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Improving e-procurement compliance: The role of user perceptions

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Abstract

Whilst the advent of e-procurement creates significant potential for reduced purchasing costs, the realisation of these savings requires the commitment of internal users towards systems and contracts. In turn, levels of compliance appear to be influenced by user perceptions of e-procurement. This paper examines the extent to which user-perceived e-procurement quality – termed *Perceived EPQ* – impacts on the level of system and contract compliance. The research applies a mixed-methods approach incorporating 58 interviews and a survey of 295 e-procurement users. Analysis of both structured interview and survey data provides strong empirical support for the view that delivering higher levels of service to e-procurement users has a positive effect on the level of both system and contract compliance. For organisations to successfully reduce maverick purchasing, they must carefully consider the expectations of their user base.

Keywords: E-Procurement, Perceived EPQ, Internal Service, Compliance

1. Introduction

E-procurement offers huge potential for lowering prices paid for goods and services, and the costs associated with the purchasing process. However, much of this potential remains unfulfilled due to the failure of end-users to comply with systems or contracts (Croom & Johnston, 2003). Compliance is notoriously hard to force – individuals invariably find a way round things they dislike. Increasingly, academics are positing the view that user perceptions of e-procurement appear to play a significant role in influencing levels of compliance (Harink, 2003; Croom & Johnson, 2003). However, to date, the evidence for such claims remains largely anecdotal. This study uses a mixed-methods approach to empirically test the relationship between user-perceived e-procurement quality – termed *Perceived EPQ* – and both system and contract compliance.

The paper is structured as follows. Firstly, there is an examination of the literature which examines the financial impact of e-procurement, the effect of compliance on procurement costs, and the role of *Perceived EPQ* on both system and contract compliance. This is followed by the study methodology and analysis of both structured interview and survey data. The implications for theory and practice are presented in the conclusion. Finally, limitations and future research opportunities are explored.

2.1 The Financial Impact of E-Procurement

One of the key themes in the existing literature is concerned with the financial impact of implementing e-procurement (McManus, 2002). Broadly, procurement expenditure is influenced by transaction costs and purchase price.

E-Procurement Impact on Transaction Costs

Transaction costs reflect the work involved in processing an order (Croom & Johnston, 2003) and include the cost of supplier search and selection, processing the order requisition, authorisation, order generation, receipting, invoicing and payment. Nolan (1999) suggests that the cost of raising an order and paying an invoice prior to e-procurement implementation usually exceeds £100. Research by Croom and Johnston (2003) puts the figure between £97.60 and £147.50. A number of studies propose

percentage reductions in transaction costs resulting from e-procurement implementation. These include 60% (Croom & Johnston, 2003), 66% (Croom, 2000), and 90% in British Telecom (Woodall, 2000). Others suggest reductions per order, including £100 to £2 (Nolan, 1999), $75 to $3 (Smeltzer & Ruzicka, 2000), and $40-$200 to $1-$20 (Eisenmann, 2002).

Sources of Transaction Savings

Prior to order placement, the use of e-sourcing reduces the time taken to find suppliers of goods or services, increasing the economies of supplier search (Evans & Wurster, 2001; Cox *et al.* 2002a, 2002b; de Boer *et al.* 2002; Narasimhan *et al.* 2003; Presutti, 2003; Harink, 2003; Subramaniam & Shaw, 2004; Croom & Brandon-Jones, 2005). In addition, e-tendering helps to simplify the tender process (de Boer *et al.* 2002). E-reverse auctions can significantly reduce processing costs through the reduction in cycle time (Emiliani, 2000; Smeltzer & Carr, 2003; Cox & Watson, 2004; Wagner & Schwab, 2004) and negotiation (Jap, 2002). Post purchase, there is an increase in the speed and accuracy of data collection (Croom, 2000).

However, the vast majority of transaction savings accrue from improvements to the purchase process itself. These savings are realised through reduced work in process (Cox, 1999; Zsidisin & Ellram, 2001); increased automation of processes (Kalakota & Robinson, 1999; Croom, 2000; Deeter-Schemelz *et al.* 2001; Barnes *et al.* 2002); reduced paperwork and improved accuracy (Lancioni *et al.* 2000; Neef, 2001; de Boer *et al.* 2002); process re-design and elimination of tasks, reduced inventory, consolidated invoices and reduced transmission errors (Croom & Johnston, 2003).

Most authors appear in agreement that e-procurement implementation results in improvements to order cycle time (Croom, 2000; Turban *et al.* 2000; Zsidisin & Ellram, 2001; Harink, 2003). Cycle time may be reduced as a result of faster product search, fewer input errors, automatic authorisation within pre-set limits, faster delivery, fewer problems with invoice consolidation, and quicker payment to suppliers (Lancioni *et al.* 2000). This in turn creates the potential for reducing inventory levels and thus minimising working capital (Martin & Hafer, 2002; Presutti, 2003). However, it is worth noting that savings figures in the literature are generally anecdotal and in some cases costs of implementation may outweigh the potential advantages of e-procurement.

E-procurement Impact on Price

In the procurement context, de Boer *et al.* (2002) define price as the expenditure on purchased goods or services. They split this into *direct* and *non-product related* (*NPR*) expenditure. Direct expenditure relates to an organisation's primary operations whilst *NPR* or *indirect* spending does not. Traditionally, the focus of procurement academics has been on direct, revenue-generating expenditure (Cox *et al.* 2005). However, given the percentage of total expenditure accounted for by *NPR* spending, there has been an increased awareness in this area (de Boer *et al.* 2003).

There are a number of studies that report price savings accruing from e-procurement implementation. Croom and Johnston (2003) report a range of savings on the price of invoiced goods and services between 5% and 20%, averaging 17%. Based on data from 200 e-reverse auctions, de Boer *et al.* (2002) identify price reductions of between 10% and 15% for both direct and non-product related goods and services. Presutti (2003) suggests e-procurement implementation creates material savings of between 5% and 20%. KPMG (2000) report a survey of purchasing managers, indicating an average price saving of 8%.

Sources of Price Savings

Prior to purchase, e-sourcing enables buyers to identify more potential suppliers, increasing the availability of goods, thus reducing purchase price (Evans & Wurster, 2001; Croom & Brandon-Jones, 2005). For example, General Electric uses e-sourcing to search for potential new suppliers. The increase in supply base has allowed the firm to increase purchase leverage and realise price reductions of between 5% and 20% (Presutti, 2003). E-sourcing may potentially be useful in leverage and bottleneck quadrants of the Kraljic matrix (de Boer *et al.* 2002), but this remains unproven.

Price savings are an important aspect of performance evaluation for e-reverse auctions. A number of authors discuss their role in reducing purchase price (de Boer *et al.* 2002; Jap, 2002; Martin & Hefer, 2002; Harink, 2003; Subramanian & Shaw, 2004; Wagner & Schwab 2004). Jap (2002) suggests that a key reason behind the growth of online reverse auctions is the significant price reductions that are often realised. Harink (2003) notes that e-reverse auctions are particularly beneficial to buyers in markets where supply exceeds demand. On-line reverse auctions have been extremely successful in reducing purchase prices – the typical price savings achieved is around 16% and these have been used for products as varied as foodstuffs, engineered components and utilities supplies (Croom & Brandon-Jones, 2005).

Post-purchase, improved management information is considered to be a major catalyst for reducing purchase prices through greater transparency of market prices, lower search costs and aggregation of requirements (Cox, 1999; Croom, 2000; Yen & Ng, 2003). This view is supported in practitioner and general management literature (Hayward, 2003; Moore, 2003; Parker, 2003; Trommer, 2003; Wheatley, 2003).

Finally, e-procurement creates significant opportunities for reductions in purchase prices through aggregation of requirements and economies of scale (Turban *et al.* 2000; Croom, 2000; Croom & Johnston, 2003). Croom (2000) gives an example of one respondent who reduced variety of office stationery from 235 to 38 items within two months of implementing e-procurement. **Table 1** summarises the sources of transaction and price savings that may arise through e-procurement implementation.

Insert table 1

2.2 The Role of Compliance in Driving Procurement Savings

Within the literature, a number of authors note the importance of e-procurement compliance. The broad idea posited in these studies is that if compliance / adoption is limited, so too are the financial benefits of e-procurement (cf. Croom. 2000; Neef, 2001; Arbin, 2003, 2006; Croom & Johnston, 2003; Harink, 2003; Subramaniam and Shaw, 2004; Cox *et al.* 2005; Reunis & van Raaij, 2006). Arbin (2003, 2006) argues that if the potential value of investment is to be achieved, it is critical to get potential users to adopt e-procurement systems when purchasing goods and services. In examining influence tactics for e-procurement, Reunis and van Raaij (2006) note how attractive business cases 'evaporate' when user adoption is limited. They suggest that benefits are only achieved when individuals use systems and their contracts appropriately. Croom and Johnston (2003) argue that e-procurement enables purchasing departments to exert increased control over organisational procurement. In line with Neef (2001), they suggest that systems increase transparency and help to point users to the approved supplier or contract. Subramaniam and Shaw (2004) discuss the issues of increased control in ensuring appropriate use. As such, e-procurement implementation is seen to create the ideal conditions for reducing maverick spending (cf. Neef, 2001; de Boer *et al.* 2002; Croom & Johnston, 2003; Harink, 2003; Subramaniam & Shaw, 2004). The term 'maverick spending' incorporates the failure of individuals to use an e-

procurement system when placing orders (*system compliance*) and the failure to use mandated contracts within the system (*contract compliance*).

System compliance may be defined as the extent to which internal customers actually use an e-procurement system to purchase goods and services (Croom & Brandon-Jones, 2005). The use of electronic documentation and process automation in e-procurement ensures high levels of accuracy in requisition, invoicing and payment (cf. Barnes *et al.* 2002). By comparison, orders placed outside of an e-procurement system are liable to transmission errors and require additional resources during invoice and payment (cf. Croom, 2000).

Contract compliance is focused on the extent to which individuals comply with mandated contracts within a system. As such, the term considers *how* an e-procurement system is used, as opposed to *if* it is used. The use of e-catalogues can significantly reduce processing times through the use of 'click boxes' and order 'cloning'. Additionally, multiple requisitions, from multiple budgets, but for the same supplier, can be aggregated into a single order. Croom and Johnston (2003) note that this reduces processing during receipt, invoice and payment. Contract compliance plays an even bigger role in price savings. The aggregation of requirements creates significant opportunities for price negotiation (cf. Turban *et al.* 2000; Croom, 2000). As contract use increases, so may the balance of power between the buyer and supplier. As such, contract compliance can have a significant impact on pre-ordering activities.

2.3 The role of user-perceived e-procurement quality – Perceived EPQ

In much of the e-procurement literature, the reduction in maverick spending is taken as a given. However, others note the apparent relationship between user-perceived e-procurement quality – termed *Perceived EPQ* – and the level of compliance (cf. Marshall *et al.* 1998; Kennedy & Deeter-Schmelz, 2001; de Boer *et al.* 2002; Croom & Johnston, 2003; Harink, 2003; Croom & Brandon-Jones, 2007). Whilst high levels of system compliance may be aided by increased levels of transparency (Neef, 2001; Subramaniam & Shaw, 2004), where *Perceived EPQ* is low, users may find ways to circumvent official purchase processes (Croom & Johnston, 2003). However, to date, the evidence for a positive relationship between *Perceived EPQ* and e-procurement compliance remains largely anecdotal.

2.4 Literature Conclusion

The literature posits the significant role e-procurement can play in reducing both transaction costs and purchase price. It is also clear that the level of benefit accruing from e-procurement implementation is largely determined by the level of system and contract compliance, which in turn appears to be influenced by user-perceived e-procurement quality (**Fig 1**). However, given the anecdotal nature of claims for such relationships, there is a concern that managers may see little improvement in e-procurement compliance as a result of attempts to improve *Perceived EPQ*. Therefore, this study seeks to empirically test the relationship between *Perceived EPQ* and both system and contract compliance.

Insert figure 1

3. Methodology

3.1 Study Companies

The study applies an exploratory multiple-case approach (Voss, 2003), using a theoretical sample of organisations ranging in size, budget, implementation strategy, and procurement activity. **Table 2** provides information on the case organisations.

Insert table 2

3.2 Data Collection

The qualitative phase of the study began by interviewing 20 system users and 3 service providers in a single case organisation. Transcribed interviews were 'open-coded' based on the provisional literature 'start list', interview notes, and post-interview contact summary sheets (Miles & Huberman, 1994). Axial coding was then used to group codes with similar characteristics into broader categories (Lowe & Glaser, 1995). 35 structured interviews were then carried out in a further three organisations, to refine axial codes and propose a measure of *Perceived EPQ* – the *EPQ Scale.* In addition, these interviews were used to measure user perceptions of each axial code based on a Likert scale 'well above my expectations' to 'well below my expectations' and to measure percentage levels of system and contract compliance. The quantitative part of the study focused on validating the proposed *EPQ Scale* and the relationships identified

in the structured interview analysis. After piloting, the questionnaire was distributed to all 295 e-procurement users across 4 organisations. However, given the relatively small initial sample (295), it was important to ensure a much higher response rate than is typical for survey work. Following a suggestion by Flynn *et al.* (1991), the researcher made contact with all but 11 individuals to seek cooperation with research. This tactic was very successful and resulted in the return of 274 questionnaires – an overall response rate of 92.9%.

4. Data Analysis

4.1 Structured Interview Analysis

Figure 2 shows the initial 83 'open' codes derived from the first phase of interviews, and the final set of 'selective codes' which resulted from the grouping of codes with similar characteristics.

Insert fig 2

Structured interview data were analysed to assess the extent to which perceptions of e-procurement influence levels of system compliance. The scatter plot below (**fig 3**) indicates a positive relationship between the two constructs with a correlation value of 0.722^{**}.

Insert fig 3

Linear regression analysis was carried out to explore the extent to which *Perceived EPQ* may predict system use. Results indicate that over half (Adjusted $R^2 = .507$) of all system compliance can be explained by average *EPQ* variable scores (axial codes) (**Table 3**). In addition, stepwise regression was carried out to produce a smaller set of explanatory variables for system compliance. The best solution with four variables (*attitudes, support availability, problem resolution,* and *system navigation*) explains 76.8% of variance in system compliance (**Table 4**). This indicates the value of using a combination of variables or factors to explain variance in system compliance, rather than relying on an average *EPQ* score.

Insert tables 3 + 4

Analysis also examined the extent to which perceptions of e-procurement may influence levels of contract compliance. The scatter plot below indicates a positive relationship between the two constructs with a correlation value of 0.407* (**Fig 4**)

Insert fig 4

Linear regression analysis indicates that 14% of variance in contract compliance can be explained by average *EPQ* variable scores (**Table 5**). Stepwise regression suggests a combination of four variables (*attitudes, training, orders to suppliers*, and *support flexibility*) predict nearly half (R^2 = .499) of all variation in contract compliance (**Table 6**).

Insert tables 5 + 6

4.2 Survey Analysis

Having collected survey data, it is possible to test the proposed measure of *Perceived EPQ* more rigorously. Of the 33 items entered into the exploratory factor analysis, just 3 have been deleted. The remaining solution extracts 74.8% of total variance and 68.8% of common variance – well above the 60% minimum suggested by Hair *et al* (1998). **Table 7** shows the final factor solution with details of factor loadings, item-to-total correlations, and alpha coefficients. *Professionalism* is concerned with the ongoing support provided to internal customers of e-procurement. *Processing* focuses on the impact of e-procurement on order cycle-time. The *training* factor considers the approach to and timing of training, and the provision of additional information. *Specification* considers perceptions of system functionality. *Content* is concerned with the suppliers and catalogues loaded on a system, and the ease of search. *Usability* relates to system availability, server speed and the ease of navigation.

Take in table 7

A detailed discussion of the *EPQ Scale's* psychometric properties is not provided in this paper. However, to summarise, scale reliability is demonstrated by high alpha score and item-to-total correlations (Nunally, 1978; Churchill, 1979; Flynn, 1990). The process of scale explication and the assessment of experts in the field point to content

validity (Sekaran, 2003). Construct validity is demonstrated by the high level of correlation between independent measures of *Perceived EPQ*, in addition to the convergence and discrimination of items in the solution (Bagozzi, 1981; Carman, 1990). Finally, predictive validity is established by how effectively the *EPQ Scale* is able to predict variance in an independent measure of user-perceived e-procurement quality and the low level of unexplained residual variance (Hair *et al.* 1998).

Data analysis can now move on to examine the relationship between *Perceived EPQ* and elements of compliance. Survey data support the positive relationship between *Perceived EPQ* and system compliance. In this case the Pearson correlation is 0.525^{**} (**Fig 5**).

Insert fig 5

As with the structured interview data, regression analysis was used to examine the extent to which system compliance is predicted by *Perceived EPQ.* Based on the much larger survey sample, 27.2% of variance in system compliance is explained by the *EPQ Score* (**Table 8**). Step-wise regression was also carried out to assess whether a combination of *EPQ* factors could more accurately predict system use. The best solution contains three factors (*Professionalism, Content,* and *Specification*) which explain 30.4% of variance in system compliance (**Table 9**).

Insert tables 8 + 9

The survey data also supports the existence of a positive relationship between *Perceived EPQ* and contract compliance. In this case the Pearson correlation is 0.656^{**} (**Fig 6**).

Insert fig 6

Regression analysis of survey data suggest that 42.7% of variance in contract compliance is explained by the *EPQ Score* (**Table 10**). In addition, a combination of four *EPQ* factors *(Processing, Content, Professionalism* and *Specification*) explains 44.8% of variance in contract compliance (**Table 11**).

Insert tables 10 + 11

Data Analysis Summary

In line with the literature, data analysis points to a positive relationship between *Perceived EPQ* and elements of e-procurement compliance. Structured interview data indicate a particularly strong relationship with system compliance, whilst survey data suggest a stronger relationship with contract compliance (**Table 12**).

Insert table 12

Analysis also suggests that whilst all factors are significant predictors of compliance, their power varies. For example, the most powerful predictor of system compliance is *Professionalism* (R^2 .259), followed by *Specification* (R^2 .148), *Processing* (R^2 .148), *Content* (R^2 .135), *Specification* (R^2 .129), and finally *Training* (R^2 .100). For contract compliance, *Processing* is the most powerful predictor (R^2 .318), followed by *Content* (R^2 .305), *Specification* (R^2 .250), *Professionalism* (R^2 .210), *Usability* (R^2 .196), and *Training* (R^2 .140). Whilst these results are interesting, they may be caused by the a range of factors, including research setting, extent of implementation, demographics of e-procurement users – to name but a few. Further research is clearly needed before making judgements as to the relative importance of *EPQ* factors in driving e-procurement use.

5. Conclusions

The advent of e-procurement has created significant potential to reduce the total cost of purchasing goods and services. However, such potential will only be realised if individuals comply with e-procurement systems and contracts. This paper has examined the relationship between user-perceived e-procurement quality – *Perceived EPQ* – and elements of compliance with the aim of empirically validating anecdotal claims made in the literature. The research provides academics and practitioners with empirical verification of the important role played by *Perceived EPQ* in influencing both system and contract compliance. As such, it provides support for the view that benefits of e-procurement are ultimately dependent on delivering e-procurement in a way that meets or exceeds users' expectations.

In addition, the study illustrates the value of triangulating data, especially when exploring social phenomena (Jick, 1979; Bryman, 2000; Mingers, 2001). The research

supports the view that using a combination of data collection methods delivers more reliable and valid research findings.

6. Limitations and Future Research

At a broad level, multi-methods research stands accused of mixing incommensurable paradigms and epistemological commitments (Burrell & Morgan, 1979). However, frameworks for classifying research designs, based on the relationship between the kind of information and the approach to knowledge generation, often ignore the fact that a single method or technique may be used in various ways and by researchers with very different philosophical positions (Donaldson, 1998; Bryman, 2001; Mingers, 2001).

Empirical verification is clearly an ongoing process (Peter & Churhill, 1986) and replication studies create increased confidence in the external validity of research findings. Therefore, replication studies, one in Holland and one in Norway, are now underway to validate the nature of the relationship between *Perceived EPQ* and e-procurement compliance.

7. References

Arbin, K. (2003). E-procurement Maturity in Industry. *International Journal of Electronic Business* 1, 396-407.

Arbin, K. (2006). The Electronic Procurement Adoption and Usage Model. *Working paper. 15th Annual IPSERA Conference, San Diego.*

Attaran, M. Attaran S. (2002). Catch the wave of E-procurement. *Industrial Management* 44, 16-21.

Bagozzi, R. O. (1981). Attitudes, intentions, and behaviour: a test of some key hypothesis. *Journal of Personality and Social Psychology* 41, 607-627.

Barnes, D. Hinton M. Mieczkowska S. (2002). Managing Operations in the Internet era. *in Christiansen, J. and Boer, H. (Eds) Operations Management and the New Economy, Copenhagen Business School and Aalborg University, Denmark* 99-109.

Brymann, A. (2001). Social Research Methods. *Oxford University Press, UK.*

Burrell, G. Morgan G. (1979). Sociological Paradigms and Organisational Analysis. *Heinemann, London*.

Carman, J. M. (1990). Consumer Perceptions of Service Quality: An Assessment of the SERVQUAL Dimensions. *Journal of Retailing* 66, 33-55.

Cavinato, J (1987). Purchasing Performance: What Makes The Magic? *Journal of Purchasing and Materials Management* 23, 10-16.

Churchill, G. A. Jr. (1979). A Paradigm for Developing Better Measures of Marketing Constructs. *Journal of Marketing Research* 16, 64-73.

Cox, A. (1999). Power, value and supply chain management. *Supply Chain Management* Vol 4, 167-175.

Cox, A. Chicksand D. Ireland P. Davies T. (2005). Sourcing Indirect Spend: A Survey of Current Internal and External Strategies for Non-Revenue-Generating Goods and Services. *The Journal of Supply Chain Management* 41, 39-51.

Cox, A. Chicksand L. Ireland P. (2002b). The impact of the Internet on marketing and sales. *Qualitative Market Research* 5, 72-77.

Cox, A. Chicksand L. Ireland P. (2002a). Purchasing IS/IT software: the impact of e-business on procurement and supply management. *in Day, M. (Ed.) The Gower Handbook of Purchasing Management, Gower, London* .

Cox, A. Watson G. (2004). One-hit wonders or lasting classics? *Supply Management* November, 21-23.

Croom, S. (2000). The Impact of Web-Based Procurement on the Management of Operating Resources Supply. *The Journal of Supply Chain Management* Winter, 4-13.

Croom, S. Brandon-Jones, A. (2005). Key issues in e-procurement implementation and operation in the UK Public Sector. *Journal of Public Procurement*.

Croom, S. Brandon-Jones A. (2007). Progress on E-Procurement: Experiences from Implementation in the UK Public Sector. *Journal of Purchasing and Supply Management,* Vol. 13, Issue 4, pp. 294-303.

Croom, S. Johnston R. (2003). E-Service: Enhancing internal customer service through e-procurement. *International Journal of Service Industry Management* Special Issue dedicated to the ICEB 2002 Conference.

Davila, D. Gupta M. Palmer R. (2003). Moving Procurement Systems to the Internet: The adoption and Use of EP Technology Models. *European Management Journal* 21, 11-23.

de Boer, L. Harink J. Heijboer G. (2002). A conceptual model for assessing the impact of electronic procurement. *European Journal of Purchasing and Supply Management* No. 8, 25-33.

Deeter-Schmelz, D. Bizzari A. Graham R. Howdyshell C. (2001). Business-to-Business Online Purchasing: Suppliers' Impact on Buyers' Adoption and Usage Intent. *The Journal of Supply Chain Management* Winter, 4-10.

Donaldson, 1998 (1998). The myth of paradigm incommensurability in management studies: Comments by an integrationist. *Organisation 5*.

Eisenmann, T. (2002). Internet Business Models. *McGraw-Hill, Irwin, Boston*.

Emiliani, M. L. (2000). Business-to-business online auctions: Key issues for purchasing process improvement. *Supply Chain Management* 5, 176-186.

Evans, P. Wurster T. S. (2001). Blown to Bits. How the New Economics of Information Transforms Strategy. *Harvard Business School Press, Boston, MA.*

Flynn, B. B, Sakakibara, S, Schroeder, R. G, Bates, K. A, and Flynn, J. E. (1990). Empirical Research Methods in Operations Management . *Journal of Operations Management* vol. 9, 250-284.

Hair, J. F. Jr. Anderson R. E. Tatham R. L. Black W. C. (1998). Multivariate Analysis 5th Edition. *Prentice-Hall*.

Harink, J. (2003). Internet-technologie in inkoop: De kinderschoenen ontgroeid. *Dissertation, Universiteit Twente. Netherlands* 1-256.

Hayward, C. (2003). Three-year glitch. *Financial Management* July/Aug, 30.

Jap, S. D. (2002). Online Reverse Auctions: Issues, Themes, and Prospects for the future. *Academy of Marketing Science* 30, 506-525.

Kalakota, R. Robinson M. (1999). e-Business: Roadmap for success. *Addison-Wesley, Reading, MA.*

Kahneman D., Miller K. T. (1986). Norm theory: Comparing reality to its alternatives. *Psychol. Reviews*

Kennedy, K. N. Deeter-Schmelz D. R. (2001). Descriptive and predictive analyses of industrial buyers' use of online information for purchasing. *The Journal of Personal Selling & Sales Management* 21, 279-291.

Lancioni, R. Smith M. Olivia T. (2000). The Role of the Internet in Supply Chain Management. *Industrial Marketing Management* 45-56.

Lowe, A. Glaser B. (1995). The Potential of Grounded Theory for the Development of Relationship Marketing. *(Private Copy).*

Marshall, G, Baker, J, and Finn, D (1998). Exploring internal customer service quality. *Journal of Business & Industrial Marketing* Vol 13, pp381-392.

Martin, T. N. Hafer J. C. (2002). Internet Procurement by Corporate Agents: Is It All Hype. *Advanced Management Journal* 67, 41-47.

McManus, S. A. (2002). Understanding the incremental nature of e-procurement implementation at the state and local levels. *Journal of Public Procurement* 21, 5-28.

Miles, M. Huberman A. (1994). Qualitative Data Analysis: An Expanded Source Book. *Sage Publications, London*.

Min, H. Galle P. (2003). E-Purchasing: profiles of adopters and nonadopters. *Industrial Marketing Management* 32, 227-233.

Mingers, J. (2001). Combining IS research methods: Towards a pluralist methodology. *Information Systems Research* 12.

Moore, J. (2003). Manufacturers struggle with eProcurement, but still see gains. *Chemical Engineering Progress* 99, 23.

Narasimhan, R. Talluri S. Ross. (2003). Evaluating E-Procurement Solutions. *CAPS Research www.capsresearch.org*.

Neef, D. (2001). E-Procurement: From strategy to implementation. *Pretice Hall*.

Nolan, Alexis (1999). Purchasing's New Power. *Director* Vol. 52.

Nunally, J. C. (1978). Psychometric Theory 2nd Ed. *McGraw-Hill, New York, NY*.

Parker, R. (2003). BA makes online sourcing mandatory to save £300m. *Supply Management* 8, 9.

Peter, J. P. Churchill G. A. Jr. Brown T. J. (1993). Caution in the Use of Difference Scores in Consumer Research. *Journal of Consumer Research* 19, 655-662.

Presutti Jr, W. D. (2003). Supply management and E-procurement: creating value added in the supply chain. *Industrial Marketing Management* 32, 219-226.

Reunis, M. R. B. van Raaij E. M. (2006). Scale Development for E-Procurement (EP) Adoption Influence Tactics. *Working paper. 15th Annual IPSERA Conference, San Diego*.

Sekaran, U. (2003). Research Methods for Business: A Skill Building Approach 4th Edition. *Wiley & Sons, Inc. U.S.*

Smeltzer, L. R. Carr A. S. (2003). Electronic reverse auctions: Promises, risks and conditions for success. *Industrial Marketing Management* 32, 481-488.

Smeltzer, L. Ruzicka M (2000). Electronic Reverse Auctions: Integrating the Tool with the Strategic-Sourcing Process. *Practix* June.

Subramaniam, C. Shaw M. J. (2004). The Effects of Process Characteristics on the Value of B2B E-Procurement. *Information Technology and Management* 5, 161-180.

Troomer, D. (2003). Learning The ABC's - Having succeeded in transforming its procurement processes for indirect materials, will Ametek now consider doing the same for direct electronic component materials? *EBN, Manhasset* 25.

Turban, E. Lee J. King D. Chung H. M. (2000). Electronic Commerce: A Managerial Perspective. *Prentice-Hall, London*.

Voss, C. A. (2003). Rethinking paradigms of service. Service in a virtual environment. *International Journal of Operations & Production Management* 23, 88-104.

Wagner, S. M. Schwab A. P. (2004). Setting the stage for successful electronic reverse auctions. *Journal of Purchasing and Supply Management* 10, 11-26.

Wheatley, M. (2003). How to Know if E-Procurement Is Right for You. *CIO* 16, 1.

Yen, B. P. C. Ng E. O. S. (2003). Impact of electronic commerce on procurement. *Journal of Organizational Computing and Electronic Commerce*.

Zsidisin, GA. Ellram LM. (2001). Activities related to purchasing and supply management involvement in supplier alliances. *International Journal of Physical Distribution and Logistics Management* Vol 31, 629-646.

8. Figures & Tables

Figure 1. The Role of *Perceived EPQ*

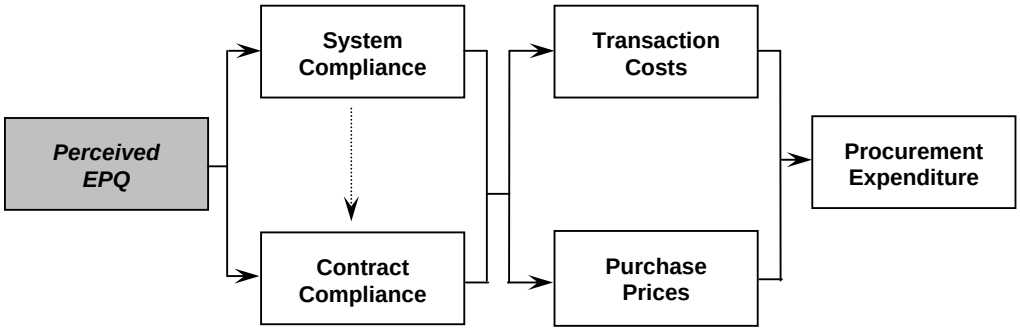

Figure 2. Developing the *EPQ Scale* – from Open to Selective Codes

Open Code	Selective Code
FMS Integration	FMS Integration
Improved Budgeting	
Goods Receipting	Invoice Reconciliation
Auto-Payment	
Payment: currencies	
Late Payment	
Advance Payment	
Customisation	System Configurability
System Flexibility	
Management Info	Reporting Capability
Reporting	
Reporting Searching	
Complex Orders	Processing Complex Orders
Processing Services	
Security	System Security
Sharing Information	
Reliability: service	System Availability
Reliability: system	
Access	
Reliability: information	
Server Speed	Screen Loading
Navigation	System Navigation
User Friendliness	
Rules	
Navigation: terminology	
Navigation: no. stages	
Visual Appeal	Visual Appeal

Open Code	Selective Code
Loaded Suppliers	Loaded Suppliers
Accreditation	
Catalogue Content	Loaded Catalogues
Number of Catalogues	
Search	Ease of Search
Terminology	
Language	
Pictures in Search	
Search: frequency of use	
Speed of Processing	Order Processing
Order Cloning	
Efficiency	
Authorisation: ease	Ease of Authorisation
Authorisation: speed	
Self-Authorisation	
Authorisation: rules	
Budget Codes	
Order to supplier: speed	Orders to Suppliers
Order to supplier: reliability	
Supplier Training	
Order to supplier: accuracy	
Lead-time	Order Lead-Time
On-time Delivery	On-Time Delivery
Order Accuracy	Order Accuracy
Support Availability	Support Availability
Availability: 1 point of call	
Advertised Support	
Advanced Queries (EGS)	

Open Code	Selective Code
Support Reliability	Support Reliability
Responsiveness	Support Responsiveness
Knowledge	Knowledge
Talking Users' Language	Talking Users' Language
Flexibility	Support Flexibility
Dealing with Problems	Problem Resolution
Helpfulness	
Confidentiality	Confidentiality
Friendliness	Friendliness
Empathy	Empathy
Training: timing	Timely Training
Training: delays / politics	Appropriate Training
Training: availability	
Training: approach	
Training: amount	
Training: content	
Training: self learning	
Training: super user	
Training: resource issues	
Training: user knowledge	
Training: refreshers	
Communication	Information Provision
Inform of new suppliers	
Communication Cascade	
Communication Problems	
Use of Intranet	
Encouraging Feedback	Encouraging Feedback

Fig 3. Scatter plot: Average *EPQ* Variable to System Compliance

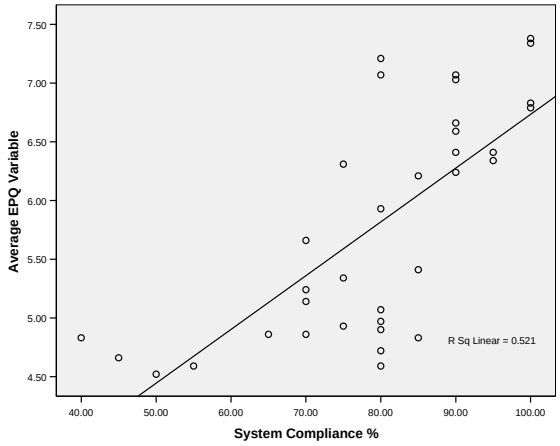

Figure 4. Scatter plot: Average *EPQ* Variable to *Contract Compliance*

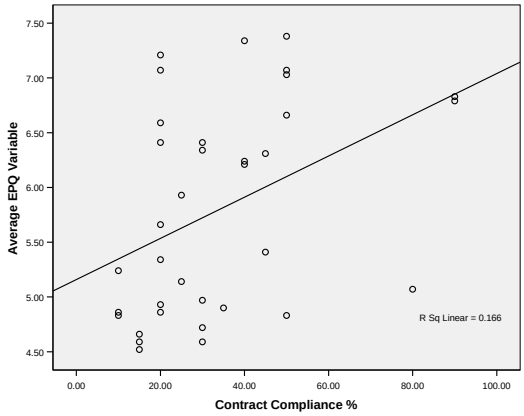

Figure 5. Scatter plot: *EPQ Score* to System Compliance

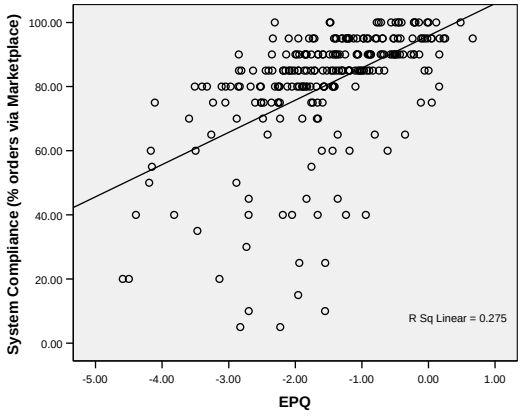

Figure 6. Scatter plot: *Perceived EPQ* to *Contract Compliance*

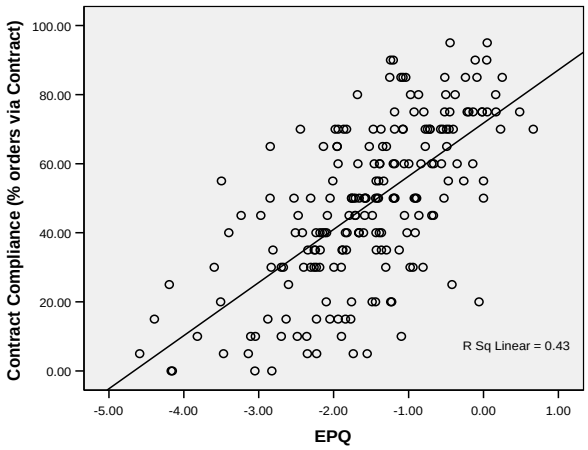

Table 1. Sources of Transaction & Price Savings

Area		Source	Kalakota & Robinson '99	Croom '00	Emiliani '00	Lancioni *et al.* '00	Turban *et al.* '00	Deeter-Schmelz *et al.* '01	Evans & Wurster '01	Neef '01	Zsidisin & Ellram '01	Attran & Attran '02	Barnes *et al* '02	DeBoer *et al.* '02	Jap '02	Martin & Hafer '02	Sashi & O'Leary '02	Croom & Johnston '03	Davila *et al.* '03	Harink '03	Min & Galle '03	Narasimhan *et al.* '03	Presutti '03	Smeltzer & Carr '03	Yen & Ng '03	Subramaniam & Shaw '04	Wagner & Schwab '04	Croom & Brandon-Jones '05
Transaction Costs	**E-Sourcing**	Economies of supplier search							x					x					x			x	x			x		x
	E-Tendering	Simplification of tendering												x														
	E-Reverse Auctioning	Reduced cycle-time			x										x									x			x	
		Reduced negotiation			x										x		x										x	
	E-MRO E-ERP	Reduced inventory									x	x		x		x		x			x	x	x	x				
		Reduced cycle time				x	x			x	x	x		x		x			x	x	x	x				x		
		Task elimination																										
		Invoice consolidation																x										
		Reduced error in transmission				x				x				x				x	x	x						x		
		Increased automation	x	x				x					x															
	E-Informing	Speed & accuracy of data collection		x																								
Purchase Prices	**E-Sourcing**	Increased supply base							x					x									x					x
	E-Reverse Auctioning	Contract price reduction			x									x	x	x	x		x					x		x	x	x
	E-MRO E-ERP	Aggregation of requirements		x			x			x		x				x		x			x		x			x		
	E-Informing	Market intelligence		x																					x			

Table 2 General Characteristics of Cases

	Case 1	Case 2	Case 3	Case 4
Number of employees (FTE)	26,500	800	200	450
Yearly Budget (Total)	£1.6 billion	£45 million	£18 million	£40 million
Yearly Budget (G&S)	£600 million	£16 million	£6 million	£15 million
Requisitions P/A	150,000	4000	2000	2900
Active Suppliers	13,000	2500	800	2300
Previous Procurement System	Mix	Mix	Paper	Paper
E-Procurement Start Data	Jan 03	Dec 03	Aug 03	Oct 03
Project Team	Procurement	Procurement	Finance	Procurement
Roll-out Strategy	Commodity	Department	Department	Commodity
System Users	156	44	41	54
Departments using E-Procurement	13 of 15	8 of 9	4 of 4	11 of 11
Level of *FMS* Integration	Extensive	Limited	None	Limited
Use of Reporting Functionality	High	High	Low	Medium

Table 3. Linear Regression: Average *EPQ* to System Compliance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.722(a)	.521	.507	10.61800

Predictors: (Constant), Average *EPQ*

Table 4. Stepwise Regression: All *EPQ* Variables to System Compliance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.692(a)	.479	.463	11.07617
2	.780(b)	.608	.584	9.75476
3	.829(c)	.687	.657	8.85233
4	.867(d)	.752	.719	8.01699
5	.893(e)	.797	.762	7.37688
6	.892(f)	.795	.768	7.27918

a Predictors: (Constant), Attitudes
b Predictors: (Constant), Attitudes, System Configurability
c Predictors: (Constant), Attitudes, System Configurability, Support Availability
d Predictors: (Constant), Attitudes, System Configurability, Support Availability, Problem Resolution
e Predictors: (Constant), Attitudes, System Configurability, Support Availability, Problem Resolution, Navigation
f Predictors: (Constant), Attitudes, Support Availability, Problem Resolution, System Navigation

Table 5. Linear Regression: Average *EPQ* to *Contract Compliance*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.407(a)	.166	.140	19.24018

a Predictors: (Constant), Average *EPQ*

Table 6. Stepwise Regression: All *EPQ* Variables to *Contract Compliance*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.506(a)	.256	.233	18.16947
2	.633(b)	.401	.364	16.55017
3	.701(c)	.491	.441	15.50780
4	.747(d)	.558	.499	14.69302

a Predictors: (Constant), *Attitudes
b Predictors: (Constant), *Attitudes, *Training
c Predictors: (Constant), *Attitudes, *Training, Orders to Suppliers
d Predictors: (Constant), *Attitudes, *Training, Orders to Suppliers, Support Flexibility

Table 7 *Perceived EPQ* Factor Solution

Variable	Item-to-total	Professionalism *Alpha* .954	Processing *Alpha* .897	Training *Alpha* .919	Specification *Alpha* .818	Content *Alpha* .796	Usability *Alpha* .751
support availability	.807	.830					
support reliability	.818	.784					
support responsiveness	.869	.899					
support knowledge	.840	.822					
support flexibility	.791	.710					
problem resolution	.824	.757					
confidentiality	.817	.829					
friendliness	.763	.867					
concern shown	.793	.919					
order processing speed	.721		.664				
ease of authorisation	.644		.547				
orders to supplier speed	.744		.901				
order lead-time	.756		.807				
processing complex orders	.608		.490				
on-time delivery	.724		.805				
order accuracy	.636		.693				
system security	.574		.567				
timely training	.859			.888			
appropriate training	.903			.982			
information provision	.755			.654			
FMS integration	.599				.666		
invoice reconciliation	.692				.644		
system configurability	.592				.486		
reporting capability	.674				.719		
loaded suppliers	.666					.738	
loaded catalogues	.689					.870	
ease of search	.571					.473	
system availability	.539						.409
screen loading speed	.639						.734
ease of navigation	.565						.625

Table 8. Linear Regression: *EPQ Scale* to System Compliance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.525(a)	.275	.272	16.55166

Predictors: (Constant), EPQ

Table 9. Stepwise Regression: *EPQ Factors* to *System Compliance*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.511(a)	.262	.259	16.70946
2	.548(b)	.300	.294	16.30319
3	.559(c)	.313	.304	16.18415

a Predictors: (Constant), Professionalism
b Predictors: (Constant), Professionalism, Content
c Predictors: (Constant), Professionalism, Content, Specification

Table 10. Linear Regression: *EPQ Scale* to Contract Compliance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.656(a)	.430	.427	17.68950

Predictors: (Constant), *EPQ Score*

Table 11. Stepwise Regression: *EPQ* Factors to Contract Compliance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.567(a)	.321	.318	19.30318
2	.652(b)	.425	.419	17.80531
3	.670(c)	.448	.440	17.48603
4	.678(d)	.459	.448	17.35661

a Predictors: (Constant), Processing
b Predictors: (Constant), Processing, Content
c Predictors: (Constant), Processing, Content, Professionalism
d Predictors: (Constant), Processing, Content, Professionalism, Specification
e Dependent Variable: Contract Compliance (% orders via Contract)

Table 12. Summary of relationship between *Perceived EPQ* and E-Procurement Compliance

Perceived EPQ and System Compliance	*Phase 2*	*Phase 3*
Correlation: *EPQ Score* to *System Compliance*	.722 (**)	.525 (**)
Regression: *EPQ Score* to *System Compliance*	R^2 .507	R^2 .272
Regression: Stepwise Factors to *System Compliance*	N/A	R^2 .304
Regression : Stepwise Items to *System Compliance*	R^2 .768	N/A
Perceived EPQ and Contract Compliance	*Phase 2*	*Phase 3*
Correlation: *EPQ Score* to *Contract Compliance*	.407 (*)	.656 (**)
Regression: *EPQ Score* to *Contract Compliance*	R^2.140	R^2 .427
Regression: Stepwise Factors to *Contract Compliance*	N/A	R^2 .448
Regression : Stepwise Items to *Contract Compliance*	R^2 .499	N/A