integrating individual level variables that affect one's decision to source via eRA; and
- a comprehensive summary of eRA research.

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Appendix 1

Table A1

Author(s)	Year	Journal	Empirical/ Conceptual	Antecedents to e- RA use	Consequences to e-RA use	Support/ Oppose/ Neutral	Key findings
<i>Antecedents to conceptual model</i>							
Arbin and Hultman	2003	<i>12th International IPSERA Conference Proceedings</i>	E Case study Interviews 3 Auctions	Rapidly changing market prices due to: Oversupply Scarcity Strategic products Competition Expected savings Buyer power Standardized offerings		S	Data suggests that strategic products (per Kraljic, 1983) are suitable for e-RA sourcing
Beall, Carter, Carter, Germer, Hendrick, Kaufmann, Maciejewski, Monczka, and Petersen	2003	<i>CAPS Focus Study</i>	E Structured interviews with buyers, suppliers, non-users, and market makers	Sourcing strategy Category of spend (non-critical, leverage and bottleneck) Competition Specificifiability Acceptable switching costs Suppliers willing to participate Current price > market price Excess supplier capacity High quality commoditized – no longer a differentiator Top management support Ease of use	Savings lower than expected Cycle time savings Cost reductions Market intelligence to suppliers Reduced selling costs for suppliers Quicker award Increased productivity of buyer Increased efficiency Increased inventory turnover	S	Comprehensive evaluation of e-RA use including: rationale for use, benefits, dysfunctional aspects, process, descriptive statistics of usage, sustainability, implementation strategies, characteristics of (un)successful e-RAs, emerging issues, and ethical issues Includes 4 case studies
Carter, Kaufmann, Beall, Carter, Hendrick, and Petersen	2004	<i>Transportation Research, Part E, Logistics and Transportation Review</i>	E Case study; structured interviews with 15 market makers, 16 buyers, and 15 suppliers	Top-down implementation approach Competition Purchase volume	Decreased cycle times Increased buyer productivity Damaged supplier relationships Decreased trust Supplier bankruptcy Supplier-initiated changes Supplier non-performance Suppliers cut corners on safety Perceptions of ethical improprieties	N	Developed grounded theory of e-RA use resulting in 14 hypotheses Training buyers and suppliers can overcome e-RA implementation barriers Buyers view e-RAs more favorably than do suppliers Both parties perceive the ethicality of e-RA use differently Rank-based auctions are more successful than are price-based auctions Auctions using multiple lots are more successful than those of single lots Suppliers are unsuccessful in their first e-RA

(continued)

Table A1

Author(s)	Year	Journal	Empirical/ Conceptual	Antecedents to e- RA use	Consequences to e-RA use	Support/ Oppose/ Neutral	Key findings
Guillemaud, Farris, Hawkins, and Roth	2005	<i>90th Annual International Supply Management Conference Proceedings</i>	C	Competition	Price reductions (12-24%) Suppliers reduce their costs of sales Supply chain efficiency Savings erosion	S	Presents two trends in e-RA use Adherence to sound guidelines (6 guidelines identified) Suppliers adopting e-RAs Identifies 4 business models of e-RA providers (Outsourced, Consultative, Software, and ASP) Benefits of e-RA use Cost reduction Price reduction Time reduction Pain reduction
Hartley, Lane, and Hong	2004	<i>IEEE Transactions on Engineering Management</i>	E <i>n</i> = 163 RR = 20% Chi square analysis	*Business size/ revenue Competition (conceptually suggested)		S	No difference in importance of cost management and supplier collaboration between e-RA users and non-users e-RA users have higher revenues e-RA use and supplier collaboration are not mutually exclusive Provides scales of 2 dimensions of purchasing objectives (supplier collaboration and cost management)
Jap	2002	<i>Journal of the Academy of Marketing Science</i>	E Survey of 54 sourcing managers	Product characteristics: Price is the largest component of value Non-strategic Sourcing strategy Supply-base characteristics: Excess capacity Competition Senior management influence	Reduce costs Reduce cycle time Damage supplier relationships Increase business opportunity for suppliers Commoditization Supplier retaliation	N	e-RAs are here to stay Identifies when, how, and why e-RAs should be used Reviews types of auctions Provides an agenda for future research Reviews auction formats Reviews results of e-RAs Buyer should evaluate effect of e-RA on total costs A "huge area of potential research" involves when e-RAs should be used How the buyer uses the e-RA might have an effect on supplier relationships rather than use of the tool itself Examined effect of e-RA use on supplier performance – found no effect

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Table A1

Author(s)	Year	Journal	Empirical/ Conceptual	Antecedents to e- RA use	Consequences to e-RA use	Support/ Oppose/ Neutral	Key findings
Kaufmann and Carter	2004	<i>Journal of Supply Chain Management</i>	E Structured Interviews with buyers, suppliers, non-users, and market makers	Specifiability Attractiveness of the auction Competition Degree of rivalry among suppliers Trust in the new process/system Dollar volume of auction Supplier's excess inventory Supplier production capability Fewer number of selection criteria Human factor not required	Purchase process improvements Better purchase prices Decreased negotiation time	S	Examines the feasibility and appropriateness of e-RAs Discusses the 4 basic auction types (English/Japanese, Dutch, first-price sealed bid, second-price sealed bid) in a seller's auction, then shows their equivalents in purchasing auctions Identifies negotiation types: pure face-to-face (F2F); almost-pure F2F; auction-integrated; and pure electronic auctions Advantages of e-RAs: increased transparency, reduced F2F, facilitate global sourcing, lower purchase price e-RAs will become standard procurement tools Multi-attribute e-RAs are used infrequently due to complexity
Mabert and Skeels	2002	<i>Business Horizons</i>	C	Quality RFQ Competition Strategic item/service Attractive bid lots Specifiability Excess capacity Low vendor qualification costs Low switching costs No contract barriers Few supplier preferences Buyers and suppliers electronically enabled	Costs of market makers Purchase price reduction	S	e-RA is a tool that needs to be used correctly to be effective Details e-RA use by a Fortune 100 firm and by the US Navy Need to understand total costs
Sashi and O'Leary	2002	<i>Industrial Marketing Management</i>	C	Available technology Expected savings Prequalifying bidders Type of product (e.g., MRO) Detailed RFQ Competition	Larger market Less inventory Lower transaction costs Cost savings Efficient pricing Less cycle time Lower margins Fees to intermediaries Reduce the number of supplier relationships needed Globalization Available market intelligence (pricing data) Reduced risk of single-sourcing Altered channel structure	N	Identifies types of web auctions Examines circumstances conducive to e-RAs Identifies (dis)advantages to e-RA use Details the role of intermediaries (market makers) e-RA use is permanent

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Table A1

Author(s)	Year	Journal	Empirical/ Conceptual	Antecedents to e- RA use	Consequences to e-RA use	Support/ Oppose/ Neutral	Key findings
Schrader, Schrader, and Eller	2004	<i>Journal of Business-to-Business Marketing</i>	C	Type of product Commodities Low volume/high cost Medium volume/medium costs High volume/low cost Procurement strategy fit Thorough specifications Advance planning Purchase situation Market situation	Decrease supplier base/ competition Lower inventory costs Reduced purchase costs Reduced total costs Increased productivity Decreased selling costs to suppliers Increased opportunity for suppliers Transparency in bidding process Decreased transaction costs Commoditizes supplier's offering Supplier forced out of market Eliminate relationship economies Increased channel conflict Decrease supplier's brand premium Decreased supplier margins Decreased supplier participation Higher prices long term (due to fewer suppliers) Increase gaming	S	Developed a set of propositions for e-RA use Case study of GE Appliance's extensive use of e-RAs
Smart and Harrison	2002	<i>International Journal of Logistics: Research and Applications</i>	E Case study n = 6	Low product complexity Competition Low switching costs	Price reductions (up to 37%) Price visibility Efficiency Reduced purchasing effort Lower transaction costs Lower cycle time Switching costs Costs of conducting the e-RA	S	e-RAs enable flexible supply chains Close, collaborative relationships are not always needed Emphasizes a mixed-portfolio strategy in supplier management as in Kraljic (1983) Provides an e-procurement solutions segmentation (2 × 2) matrix depicting where each type of e-procurement is appropriate in terms of number of suppliers and product complexity

(continued)

Table A1

Author(s)	Year	Journal	Empirical/ Conceptual	Antecedents to e- RA use	Consequences to e-RA use	Support/ Oppose/ Neutral	Key findings
Smeltzer and Carr	2002	<i>Business Horizons</i>	C	Dollar volume of auction Supplier excess inventory Supplier production capability Cycle time Specifiability Elasticity of market price Competition Skilled workers Accurate forecasted demand Information system	Expand sellers market penetration Decreased cycle time Reduced purchase prices Reduced administrative costs Decrease inventory Decreased buyer loyalty to seller Unrecoverable investments by supplier Destroy seller's trust Increase market effectiveness Increase market efficiency	N	"The appropriate use of reverse auctions is simply as a managerial tool. It will be successful only when used correctly within the strategic sourcing and marketing processes (p. 52)."
Smeltzer and Carr	2003	<i>Industrial Marketing Management</i>	E Non-directive interviews <i>n</i> = 41	Specifiability Sufficiently-large purchase lot Appropriate supply market conditions Competition (at least five suppliers) Excess supply capacity Elastic market price Correct organizational infrastructure Strategic sourcing Skilled purchasers Forecast accurate demand	Expand sellers market penetration Decreased cycle time Reduced purchase prices Reduced administrative costs Decrease inventory Increase market efficiency	N	Identifies reasons for buyer use of e-RAs Identifies reasons for supplier participation in e-RAs Identifies risks to buyers and suppliers Identifies conditions required for e-RA success
Talluri and Ragatz	2004	<i>Journal of Supply Chain Management</i>	C	Specifiability Emphasis on price as a selection criteria Low switching costs Competition No well-established commodity market Non-strategic spend		N	Identifies auction types (English, single and multiple-round sealed bid, and Vickery) and (dis)advantages thereto Declares that "leverage" and "non-critical" spend categories are suitable for e-RA sourcing Use of multiple-attribute e-RAs is limited Recommends the analytic hierarchy process technique to resolve the winner determination problem where non-price factors need to be considered

(continued)

Table A1

Author(s)	Year	Journal	Empirical/ Conceptual	Antecedents to e- RA use	Consequences to e-RA use	Support/ Oppose/ Neutral	Key findings
Wagner and Schwab	2004	<i>Journal of Purchasing and Supply Management</i>	E Case survey method <i>n</i> = 23 Logistic regression	*Available time-to-auction *Competition *Specifiability		N	Summarizes contributions of 22 publications covering e-RAs The majority of publications are conceptual or qualitative e-RAs research is still in infancy Statistically significant antecedents to e-RA success are annotated in the antecedents column
<i>Other proposed antecedents</i>							
Bichler and Kalagnanam	2005	<i>European Journal of Operational Research</i>	C	Multiple attributes (selection criteria) Configurable offers (e.g., volume discount)	Market efficiency Flexibility	N	Extends multi-attribute e-RAs to facilitate the winner determination problem via multiple sourcing and configurable offers
Carter and Stevens	2006	<i>Journal of Operations Management</i>	E Experiment 2 × 2 × 2 mixed design ANOVA <i>n</i> = 96	Auction structure (combination of variables)	Buyers' cost reduction Suppliers' perception of buyer opportunism	N	"The combination of rank (versus price) visibility, high (versus low) supplier need to win a contract, and six (versus three) competitors was significantly more effective than other combinations of variables in immediately reducing bid prices" "Increased supplier experience with e-RAs leads to decreases rather than increases in final bid prices" Suppliers' perceptions of buyer opportunism increase over time A combination of rank visibility and suppliers with a high need to win the contract increases suppliers' perceptions of buyer opportunism
Emiliani	2004	<i>Industrial Marketing Management</i>	C	Buyer's ignorance of true cost structure of self and suppliers Buyer power Unit-price (versus total cost) focus Competitive pressures Cost savings potential	Reduced purchase price Erosion of savings Create distrust Damage buyer's long-term performance Re-sourcing to incumbent supplier Retaliatory pricing Decrease competitiveness of buyers and sellers	O	Examines the use of e-RAs in the aerospace industry (buyer-designed and specified components) e-RAs are a technology-assisted version of power-based bargaining Buyers need to examine total costs versus unit price Need improved knowledge of successful application for e-RA

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Table A1

Author(s)	Year	Journal	Empirical/ Conceptual	Antecedents to e- RA use	Consequences to e-RA use	Support/ Oppose/ Neutral	Key findings
Emiliani	2005	<i>Industrial Marketing Management</i>	E Content analysis (methodology not elaborated)	Buyer's emphasis on purchase-price variance Power	Decrease margins Supplier's loss of business Distrust Damaged relationships Buyer's dissatisfaction with e-RA results Overstated savings Declining supplier participation	0	Reviews industry-specific codes of conduct and white papers for participants of e-RAs Codes of conduct and white papers seem to have been ineffective in expanding and improving e-RA use, building trust, and preventing abuses Codes of conduct for e-RAs are an afterthought versus a best practice
Emiliani	2006	<i>Supply Chain Management: An International Journal</i>	C	Senior manager influence – decision-making trap: Anchoring Status quo Sunk cost Confirming evidence Framing Estimating/ forecasting Overconfidence Prudence Recallability Use of purchase-price variance metric Competitive pressure		0	Describes how buyers fail to consider 9 hidden decision-making traps often encountered in deciding whether to source via e-RA Uses Hammond <i>et al.</i> (1998) as a framework
Emiliani and Stec	2002b	<i>Supply Chain Management: An International Journal</i>	C	Buyer's perception that costs are too high Need to optimize financial performance Batch-and-queue processes Local optimization focus Firm goals Firm rewards Senior management emphasis	Reduced competitiveness of buyers and sellers Savings erosion	0	Examines use of e-RAs for custom-designed machined parts From (unsubstantiated) "5 Whys" analysis, the root cause of e-RA use "is local optimization of the business system along functional, managerial, or financial dimensions"

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Table A1

Author(s)	Year	Journal	Empirical/ Conceptual	Antecedents to e- RA use	Consequences to e-RA use	Support/ Oppose/ Neutral	Key findings
Gattiker, Huang, and Schwarz	2006	<i>Journal of Operations Management</i>	E Simulation experiment n = 117 Student sample	Low procurement complexity	Decreased seller trust in buyer	N	Compares email negotiation, e-RAs, and face-to-face negotiation Information richness (via face-to-face negotiation) shows higher trust in buyer by supplier than e-RA and email Some advantages of email over e-RA With e-RA, a more complex procurement further decreases seller trust With email, a more complex procurement increases seller trust Buyers must match the tool to “the procurement situation and with the relative importance of various outcomes desired”
Jap	2003	<i>Journal of Marketing</i>	E Experiment 1 Buyer 6 e-RAs n = 68Suppliers 44% RR ANCOVA	Transactional exchange	*Increased supplier perception of buyer opportunism	N	Supplier suspicion of buyer opportunism is greater in open versus sealed bid auctions Supplier suspicion of buyer opportunism is greater among incumbents than new suppliers Suppliers do (do not) increase their willingness to make idiosyncratic investments when sourcing via sealed bid (open auction)
Joo and Kim	2004	<i>Journal of Purchasing and Supply Management</i>	E n = 42 47% RR Discriminant analysis	*External pressure (competition) *Firm size		N	A study of factors influencing e-marketplace adoption Power as an antecedent of e-marketplace adoption was not statistically significant
Nair	2005	<i>Supply Chain Management: An International Journal</i>	C	Known order volume Clear e-RA process Clear terms	Reduced time to award contract Efficiency Buyer-seller mistrust High long-term learning costs associated with relationship Industry consolidations	N	Research paper focusing on e-RA use in the transportation sector Buyer must base their decision to use a e-RA on relational factors – not just price reduction
Ruzicka	2000	<i>9th International IPSERA Conference Proceedings</i>	C	Risk (supply availability, quality requirements, safety/environmental reliability) Total relevant value (annual spend volume)	Quality of final negotiated agreement e-RA future reuse	S	Reviews auction theory Offers antecedent conditions where an e-RA is an appropriate sourcing method

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Table A1

Author(s)	Year	Journal	Empirical/ Conceptual	Antecedents to e- RA use	Consequences to e-RA use	Support/ Oppose/ Neutral	Key findings
Teich, Wallenius, Wallenius, and Koppius	2004	<i>European Journal of Operational Research</i>	C	Structuring the e-RA Winner determination Closing rules Type of e-RA Information displayed Reservation price Bid decrement	Procurement efficiency Sales channel for sellers Reduced costs for buyers	N	Distinguishes between multi-attribute e-RAs (considers multiple selection criteria such as quality, delivery, and warranty) and multiple-issue e-RAs (considers differing quantities) Provides a glossary of auction-related terms Distinguishes between auction (one to many) and negotiation (only two parties) Lists/explains 18 auction structure characteristics that must be decided by the user Identifies 9 multi-attribute e-RA service providers and features of each e-RA service providers have consolidated Presents approaches for solving the winner determination problem How to develop the buyer's value function (four methods) Presents means to judge the performance of various auctions

Note: \* Statistically supported at the 0.05 level of significance or better

## Appendix 2

Table All Proposed scale

Construct	Proposed item
Excess supplier capacity/inventory	<ol style="list-style-type: none"> <li>1. Our market research revealed that at least one prospective reverse auction participant had excess inventory prior to the bidding event</li> <li>2. Our market research revealed that at least one prospective reverse auction participant had excess production capacity prior to the bidding event</li> <li>3. Based on our market research, we believed there was excess inventory in the supply base</li> <li>4. The supply market for the item/service was best characterized as oversupply</li> <li>5. At least one prospective supplier needed our business due to having either excess inventory or excess production capacity</li> </ol>
Purchase volume	On the sourcing event in which you used a reverse auction, what was the pre-auction estimated value in US dollars? _____
Specifiability	<ol style="list-style-type: none"> <li>1. To what extent was it possible to communicate all technical or performance requirements/specifications to the suppliers completely with little risk of supplier misinterpretation?</li> <li>2. For the reverse auction, suppliers completely understood all performance requirements</li> <li>3. For the reverse auction, the chance of a supplier misinterpreting the requirements was very low</li> </ol>
Category of spend <sup>a</sup>	<ol style="list-style-type: none"> <li>1. The item/service I procured via reverse auction was best characterized as the following type of spend: <i>Non-critical; Leverage; Bottleneck; Strategic</i></li> </ol>
Competition	<ol style="list-style-type: none"> <li>1. A sufficient number of suppliers wanted to win my business</li> <li>2. There is ample competition in the market for these items/services</li> <li>3. If our supplier for the auctioned items/services is not performing to standards, we can find another supplier</li> </ol>
Expected savings	<ol style="list-style-type: none"> <li>1. Prior to the reverse auction, what percentage of the estimated value of the procurement did you expect to save? _____</li> </ol>
Social influence	<ol style="list-style-type: none"> <li>1. My leaders push for increased use of reverse auctions</li> <li>2. Leadership (e.g. CEO, COO, CPO, Commodity Director, Supply Chain Mgr) strongly encourages reverse auction use</li> <li>3. Leadership establishes periodic (e.g. annual, quarterly) goals for using reverse auctions</li> </ol>
Buyer confidence	<ol style="list-style-type: none"> <li>1. For the item/service procured via reverse auction, prior to the reverse auction, it was difficult to accurately estimate its value</li> <li>2. Our pre-auction estimated value of the procurement was not reliable</li> <li>3. Had I used a method other than a reverse auction, I doubt I would have obtained the best deal</li> <li>4. Had I used a method other than a reverse auction, I may not have obtained the best price</li> <li>5. Sometimes when I do not use a reverse auction, I am unsure whether I obtained the best price</li> </ol>
Prior eRA sourcing satisfaction (adapted from Jap, 2002)	<ol style="list-style-type: none"> <li>1. On the last reverse auction in which I participated, the results of the reverse auction met or exceeded my expectations</li> <li>2. I am satisfied with the results of the last reverse auction in which I participated.</li> <li>3. The last time I used a reverse auction, I was pleased with the experience</li> </ol>
Perceived eRA appropriateness	<ol style="list-style-type: none"> <li>1. Based on our sourcing strategy, a reverse auction was the best means to source our requirement</li> <li>2. A reverse auction was the best means to achieve our sourcing goals</li> <li>3. I used a reverse auction because the projected savings exceeded the cost of the auction</li> </ol>

Note: <sup>a</sup>Must provide definitions of the four categories from Kraljic's (1983) framework

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