

AN EMPIRICAL EXAMINATION OF REVERSE AUCTION APPROPRIATENESS IN B2B SOURCE SELECTION

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Electronic reverse auctions (e-RAs) are receiving attention as an effective strategy for reducing the price of purchased goods and services. To optimize their use, sourcing professionals will need to match firm requirements to market characteristics and supplier capabilities through the application of optimal sourcing strategies. To date, explanations of why sourcing managers decide to utilize an e-RA strategy are incomplete. This study relies upon strategic sourcing concepts coupled with extant research on e-RA use to develop a conceptual model of antecedents to the perceived *appropriateness* of e-RA usage. The model is tested and supported via structural equation modeling. Findings demonstrate that a sourcing professional's perception as to the appropriateness of using an e-RA for sourcing a particular requirement is influenced by (1) the specifiability of the requirement (2) supplier competition, (3) leadership influence, and (4) a price-based selection criterion. Further, a requirement with higher specifiability was found to increase competition in an e-RA bidding event. Contributions to theory, practice, and future research directions are identified.

Keywords: reverse auction; sourcing strategy; leadership; specifiability; competition

INTRODUCTION

Sourcing continues to become more strategic in nature because: (1) it is a key link between an organization and its suppliers that "play a critical role in supporting a firm's competitive strategy, whether it be cost leadership, differentiation, or a mixed strategy" (Ellram and Carr 1994, p. 17), and (2) the explosive increase in outsourcing goods and services. Therefore, sourcing innovations that enhance the organization's competitive advantage and financial performance (Ellram and Carr

1994; Ittner, Larcker, Nager and Rajan 1999) are receiving increased attention in business and academic literature.

One sourcing innovation receiving increased attention is the use of electronic reverse auctions (e-RA). An e-RA is an online, downward bidding event that links supply managers and suppliers in real time (Beall, Carter, Carter, Germer, Hendrick, Jap, Kaufmann, Maciejewski, Monczk and Petersen 2003). In an e-RA online market, supply managers post bid schedules for products or services they are purchasing (or plan to purchase over a prescribed timeframe), and multiple suppliers bid to win the purchase business. In a number of cases, e-RAs are substituting for traditional, asynchronous, paper-based or email-based requests for proposals and subsequent face-to-face negotiations.

Currently, e-RAs are the focus of much discussion among academics and practitioners. E-RAs are viewed as

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having the potential to reduce the price of purchased goods and services as much as 5–40 percent (Tully 2000) with an average of 15–20 percent (Cohn 2000; Guillemaud, Farris, Hawkins and Roth 2005). Researchers suggest that e-RAs provide an opportunity for firms to contribute to a position of competitive advantage by reducing the price and the transaction costs associated with purchasing goods and services (Reck and Long 1988; Monczka 1992; Ellram and Carr 1994; Cohn 2000; Tully 2000). E-RAs have also been cited as a means to reduce procurement lead time allowing sourcing professionals to concentrate on strategic issues (Carbone 2005; Percy, Giunipero and Wilson 2007). However, e-RA use is also criticized because it may negatively affect relationships with suppliers (e.g., Jap 2003; Emiliani and Stec 2005; Carter and Kaufmann 2007; Lösch and Lambert 2007; Percy et al. 2007). Some suppliers may view supply managers that use e-RAs as opportunistic (Jap 2003) resulting in lower levels of trust and greater dysfunctional conflict (Carter and Kaufmann 2007). If e-RA use damages relationships with strategic suppliers, the long-term negative consequences may outweigh any short-term benefits. Thus, research that examines how sourcing professionals reach the conclusion that an e-RA is *appropriate* for a particular procurement situation is important. Given the fact that e-RA research is still new, it is not surprising that there is relatively little empirical research exploring the appropriateness of e-RA use (Beall et al. 2003; Joo and Kim 2004; Kaufmann and Carter 2004; Wagner and Schwab 2004). The strategic implications of e-RA use necessitate that researchers and practitioners increase their understanding of how sourcing managers determine e-RA appropriateness.

This work represents a logical next step in e-RA research by moving beyond description and initially developed constructs to provide an initial validation of correlation (Burrell and Morgan 1979; Eisenhardt 1991; Charmaz 2006). Previous e-RA research has been either qualitative or based on small samples as shown in Table I. In framing this research along the research evolutionary model (Burrell and Morgan 1979), our investigation builds on initial categorization to validate proposed theoretical associations. To do so, we examined 27 studies that identified antecedents of e-RA appropriateness. These studies were generally qualitative, conceptual, or, when quantitative, based on small samples. Therefore, the field needs confirmation from a quantitative test of hypotheses using a large, diverse sample of practitioners. Qualitative investigations are the appropriate first step in understanding a phenomenon through organization and categorization of constructs along with the initial stages of inductive theoretical relationship identification (Glaser and Strauss 1967; Charmaz 2006). To make these initial finding generalizable and practically applicable requires deductive validation using quantitative statistical methodology (Hair, Black, Babin, Anderso and Tatham

2006). This investigation provides such confirmation of e-RA theory.

Within the 27 studies, a total of 48 separate antecedents were either suggested or empirically supported (please see Table II). Of these, only five have been statistically related to an aspect of e-RA use. Based on previous research and for the sake of parsimony, we restricted the scope of our study to four of the most-frequently occurring predictors: competition, specificity, selection criteria, and leadership emphasis.

The purpose of this research is to develop and test a model that explains how sourcing managers develop the perception that an e-RA is appropriate in a specific sourcing scenario (see Figure 1). More specifically, we focus our efforts on situations in which a procurement professional used an e-RA and the factors that influenced the degree to which the professional believed that the use of an e-RA was appropriate. Using data from sourcing professionals in Fortune 500 companies, we construct and test a structural equations model (SEM) of e-RA appropriateness. The remainder of the manuscript is organized as follows. First we review the relevant literature and develop the model and hypotheses. Next, we explain the methods and results. Finally, we discuss the theoretical and managerial implications as well as limitations and future research.

LITERATURE REVIEW AND MODEL DEVELOPMENT

e-RA Appropriateness

While a number of these constructs have been linked to e-RA use, little attention has been given to e-RA appropriateness. We define perceived *e-RA appropriateness* as the degree to which a sourcing professional views the use of an e-RA as a fit between the attributes of the tool, the specific requirement being sourced, and the supply market. We assume a strong link between perceived appropriateness, an attitude, and actual appropriateness. The theory of reasoned action (Fishbein and Ajzen 1975; Ajzen 1991) suggests that there is a strong link between attitudes and behavior. Therefore, we argue that perceived e-RA appropriateness precedes a decision to use an e-RA. A sourcing professional may decide to use an e-RA based on factors such as organizational policy, manager mandates, organizational incentives, or other guidelines even when he/she views an e-RA as inappropriate. Further, we hypothesize that perceived e-RA appropriateness is influenced by factors such as competition, specificity, price-based selection criteria and leadership. We further suggest that e-RA appropriateness can indicate success. That is, when an e-RA is suitable given the purchase requirement and the supply market, it is likely to be successful. Given the relevance of e-RA appropriateness to usage decisions and likely outcomes, understanding how e-RA appropriateness is derived is prudent.

TABLE I

Summary of Extant Empirical e-RA Research

Antecedent	Supporting Literature	Methodology	Type of Sample	Sample Size
Competition	Beall et al. (2003)	Case study	Practitioners	17 providers; 16 buyers; 15 suppliers; 9 nonusers
	Carter et al. (2004)	Case study	Practitioners	15 providers; 16 buyers; 15 suppliers
	Hartley, Lane and Hong (2004)	Survey	Practitioners	163
	Jap (2002)	Survey	Practitioners	54
	Kaufmann and Carter (2004)	Case study	Practitioners	15 providers; 16 buyers; 15 suppliers
	Smart and Harrison (2002)	Case study	Practitioners	6
	Smeltzer and Carr (2003)	Case study	Practitioners	41
	Wagner and Schwab (2004)	Case survey	Practitioners	23
Specifiability	Beall et al. (2003)	Case study	Practitioners	17 providers; 16 buyers; 15 suppliers; 9 nonusers
	Kaufmann and Carter (2004)	Case study	Practitioners	15 providers; 16 buyers; 15 suppliers
	Wagner and Schwab (2004)	Case survey	Practitioners	23
Price-based selection criterion	Emiliani (2006)	Content analysis		
	Jap (2002)	Survey	Practitioners	54
Leadership	Beall et al. (2003)	Case study	Practitioners	17 providers; 16 buyers; 15 suppliers; 9 nonusers
	Carter et al. (2004)	Case study	Practitioners	15 providers; 16 buyers; 15 suppliers
	Emiliani (2006)	Content analysis		
	Jap (2002)	Survey	Practitioners	54

Hypotheses

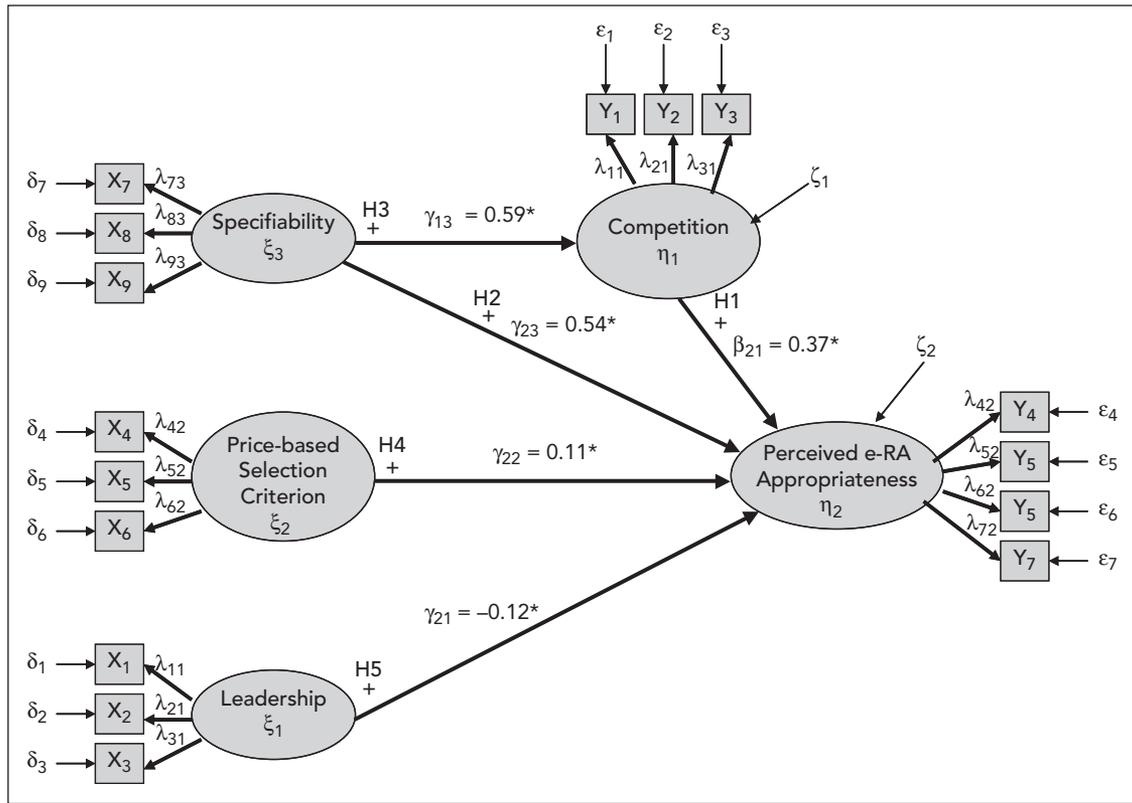
Our research extends the extant literature by integrating previously researched constructs into a single model and empirically testing the model using a large, diverse sample of sourcing professionals. For the purpose of this research note, with the exception of H3, we limit our discussion of the hypotheses that have received previous support in the literature. A summary of the supporting research is provided in Table I. Therefore, in short, we hypothesize the following:

H1: The greater a sourcing professional's perception of higher levels of competition, the greater is his or her view of e-RA appropriateness.

H2: There is a positive relationship between specifiability and a sourcing professional's perception of e-RA appropriateness.

Schoenherr and Mabert (2007) suggest that successful e-RAs hinge on obtaining adequate competition (Wagner and Schwab 2004). They found that more suppliers are likely to bid on standard products or services due to less differentiation. Hence, more suppliers are able to discern that they possess the capability to satisfy the need. Additionally, where a supply manager's requirement is better defined, the suppliers' uncertainty as to whether its product or service can meet the supply managers is likely reduced. With less uncertainty about the effort and

FIGURE 1
Structural Model of Determinants of Reverse Auction Appropriateness in B2B Source Selection.



resources needed to satisfy the supply manager’s requirement, suppliers can better predict their costs to perform. This decreased uncertainty and increased confidence in predicted costs enables suppliers to assume less risk — an essential aspect in competing in the hypercompetitive, often firm-fixed price environment of an e-RA. Less risk should invite more participation in the e-RA. Provided that (1) increased competition improves e-RA results and (2), a better specified requirement provides a more favorable, more informed bidding environment, we hypothesize that:

- H3:** There is a positive relationship between specificifiability and competition. Additional hypotheses that have received previous support in the literature include:
- H4:** A dominant price-based selection criterion will positively influence a sourcing professional’s view of e-RA appropriateness.
- H5:** There will be a direct, positive relationship between leadership emphasis to source via e-RAs and the sourcing professional’s perception of e-RA appropriateness.

The proposed model addresses the sourcing professional’s assessment of the appropriateness of e-RA use for sourcing specific requirements. The principle arguments are that: (1) a reverse auction is an appropriate sourcing methodology in certain circumstances and inappropriate

in others; (2) that specificifiability not only influences e-RA appropriateness, but also enhances competition and (3) that leaders affect perceived e-RA appropriateness.

METHODS AND RESULTS

Sampling Procedures

E-RA users are difficult to identify since only a fraction of sourcing professionals have used e-RAs. To target the population of users, we relied on points of contact within organizations that use e-RAs. Similar to the procedure reported in Petersen, Ragat and Monczka (2005), a solicitation to assist in the research was delivered via email directly to the purchasing vice presidents or chief procurement officers from a list of Fortune 500 firms based in the United States. Of the 507 invited, 258 confirmed receipt and 50 agreed to participate. The supply management executives from the 50 organizations collectively agreed to distribute the survey invitation to a total of 486 of their sourcing professionals. The only criteria provided to the supply management executives for selecting sourcing professionals as respondents were a requirement to have experienced an e-RA procurement transaction, and that they must have been involved in the decision to use the e-RA. Since the unit of analysis of the study was the sourcing decision for a specific e-RA transaction, we asked respondents to complete the survey

TABLE III
Industries Represented

Industry	Percentage of Responses
Travel/hospitality	1
Military	1
Consulting	2
Transportation	2
Telecommunications	5
Healthcare	5
Energy	6
Other	6
Food/apparel	8
Computers	11
Finance/banking	11
Manufacturing	18
Consumer prod/retail/ wholesale	23

with a specific e-RA bidding event in mind — one in which they were personally involved. We received 147 responses from the convenience sample (142 usable) yielding a 30.2 percent response rate. This response rate is consistent with rates reported for web-based surveys (Dillman 2000), and with similar logistics research (Larson 2005).

Responses represented a diverse yet balanced representation of industries (Table III). Additionally, reported transactions (Table IV) were diverse representing direct material, indirect material, capital equipment and services. Finally, a broad spectrum of procurement dollar values are represented from a \$785 transaction to a \$300 million spend (mean \$12M; std dev \$32M; median \$2M).

Respondents averaged 9.8 years' supply management experience. When asked about their experience with e-RAs, 28.9 percent self-reported as novice e-RA users (fewer than five e-RA bidding events), 33.8 percent identified themselves as experienced (five to nine e-RA bidding events), and 37.3 percent were expert users (more than 10 e-RA bidding events), offering an even distribution of e-RA experience.

Given the response rate (Lambert and Harrington 1990), we tested for nonresponse bias using the Armstrong and Overton (1977) approach. Using multiple discriminant analysis, we examined responses in the first and fourth quartiles and found no significant difference in mean scores across the survey's 16 salient items. This suggests the absence of non-response bias.

The survey design enabled the detection of faulty and inconsistent responses. One survey item was reverse coded and one was duplicated (Churchill 1979). Additionally, the survey included comment fields inviting respondents to elaborate on their responses. Several

responses were deleted due to extreme differences in ratings for the duplicate question. One response was deleted due to inexperience with e-RA use divulged in the comments field. Thus, the final sample size used for analysis became 142. Responses were absent in three data elements overall. Each missing data point was accommodated via mean substitution since the missing data were determined to be completely at random (Hair et al. 2006).

Measures

In order to follow established survey guidelines concerning survey length (Dillman 2000) and because of the narrowly tailored application of the constructs in the context of e-RA use, simplified measures were developed for leadership, *competition*, perceived *e-RA appropriateness*, *specificity*, and price-based *selection criterion*. Each a priori construct included five items measured with a seven-point Likert scale. A panel of doctoral candidates, some with extensive supply management experience, pre-tested the initial survey instrument. Following modification, the survey was reviewed by e-sourcing managers from two Fortune 500 firms who are acknowledged leaders in e-RA utilization. We also asked academic supply chain experts to review the survey. According to Kerlinger and Lee (2000), positive feedback from subject matter experts can be taken as an indication of content validity. Appendix B contains the resultant measurement scales.

Measure Assessment

Through iterative scale purification (Churchill 1979), the 25 items reduced to 16 across five a priori constructs. For each analysis, items were considered to have loaded to a factor where factor correlations exceeded at least 0.5 on one factor, and were less than 0.38 on any other factor. Items with low factor loadings, excessive cross loadings or those that compromised reliability were discarded. Exploratory factor analysis of the independent variables (Appendix A) with Varimax rotation and a standard of eigenvalues greater than 1.0 yielded five distinct constructs. These measures proved to be sufficiently reliable with final coefficient alphas ranging from 0.77 to 0.85, above the minimum acceptable threshold of 0.70 (Nunnally 1978). Validity was demonstrated via two investigations. First, none of the item inter-correlations exceeded the reliability estimates (Churchill 1979). Second, since three constructs showed cross-loadings greater than the 0.3 limit recommended by Hair et al. (2006), we also examined construct validity using confirmatory factor analysis (Table V). The model demonstrated solid fit indices and statistically significant path coefficients. Significant parameter estimates loading on the intended factors suggested convergent validity (Anderson and Gerbing 1988). Additionally, Table VI shows the average variance extracted (AVE) by each

TABLE IV
Products/Services Variety

Description	Description
Magnetic stripe readers	Ingredients
4-oz developer bottles	Janitorial paper supplies
Airbag	Leasing equipment
Aircraft batteries	Life insurance/accidental death
Armored car services	Macromedia software
Autos	Meeting and events
Beef	Multifunction devices – managed print
Blisters	Office supplies
Cable assemblies	Personal computers
Cafeteria/employee breakroom equipment	Plastic credit cards
Casework/built-ins for store	Plastic cups
Chemicals – caustic	Plastic injection molding
Collections agencies	Plastic resins
Compact V2 out door cabinet	Point of sale authorization terminals
Corrugate packaging	Printing paper
Corrugate shippers	Professional services
Cut-sheet paper	Retail air conditioners
Data processing	Retail boxes
Direct mail components (envelopes, etc.)	Security guard services
Direct services to meet customer needs	Security guards
Displays	Server tapes
Drilling service	Sheet metal chassis
Electricity meters	Soft packaging
Energy—electricity	Software upgrade
Frozen storage	Specialty millwork
Gasoline	Supermarket shelving system
Harnessing	Temp labor, recruitment, etc.
HDPE pipe	Trade show services
IBM System p series servers	Transportation

construct; all exceed the 0.50 minimum demonstrating convergent validity (Fornell and Larcker 1981). We then compared each AVE to the variance shared between constructs. None of the shared variances approached the AVE providing sufficient evidence that the constructs were indeed unique (Lam, Shanka and Murthy 2004). These analyses indicate acceptable levels of reliability and construct, convergent, and discriminant validity.

Additionally, since our data included some instances of multiple responses from the same firm, we tested for

firm-level effects using MANOVA. We identified nine firms that had more than six respondents. Firms that had less than six respondents were aggregated into one group. We tested for differences in the five constructs in the model across these ten groups. At the 0.05 significance level, we found differences between three of the ten groups, but only on one construct each. Out of 50 possible differences, we found three. Given a large number of potential differences, some will emerge by chance. Overall, there was little evidence of firm-level effects.

TABLE V
Measurement Model Diagnostics

	$\chi^2(df)$	Measurement Model Diagnostics							
		p-value	SRMR	GFI	AGFI	CFI	NFI	IFI	RMSEA
Measurement model	130.78 (94)	0.007	0.058	0.90	0.85	0.97	0.92	0.97	0.053

TABLE VI

Convergent and Discriminate Validity

	Leadership	Specifiability	Price-based Selection Criterion	Competition	Perceived e-RA Appropriateness
Leadership	0.65				
Specifiability	0.04	0.59			
Price-based Selection Criterion	0.01	0.00	0.58		
Competition	0.01	0.27	0.00	0.53	
Perceived e-RA Appropriateness	0.00	0.26	0.03	0.22	0.60

Values on the diagonal (bold-faced) represent the construct's average variance extracted. The remaining values represent the amount of variance shared between constructs.

RESULTS OF HYPOTHESIS TESTING

We used LISREL version 8.8 to compute maximum likelihood estimations of parameter values based on the variance/covariance matrix. We used a number of fit statistics including those suggested by Bagozzi and Yi (1988), Bentler (1990, 1992), and Hair et al. (2006). While the chi square statistic is significant ($\chi^2(96df) = 131.99, p < 0.009$), this is not unusual. Research suggests that higher-order models will almost assuredly fail a chi square test and recommends more appropriate measures of fit (Fornell 1983). A global assessment of alternative fit indices supports the model (see Table VII). The goodness of fit index (GFI) meets the "rough guideline" of 0.90 (Bagozzi and Yi 1988, p. 79), and the Standardized Root Mean Square Error of Approximation (SRMR) of 0.059 is much lower than the 0.08 threshold (Hair et al. 2006). Additionally, the ratio of chi squared to degrees of freedom (1.37) is much lower than the standard 2.0 (Carmines and McIver 1981), further suggesting a good fit.

Table VII displays the results of the structural equations modeling procedure per the model in Figure 1. Significant support was found for H1, H2, and H3, and marginal support was found for H4 and H5. Specifically:

- H1:** Consistent with expectation, the degree of competition in the bidding event for the purchased goods/services positively influenced the perceived appropriateness of e-RA sourcing ($t = 3.54, p < 0.001$).
- H2:** The hypothesis that the ability to clearly specify the salient requirements of a purchased good/service will positively influence perceived e-RA appropriateness was supported ($t = 3.98, p < 0.001$).
- H3:** As predicted, specifiability also promotes competition in the bidding event for the goods/services ($t = 6.41, p < 0.001$).
- H4:** A predominantly price-based selection criterion marginally affects perceived e-RA appropriateness ($t = 1.40, p < 0.10$).
- H5:** The hypothesis that leadership impacts the perceived appropriateness of an e-RA as a sourcing

strategy was marginally supported ($t = -1.49, p < 0.10$).

The results show that 55 percent of the variance in the dependent variable, *perceived e-RA appropriateness*, is explained by a combination of *specifiability*, *competition*, *price-based selection criterion*, *leadership*, and by the path: *specifiability-to-competition*. Table VIII displays the means, standard deviations, reliability estimates, correlations, and covariances of all five constructs.

DISCUSSION AND IMPLICATIONS

This research supports and extends existing quantitative and qualitative research by empirically examining relationships among constructs thought to influence sourcing professionals to use e-RAs. These findings both quantitatively confirm qualitatively derived e-RA theory and yield new insights.

The results of our first three hypotheses are consistent with the extant literature on e-RAs (Ruzicka 2000; Smart and Harrison 2002; Beall et al. 2003; Smeltzer and Carr 2003; Kaufmann and Carter 2004; Emiliani and Stec 2005). Specifiability and competition among suppliers increased the perception of e-RA appropriateness. Furthermore, we find that a well-defined requirement (specifiability) increases the perception of the level of competition in an e-RA bidding event. Therefore, since the success of an e-RA hinges on adequate competition (Wagner and Schwab 2004), sourcing professionals who anticipate using e-RAs should make every effort to thoroughly define their requirements in specifications or statements of work. This will attract more suppliers to participate in the e-RA, further increasing the perception of e-RA appropriateness.

Because some researchers (e.g., Emiliani and Stec 2002b) have suggested that e-RAs are not appropriate for non-price-based source selections, one would expect the price-based criterion to be strongly related to e-RA appropriateness. Hence, where technical factors such as

TABLE VII

Test of Hypotheses: Estimates of Structural Equations Model

Structural Equations:				
1. $\eta_1 = 0.59\xi_3 + \zeta_1$				
2. $\eta_2 = -0.12\xi_1 + 0.11\xi_2 + 0.54\xi_3 + 0.37\eta_1 + \zeta_2$				
Parameters	Path	Standardized Estimate	t-value	
Leadership (ξ_1)				
LDRSHP2 (X1)	λ_{11}	0.81	9.68	
LDRSHP3 (X2)	λ_{21}	0.87	λ_{21} set to 1.0	
LDRSHP4 (X3)	λ_{31}	0.73	8.88	
Selection criteria (ξ_2)				
SELCRIT1 (X4)	λ_{42}	0.60	6.58	
SELCRIT3 (X5)	λ_{52}	0.84	λ_{52} set to 1.0	
SELCRIT4 (X6)	λ_{62}	0.82	7.62	
Specifiability (ξ_3)				
SPEC1 (X7)	λ_{73}	0.72	9.23	
SPEC2 (X8)	λ_{83}	0.90	λ_{83} set to 1.0	
SPEC3 (X9)	λ_{93}	0.66	8.22	
Competition (η_2)				
MKTSTCR4 (Y1)	λ_{11}	0.72	7.87	
MKTSTCR5 (Y2)	λ_{21}	0.63	6.98	
ATTRV2 (Y3)	λ_{31}	0.82	λ_{31} set to 1.0	
e-RA Appropriateness (η_3)				
SRCOBJ3 (Y4)	λ_{42}	0.94	λ_{42} set to 1.0	
SRCOBJ4 (Y5)	λ_{52}	0.70	10.26	
SRCSTRA2 (Y6)	λ_{62}	0.92	17.35	
ACTRET1 (Y7)	λ_{72}	0.44	5.49	
Tests of hypotheses				
Competition to perceived e-RA appropriateness	β_{21}	H1	0.37	2.73
Specifiability to perceived e-RA appropriateness	γ_{23}	H2	0.54	4.29
Specifiability to competition	γ_{13}	H3	0.59	6.71
Price-based selection criterion to Perceived e-RA appropriateness	γ_{22}	H4	0.11	1.74
Leadership to perceived e-RA appropriateness	γ_{21}	H5	-0.12	-1.49
Global model fit diagnostics				
χ^2 (df)			131.99 (96)	
p-value			0.009	
χ^2/df			1.37	
RMSEA			0.052	
IFI			0.97	
GFI			0.90	
AGFI			0.85	
SRMR			0.059	
Bentler and Bonett's NFI			0.92	
Bentler's CFI			0.97	
Critical N			135.46	

Notes: See Figure 1 for a visual representation of parameters.

TABLE VIII

Correlation Matrix

Constructs		Mean	SD	1	2	3	4	5
Leadership	1	5.05	1.65	(0.85)	0.30	0.44	0.15	0.10
Price-based selection criterion	2	3.95	1.58	0.12 ^a	(0.80)	0.10	0.10	0.37
Specifiability	3	5.23	1.32	0.20	0.04 ^a	(0.81)	0.87	0.99
Competition	4	5.60	1.27	0.07 ^a	0.06 ^a	0.52	(0.77)	0.86
Perceived e-RA appropriateness	5	4.93	1.46	0.04 ^a	0.16 ^a	0.51	0.47	(0.85)

Note: Diagonal elements in parentheses are composite reliabilities. The lower diagonal elements are intertrait correlations of summated scales. The upper diagonal elements (bold) represent the covariance matrix.
^aDenotes nonsignificant ($p > 0.05$) correlations; all others are significant at $p < 0.05$.

capability, performance risk, relationship, experience, and past performance are more important than price, the appropriateness of e-RA use has been questioned. While we did not test this proposition directly, our study marginally suggests that sourcing professionals increasingly perceive e-RA use to be appropriate as the importance of price in the winner's determination increases. Given today's economic environment and the significant price reductions delivered by e-RAs, this relationship is not surprising. However, complex (critical) requirements and e-RA sourcing apparently are not mutually exclusive. Our sample included a variety of products and services (Table III) including complicated requirements such as consulting and logistics services. This might be explained by the expanding versatility of e-RAs to accommodate nonprice attributes during the bidding event. Such a non-price based source selection could result from prequalifications where nonprice factors are evaluated for acceptability prior to allowing a supplier to enter the bidding event, or in emerging multiattribute, best-value source selections where price is dynamically bid along with weighted non-price factors. More research is needed in this area, but it is clear that e-RAs are being integrated in more complicated source selections.

In our results, leadership influence was only marginally significant and negatively related (hypothesized to be positive) to e-RA appropriateness. Carter, Kaufmann, Carter, Hendrick and Petersen (2004) suggest that e-RA use is often dictated from the top down. In some cases, this could result in e-RA use in situations that may not be appropriate. Our results suggest that leadership influence may not be as strong of an influence on perceived appropriateness as previously posited. Our results suggest that sourcing managers are more likely to form their opinions of e-RA appropriateness independent of leadership influence. Furthermore, our results also suggest that supply managers might even be less likely to view e-RAs as appropriate when managers attempt to dictate e-RA use.

While our research did not directly explore e-RA success factors, by examining appropriateness, our research may provide a peek into this phenomenon. It may be logical to infer that if a sourcing professional perceives a particular requirement is appropriate for sourcing via e-RA, it is likely to be successful. However, we caution equating a supply manager's perception of appropriateness to e-RA success. A particular product or service in a given supply market may be appropriate for e-RA sourcing, yet the bidding event may not be successful (may not generate the expected savings in dollars or procurement lead time). This could be due to many factors such as incomplete or incorrect market research data, supplier collusion during the bidding event, technical difficulties, etc. Nonetheless, we do suggest that when an e-RA is suitable given the purchase requirement and the supply market, it is likely to be successful. Hence, if factors such as competition, specifiability, price-based selection criterion, and leadership affect sourcing professionals' perceptions of appropriateness, they might also impact e-RA success. Given these assumptions, findings surrounding e-RA appropriateness may yield important insights into the use and outcomes of e-RAs.

We further contribute to the body of e-RA knowledge by developing new scales and modifying or condensing several existing scales including: perceived e-RA appropriateness (new scale), specifiability (first multi-item scale), price-based selection criterion (new scale), and leadership (simplified scale). Based on our analysis, these scales demonstrated reliability and validity and, therefore, can be used by researchers in the future. Researchers are cautioned, however, to amend the scale items by removing references to e-RAs if used in different contexts.

LIMITATIONS AND FUTURE RESEARCH

This study was not without challenges. First, the research design relied upon self-reported data from respondents. While this introduces the potential for

common method bias, our measures were focused on the perceptions of the sourcing professional. Second, the sample included only large firms which limited the study's generalizability. Third, whereas the model explains 55 percent of the variance in the focal construct, we recognize that there are other factors that influence perceived e-RA appropriateness (Table I). Nonetheless, the results suggest that the model represents a parsimonious explanation of perceived e-RA appropriateness, a central tenet of theory development and testing (Whetten 1989). Fourth, due to the difficulty of identifying e-RA users, survey responses were drawn from a convenience rather than a random sample. Additional selection bias may have been introduced through the manner in which organizational contacts were allowed to choose the participating supply managers and how supply managers were allowed to choose the e-RA transaction. Responses may be skewed toward successful e-RAs since people tend to emphasize their successes. However, this potential bias is the price that researchers commonly must pay to ease the burden on respondents who likely suffer from survey fatigue. Fifth, we also used a perceptual measure of perceived e-RA appropriateness as an approximate measure of actual appropriateness. A more objective measure of appropriateness would strengthen future research. The sixth limitation was sample size. SEM using maximum likelihood estimation can be useful with a minimum sample size of 100–150 (Hair et al. 2006). While this study relied on a sample size of 142, samples of at least 200 are preferable (Smith and Langfield-Smith 2004). An inadequate sample size can invalidate fit measures (Smith and Langfield-Smith 2004), and can decrease the reliability of the estimation of sampling error and, therefore, compromise unbiased parameter estimates (Hair et al. 2006). In order to evaluate the impact, if any, our sample size had on the sampling error, the SEM was replicated using single indicators per construct (Smith and Langfield-Smith 2004). The results were consistent with those generated in the model using multiple indicators, suggesting that the results of the SEM were not tainted by a small sample. Finally, the scope of the study was restricted to determining perceived e-RA appropriateness relative to a situation when a supply management professional had utilized an e-RA. Consequences of e-RA use were not examined.

Further research is needed to explore whether our finding of competition enhanced by the specificity of the requirement generalizes to non-e-RA procurement scenarios. Hence, does specificity enhance competition regardless of sourcing methodology? Or, is this effect unique to the e-RA context possibly due to extreme risk to narrow margins if costs are not accurately estimated before the bidding event? Additionally, further research should empirically explore the consequences of e-RA use. This is at the center of much debate (Emiliani and Stec 2002a; Jap 2003; Carter et al. 2004; Hartley, Lane &

Hong, 2004) as to whether e-RAs are beneficial or detrimental and to which part of the supply chain dyad. For example, to what extent does e-RA use affect supplier satisfaction and total cost of ownership?

SUMMARY

This research developed and tested a model that helps to explain how sourcing professionals determine that e-RAs are appropriate for a particular sourcing event. Factors impacting a sourcing professional's judgment include: (1) the amount of competition interested or available to compete in the bidding event, (2) how well the purchase product or service is defined (specificity), (3) leadership influence, and (4) the importance of price in the source selection decision. Interestingly, a more specific product or service stimulates competition in the bidding event. We also developed measurement scales that can be used to replicate and extend existing research on e-RAs. Finally, we suggest that the results from this study provide guidance to managers and serve as part of a foundation for future e-RA research.

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APPENDIX A

Exploratory Factor Analysis — Independent Variables

Factor	1	2	3	4	5
1. Price-based selection criterion					
SELCRIT4	0.880				
SELCRIT3	0.848				
SELCRIT1	0.763				
2. Leadership					
LDRSHP2		0.882			
LDRSHP3		0.869			
LDRSHP4		0.852			
3. Specifiability					
SPEC1			0.821		
SPEC3			0.820		
SPEC2			0.674		
4. Competition					
MKTSTCR5				0.802	
ATTRV2				0.778	
MCTSTCR4				0.716	
5. Perceived e-RA appropriateness					
SRCOBJ4					0.861
SRCSTRA2					0.788
SRCOBJ3					0.763
ACTRET1					0.624
Percentage of variance explained	70.69	76.48	72.85	68.17	67.97
Factor mean	3.95	5.05	5.23	5.60	4.93
Factor SD	1.58	1.65	1.32	1.27	1.46
Cronbach α	0.79	0.83	0.81	0.76	0.81

APPENDIX B

Measurement Scale

Label	Dimension/Items ^{a,b}	Composite Reliabilities
Perceived e-RA appropriateness (I=5, F=4)		0.85
SRCSTRA2	Based on our sourcing strategy, a reverse auction was the best means to source our requirement.	
SRCOBJ3	A reverse auction was the best means to achieve our sourcing goals.	
SRCOBJ4	It would have been difficult to achieve our goals without the use of a reverse auction.	
ACTRET1	I used a reverse auction because the projected savings exceeded the cost of the auction. If a sourcing strategy is not relied upon, a reverse auction may be inappropriately used. ^c	
Leadership (I=5, F=3)		0.85
LDRSHP2	My leaders push for increased use of reverse auctions.	
LDRSHP3	Leadership (e.g. CEO, COO, CPO, Commodity Director, Supply Chain Mgr) strongly encourages reverse auction use.	
LDRSHP4	Leadership establishes periodic (e.g. annual, quarterly) goals for using reverse auctions. To what extent did the following influence your decision to source using a reverse auction: company leaders or managers? ^c My leaders can inspire enthusiasm for reverse auctions. ^c	
Specifiability (I=5, F=3)		0.81
SPEC1	On a scale of 1–7, to what extent was it possible to communicate all technical or performance requirements/specifications to the suppliers completely with little risk of supplier mis-interpretation?	
SPEC2	For the reverse auction, suppliers completely understood all performance requirements.	
SPEC3	For the reverse auction, the chance of a supplier misinterpreting the requirements was very low. We must be able to clearly articulate our requirements in writing, else we will not use a reverse auction. ^c We will only use a reverse auction for items/services that are fixed price (i.e. won't use a reverse auction where other pricing arrangements are necessary such as cost reimbursement, time and materials, level of effort, etc.). ^c	
Competition (I=5, F=3)		0.77
ATTRV2	A sufficient number of suppliers wanted to win my business.	
MKTSTCR4	There is ample competition in the market for these items/services.	
MKTSTCR5	If our supplier for the auctioned items/services is not performing to standards, we can find another supplier. In the event of an interruption in supply or service (e.g., a stockout), I could find another supplier. ^c The availability of competition in this market-space influenced my decision to use a reverse auction. ^c	

APPENDIX B Continued

Label	Dimension/Items ^{a,b}	Composite Reliabilities
Price-based selection criterion ($I=5$, $F=3$)	<p data-bbox="124 422 240 449">SELCRIT1 For the reverse auction, a supplier's past performance record was less important than price.</p> <p data-bbox="124 485 1062 512">SELCRIT3 Low price was the most important selection criterion.</p> <p data-bbox="124 516 1206 737">SELCRIT4 For this reverse auction bidding event, obtaining a low price was most important. For the reverse auction, a supplier's technical capabilities were less important than price.^c If I need to evaluate other nonprice factors (e.g. experience, past performance, technical capabilities), I am less likely to use a reverse auction.^c</p>	0.80
<p data-bbox="89 751 1150 779">^aI, initial number of scale items; F, final number of scale items after measure purification.</p> <p data-bbox="89 783 831 810">^bAll responses were obtained using 7-point Likert-type scales.</p> <p data-bbox="89 814 272 842">^cDropped item</p>		