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The EPQ Scale: A Multi-Item Measure of Perceived E-Procurement Quality

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Abstract

The advent of e-procurement has created significant potential to reduce the total cost of purchasing. However, without the commitment of internal users to adopt e-procurement systems and contracts, savings are unlikely to be realised. This paper presents a study of user-perceived e-procurement quality – *Perceived EPQ* – with the aim of developing a multi-item construct measure to help improve e-procurement compliance. The research adopted a mixed-methods approach incorporating 58 interviews and a survey of 295 users across four organisations. The research makes two significant contributions. Firstly, the study proposes a 6-factor, 30-item measure of *Perceived EPQ* which exhibits high levels of reliability and validity. This scale can be used to measure users' attitudes toward an e-procurement system and its support, and thus focus improvement efforts on areas of dissatisfaction. Secondly, it provides a methodological template for researchers within OM looking to use interview and survey data in combination when developing construct measures.

Keywords: E-Procurement, EPQ Scale, Perceived EPQ, Scale Development, Internal Service.

1. Introduction

E-procurement offers huge potential for lowering prices paid for goods and services, and reducing 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. There is increasing awareness that end-user perceptions of e-procurement systems and support play a significant role in influencing levels of compliance (Harink, 2003; Croom and Brandon-Jones, 2008). As such, the ability to understand how e-procurement delivery is perceived by end-users appears critical to the eventual success of implementation.

Whilst there have been studies examining user perceptions in traditional procurement settings (Cavinato, 1987; Hendrick and Ruch, 1988; Rossler and Hirsz, 1996; Marshall *et al.* 1998), the idea has received relatively little attention in an e-procurement context. In addition, whilst the value of developing robust construct measures has been highlighted by numerous researchers (cf. Churchill, 1979; Hensley, 1999; Rossiter, 2002; Finn & Kayande, 2005), scale development work within the OM field remains surprisingly limited. Hence, the main objective of the research is to examine user-perceived e-procurement quality – referred to as *Perceived EPQ* – with the aim of developing a multi-item construct measure to improve user compliance.

A secondary objective of the study is to provide a methodological template for researchers within OM looking to adopt a mixed-methods approach in developing construct measures. Whilst Churchill's (1979) seminal step-by-step approach to scale development remains the dominant orthodoxy, it is criticized for an over-emphasis on psychometric testing, to the detriment of conceptual rigor (Rossiter, 2002). On the other hand, alternative approaches focusing more on the conceptualization of constructs – for example C-OAR-SE – may place too much emphasis on context (Finn & Kayande, 2005). The mixed methods approach used in this study seeks a balance between these two extremes.

The paper is structured as follows. Firstly, there is an examination of the literature upon which the *Perceived EPQ* construct is based. This is followed by details of the mixed-methods approach used for the study. Analysis of interview and survey data is then presented and the quality of findings is discussed. The implications for theory and

practice are presented in the conclusion. Finally, limitations and future research opportunity are explored.

2. The Role of Internal Service in E-Procurement

Figure 1 illustrates the relationship between *Perceived EPQ*, compliance, transaction cost, price, and ultimately, total procurement expenditure. Reductions in procurement expenditure broadly arise by minimising activity in the requisition-to-payment process and lowering prices of goods and services (cf. Cox *et al.* 2002; de Boer *et al.* 2002; Croom & Brandon-Jones, 2005). Critically, these potential savings are all, to a greater or lesser extent, affected by levels of compliance, which in turn is affected by *Perceived EPQ*. As such, the ultimate effect of e-procurement implementation on total expenditure is strongly influenced by the attitudes of end-users.

Take in figure 1

Perceived EPQ is inherently an intangible phenomenon, because it is concerned with perceptions of quality rather than objective measures of quality. Because of this, the theoretical core of the study is underpinned by the dominant disconfirmation paradigm (Oliver, 1980) which states that service perceptions are determined by the gap between expectations and perceptions of performance. However, most service quality literature considers service delivered to external customers in a traditional (off-line) context. Therefore, at an operational level, we internal service, information systems, and e-service literatures were examined in developing a measure of *Perceived EPQ* (**Figure 2**). These three areas are relevant, because of their focus on either internal settings, on-line settings, or both.

Take in figure 2

2.1 Internal Service

Whilst the importance of delivering internal service is widely recognised, there remains very little empirical research focusing on service perceptions within organisations (Davis, 1999). Of the studies that do exist, measuring internal service is often seen as no more complex than adapting findings from existing external service research (Reynoso & Moores, 1995), such as SERVQUAL (Parasuraman *et al.* 1988).

However, concerns of external service scale applicability have led some academics to develop specific measures for internal service (cf. Cavinato, 1987; Hendrick & Ruch, 1988; Lewis and Gabrielson, 1995; Lewisohn and Reynoso, 1995; Hallowell *et al.* 1996; Rossler & Hirz, 1996; Marshall *et al.* 1998; Gilbert, 2000; and Bruhn, 2003) Whilst these scales incorporate many purchase elements relevant to *Perceived EPQ*, their limitation is that they all consider traditional procurement settings and therefore only provide a partial view of the construct. **Table 1** provides an overview of the variables identified in the internal service literature that may be useful in modelling *Perceived EPQ*.

Take in table 1

2.2 Information Systems

Information systems research is relevant to the study because of the extensive systems element of *Perceived EPQ*. Popular measures of end-user system satisfaction include Doll and Torkzadeh's (1988) EUCS, Baroudi and Orlikowski's (1988) UIS, and DeLone and McLean's (1992) ISS. However, these instruments are all essentially product-oriented (Pitt *et al.*, 1995) and thus fail to incorporate the significant service component which modern information system (Pitt *et al.*, 1995). Whilst SERVQUAL has been used by some authors to address this problem (cf. Pitt *et al.* 1995, 1997; Kettinger and Lee, 1997, 1999) Van Dyke *et al.* (1997) state that neither traditional measures nor SERVQUAL capture all the factors relating to perceived information systems service. Therefore, whilst the variables identified in the information systems literature (**Table 2**) are useful, none of the existing scales are appropriate for measuring perceptions of e-procurement in their own right.

Take in table 2

2.3 E-Service Quality

Limited service research examines situations where consumers have little interaction with the firm's employees (Meuter *et al.*, 2000). E-service measures developed by practitioners (cf. Rice, 1997; Balfour *et al.*, 1998; Chen, 1999; Liu and Arnett, 2000; Bizrate; Gomez) consider factors such as design features, emotional experience,

security, ease of ordering, product selection, product information, on-time delivery, customer support, and ease of use. However, such scales lack conceptual underpinning or empirical validation (Zeithaml *et al.*, 2002a). SERVQUAL has proved popular with academics looking to measure e-service quality, but have, in many ways, demonstrated the scales' inapplicability to new contexts. Even the authors of SERVQUAL have their concerns – Zeithaml *et al.* (2002b) concede that ease of navigation, flexibility, efficiency, site aesthetics, and security are new dimensions/sub-dimensions of e-service quality, which are not found in traditional service settings. Academic attempts to scale e-service quality from scratch (cf. Loiacono *et al.* 2002; Wolfinbarger & Gilly, 2003; Yang *et al.* 2003; Bansal *et al.* 2004) have produced a wide variety of measures, which indicate that ease of use and security play an important role in determining perceptions of online service. Beyond these concepts, there is little consensus on factors that drive e-service perceptions.

Whilst e-service literature is useful to the study, there are limits to its applicability in an e-procurement context. *Perceived EPQ* spans on-line and traditional (off-line) forms of service, whilst some issues, for example system integration, authorisation channels, and invoicing procedures, are not applicable to external customers. Finally, the provision of training and support is more limited in an external context. **Table 3** provides a summary of variables used in *E-SQ* measurement.

Take in table 3

2.4 Literature Summary

Given its dominance and broad academic support, disconfirmation appears to be an appropriate theoretical basis for *Perceived EPQ*. Concerns over SERVQUAL's reliability and validity make it inappropriate to apply this measure to an e-procurement context, whilst no measure from internal service, information systems or e-service can measure the construct fully. For academics and practitioners to fully understand *Perceived EPQ* it is important to delineate the construct through empirical research. This study seeks to develop a multi-item measure of *Perceived EPQ* using variables from both existing literature and study data.

3. Methodology

3.1 Study Companies

Due to the limited empirical work in this area, an exploratory multiple-case approach was applied (Voss, 2003). The study used a theoretical sample of organisations ranging in size, budget, implementation strategy, and procurement activity. The research employed both qualitative and quantitative methods to develop and validate the *EPQ Scale*. **Table 4** provides information on the case organisations.

Take in table 4

3.2 Interview Data Collection

The study began by interviewing 20 system users and 3 service providers in a single organisation. Transcribed interviews were coded based on a provisional ‘start list’ from the literature, interview notes, and post-interview summary sheets. Axial coding was used to group codes with similar characteristics into broader categories whilst retaining their original meaning (Lowe & Glaser, 1995). A second batch of 35 interviews were carried out in a further three organisations, to refine axial codes, validate selective codes and propose a measure of *Perceived EPQ* – the *EPQ Scale*.

3.3 Survey Data Collection

The quantitative part of the study focused on validating the proposed *EPQ Scale* and examining the latent structure of *Perceived EPQ*. The questionnaire consisted of 33 paired-statements relating to each item in the proposed *EPQ Scale* and a single ‘overall e-procurement quality rating’ to assess the predictive power the proposed scale (cf. Parasuraman *et al.* 1988; Pitt *et al.* 1995). After piloting, the questionnaire was distributed to all 295 e-procurement users across 4 organisations. 274 questionnaires were returned, representing an overall response rate of 92.9%. Exploratory factor analysis (EFA) was employed, as the factor structure is determined by empirical data rather than theory (Velicer & Jackson, 1990; Hair *et al.* 1998). Total variance extracted is 74.8%, whilst common variance extracted is 68.8% - above the 60% minimum suggested by Hair *et al.* (1998). Cronbah Alpha, item-to-total correlations, regression, and analysis of variance were all employed to assess the reliability and validity of the proposed *EPQ Scale*.

4. Interview Data Analysis

Figure 3 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. The number of references for the initial set of 83 codes varies considerably. For example, 33 codes are mentioned by less than 20% of interviewees, whilst 18 are found in over 50% of transcripts.

Take in figure 3

Prior to the quantitative phase of the research, it was important to make an initial assessment of the proposed *EPQ Scale*. Where no construct measure currently exists, the ‘dummy criterion’ method is a popular approach to scale development and validation (Pitt *et al.*, 1995; 1995; Finn *et al.*, 1996). A close relationship between two independent measures – in this case the *OEPQ Rating* and *EPQ Scale* – would provide an indication that one is accurately measuring the phenomena of interest. The scatter plot, shown in **Figure 4**, indicates the linear relationship between the two measures. The strength of this relationship, indicated by a Pearson correlation .870**, provides an indication that no critical variables have been omitted from the *EPQ Scale*.

Take in figure 4

Additionally, the proposed *EPQ Scale* was validated by examining the power of scale scores to predict the independent criterion (Flynn *et al.*, 1990). Linear regression indicates that the average *EPQ* score predicts 75% of variance in the *OEPQ* rating, whilst a combination of all variables predicts 91.3% of variance.

5. Survey Data Analysis

Table 5 shows the final factor solution with details of factor loadings, item-to-total correlations, and alpha coefficients. Examination of the content of item resulted in factor labels and definitions. *Professionalism* is concerned with the ongoing support

provided to internal customers of e-procurement. Support personnel should always be available, get back to users quickly and when they say they will. Whilst technical expertise is important in solving problems, the attitude of support personnel is also important. *Processing* focuses on the impact of e-procurement on order cycle-time. Issues include order processing speed, ease of authorisation, how long requisitions take to reach suppliers, overall lead-time, and order accuracy. The *training* factor considers the approach to training (e.g. online tutorials, group sessions, advanced training, refresher courses, or one-to-one help), the timing of training, and the provision of additional information, such as system enhancements or newly available contracts. *Specification* considers perceptions of system functionality, including reporting, configurability, and how well e-procurement integrates with finance systems. The ability of an e-procurement system to integrate with the *FMS* and reconcile invoices efficiently may be perceived as of great benefit to some users. In addition, how easy the system is to configure to individual or departmental requirements may have a significant effect on *Perceived EPQ*. Finally, a number of users will have expectations relating to management information, so the reporting capability of the system will be important. *Content* is concerned with the suppliers and catalogues loaded on a system, but also searchable this content is. *Usability* relates to perceptions of system availability, server speed and the ease of navigating through the system.

Take in table 5

5.1 EPQ Scale Reliability

Given the fact that the research was not longitudinal (test-retest) and there is no alternative construct measure (parallel forms), assessment of reliability focuses on internal consistency (Flynn, 1990). Cronbach alphas for the six *EPQ* factors range from .751 to .954, easily exceeding the recommended cut-off points of .70 and .60 (Nunally, 1978). These results combined with high item-to-total scores (.539 to .903, average .716) indicate a high level of internal consistency between items making up each factor. The overall alpha for the *EPQ Scale* is .949. **Table 6** shows the pair-wise correlations between the six factors. The average correlation of .477, illustrates the strong relationship between the distinct facets of *Perceived EPQ*. The strongest relationships exist between *Professionalism* and *Training* – two support factors - and between *Processing*, *Specification*, and *Usability* – three system factors.

Take in table 6

5.2 EPQ Scale Validity

The high reliabilities and clear factor structure provide support for trait validity of the *EPQ Scale* (Peter, 1981). However, this is not sufficient in assessing the extent to which a scale captures the latent construct (Churchill, 1979). Content validity cannot be determined statistically, but rather by experts with reference to experience and literature (Sekaran, 2003). In explicating the *Perceived EPQ* construct a wide range of literature was drawn on and combined with both qualitative and quantitative data. The resulting *EPQ Scale* appears to accurately reflect the construct, thus exhibiting good content validity. Construct validity measures the extent to which a scale is a good operational definition of a construct and can be split into two elements. Convergent validity is established when variables load on a single factor and correlate with other variables in their assigned factors (Bagozzi, 1981). Discriminate validity is indicated if the factors and variables are truly different for one another (Carman, 1990). The rules of variable convergence and discrimination hold good for this data. The factor analysis reveals that of the original 33 variables, 30 have high loadings on a single factor. In addition, the scale exhibits high Alphas and high item-to-total scores. In line with other research (cf. Parasuraman *et al.* 1988; Pitt *et al.* 1995), the correlation between the *EPQ* factors and responses to a single-question ‘overall e-procurement quality rating’ (*OEPQ*) is assessed (**Table 7**). The high correlation between the two measures provides additional evidence of construct validity.

Take in table 7

Predictive validity is derived by examining the predictive power of scale scores on a separate criterion (Flynn *et al.* 1990). **Table 8** illustrates that just under half of variance in the *OEPQ Rating* is explained by the average of six *EPQ* factors ($R^2 .486$).

Take in table 8

Subsequently, the predictive validity of the six *EPQ* factors has been examined using a step-wise multiple regression (**Table 9**). This helps to assess the relative value of each

factor to the regression model. The best solution has four factors explaining 54.9% of variance in *OEPQ Ratings*.

Take in table 9

Whilst *Content* and *Usability* are correlated to *OEPQ Ratings*, they produce only a marginal improvement to the regression model. This is because the predictive power of additional independent variables is not only determined by its correlation to the dependent variable, but also its correlation to other independent variables already in the model. The effect of multicollinearity is to limit the value of *Content* and *Usability* factors due to their strong relationship with *Professionalism*, *Processing*, *Training* and *Specification*. It is important to avoid the conclusion that the factors are inconsequential in driving *Perceived EPQ* simply because they are not included in the stepwise regression model.

The statistical power of the regression model is partly determined by the number of independent variables and the significance level chosen (Hair *et al.* 1998). For this research, using the six *EPQ* factors as independent variables and specifying a .01 significance level, the sample of 274 will detect R^2 values of around 7% and greater. The other factor influencing regression model significance is sample size. Very small samples (<20) only allow the use of simple regression with one independent variable and only very strong relationships detected with certainty. Very large samples (>1000) create problems of over-sensitivity in statistical tests. Hair *et al.* (1998) suggest that, assuming a representative sample, the ratio of observations to independent variables should always be greater than 5-to-1, ideally 20-to-1, and if stepwise regression is applied, closer to 50-to-1. In this research, the ratio of observations to independent variables is 45.7-to-1.

Table 10 summarizes the results of the analysis of variance (*ANOVA*). The output for the regression displays information about variation accounted for by the four-factor regression solution. Residual output shows information regarding unaccounted variation. A comparison of the regression sum of squares and the residual sum of squares indicates that the model accounts for significant variation in the dependent variable. The F-statistic is the regression mean square (*MSR*) divided by the residual mean square error (*MSE*). The small significance value of this statistic indicates that the *EPQ* factors do a good job explaining variation in the *OEPQ Rating*.

Take in table 10

In examining standardized residuals, 271 of the 274 cases were less than 3 standard deviations away from the mean. This indicates that, in all but three cases, the regression model accurately predicts *OEPQ Ratings*. **Figure 5** shows the distribution of residuals (The difference between the observed and predicted value). The normal distribution of residuals is further evidence of the *EPQ Scale's* predictive validity.

Take in figure 5

In summary, the *EPQ Scale* appears to meet all the criteria to be considered a reliable and valid measure of *Perceived EPQ*. However, scale validation is clearly an ongoing process (Peter & Churchill, 1986) and replication studies are required to further refine the measure.

6. Conclusions

The advent of e-procurement has created significant potential to reduce the total cost of purchasing goods and services. However, it is vital that managers appreciate the effect that user-perceived e-procurement quality (*Perceived EPQ*) has on the levels of compliance and, ultimately, total expenditure. The research has developed a scale, with high levels of reliability and validity, which can help improve e-procurement compliance. Whilst the study has focused on procurement, many of the scale components are applicable to other information system contexts. In addition to the scale, the study also provides a methodological template for researchers within OM looking to adopt a mixed methods approach in developing construct measures. Using a combination of literature and interview data helps the researcher to generate a small set of highly defensible construct variables (Wuensch, 2004), whilst survey data enables rigorous assessment of a scale's psychometric properties. **Figure 6** shows the *EPQ Model* in light of the empirical research.

Take in figure 6

7. Limitations and Future Research

Considering the scale development approach, multi-methods stand 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). Considering the *EPQ Scale*, the scope of the research is naturally limited by the variables used to define *Perceived EPQ*. As such, the aim of selection has been to balance comprehensiveness (i.e. capturing the totality of the construct) and parsimony.

Scale validation is clearly an ongoing process (Peter & Churchill, 1986). Yin (1994) argues that replication studies create increased confidence in the external validity of research findings. For this reason, two replication studies, one in Holland and one in Norway, are now underway to assess the extent to which the *EPQ Scale* is applicable beyond the original study organisations. In addition, a study into the relationship between *Perceived EPQ* and e-procurement compliance is currently underway in the UK. It is hoped that this will provide empirical support for the view in existing literature that user perceptions of e-procurement quality play a critical role in determining levels of system and contract compliance.

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Figures

Figure 1. The Role of *Perceived EPQ*

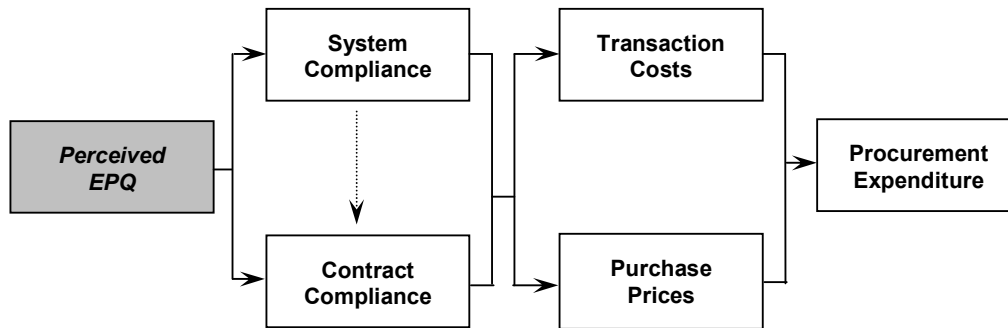
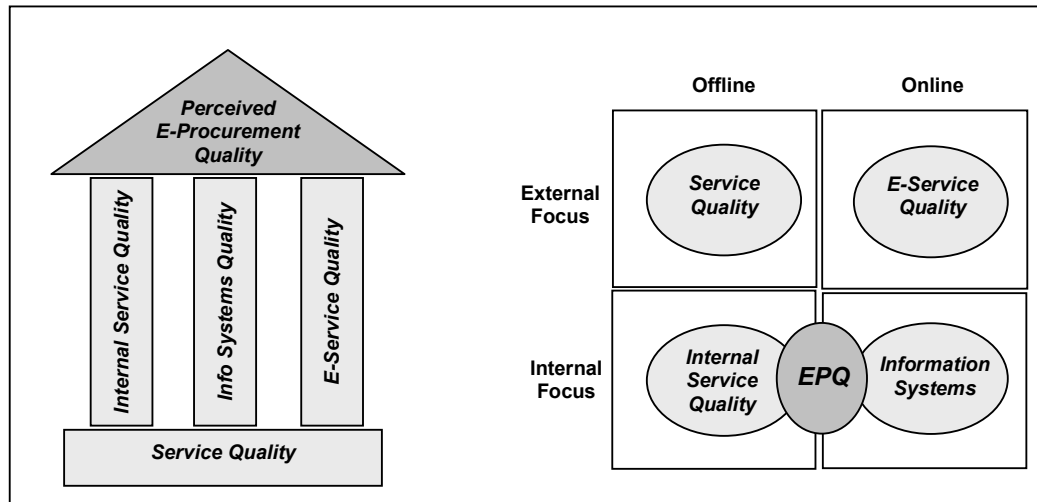


Figure 2. Literature Related to *Perceived EPQ*



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

Figure 3. Perceived EPQ Selective Codes

Figure 4. Scatter plot: Average *EPQ* Variable to *OEPQ* Rating

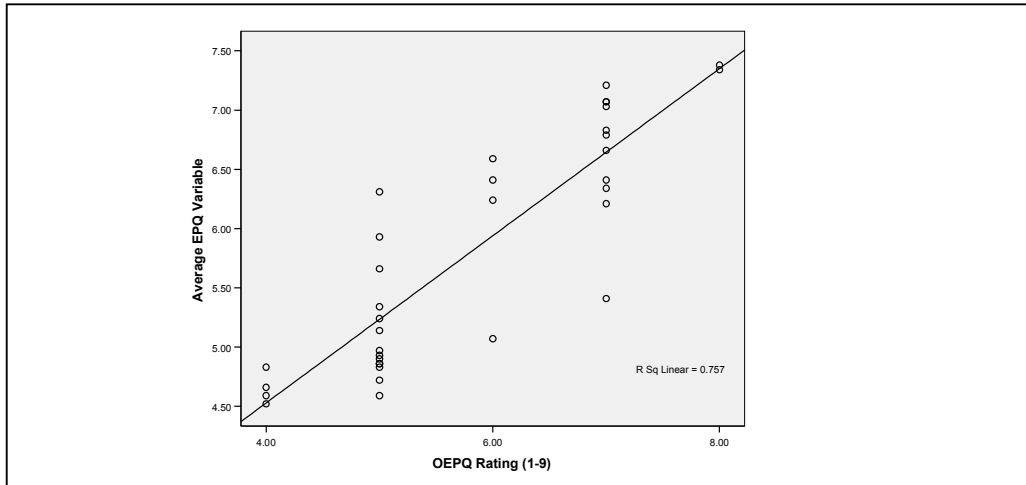


Figure 5. Histogram of *EPQ* Residuals

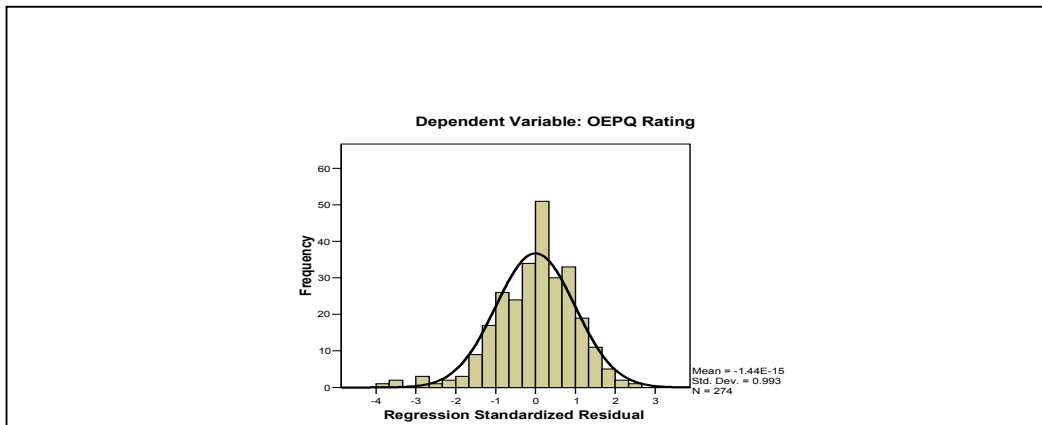


Figure 6. EPQ Model (Post-Survey Analysis)

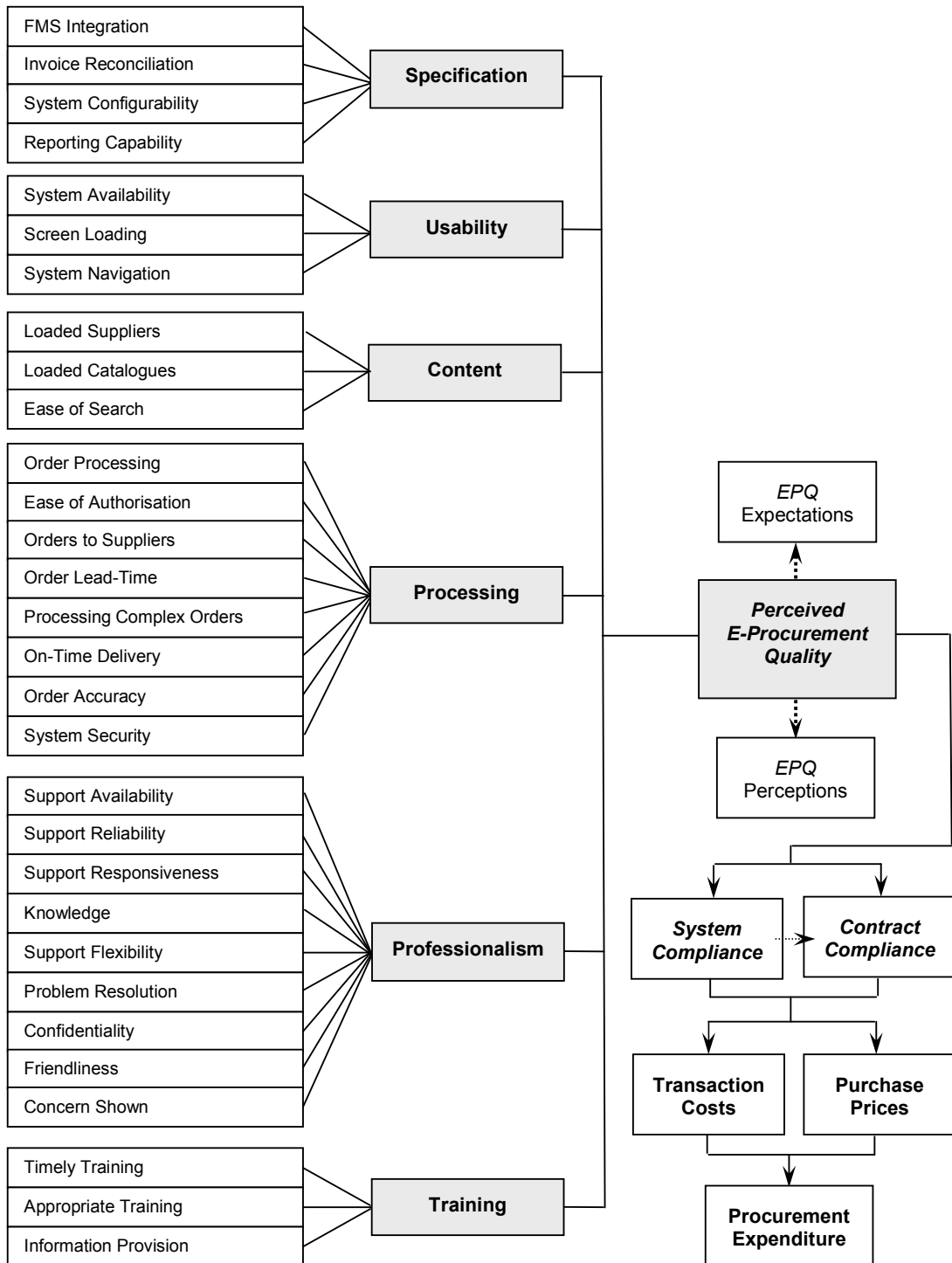


Table 1. Relevant variables from the ISQ literature

VARIABLE NAME	Cavinato '87	Hendrick & Ruch '88	McDermott & Emerson '91	Chaston '94, '95	Boshoff & Mels '95	Lewis & Gabrielson '95, '98	Lewisohn & Reynoso '95	Reynoso & Moores '95, '97	Finn <i>et al.</i> '96	Hallowell <i>et al.</i> '96	Rosler & Hirsz '96	Caruana & Pitt '97	Fierens '97	Hill & McCrory '97	Young & Varble '97	Lings & Brooks '98	Stanley & Wisner '98, '01, '02	Auty & Long '99	Kuei '99	White & Ruddell '99	Frost & Kumar '00, '01	Gilbert '00	Kang <i>et al.</i> '02	Bruhn '03	Croom & Johnston '03	Fredendall <i>et al.</i> '05
Responsiveness / Promptness	x	x	x	x	x			x	x		x	x		x	x	x	x	x	x	x	x	x	x	x	x	x
Concern / Empathy			x	x	x		x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x		x	x
Knowledge / Competence / Skills	x	x			x		x	x	x		x	x	x	x		x		x	x	x	x	x	x	x	x	x
Support Availability / Resources	x		x	x		x	x	x	x	x		x			x	x		x	x	x	x	x	x	x	x	
Service Reliability / Dependability	x		x	x	x		x	x	x			x			x	x		x	x	x	x	x	x	x	x	
Flexibility of Support	x		x		x	x	x	x	x		x	x		x	x		x	x	x	x	x	x		x	x	x
Information Provision / Communication	x	x	x		x	x		x	x	x	x	x	x	x		x	x			x			x		x	x
Dealing with Problems	x		x	x	x	x		x	x	x		x			x			x	x	x	x		x		x	x
Friendliness				x	x			x	x			x	x		x	x		x	x	x	x	x	x	x	x	x
Helpfulness / Assistance	x			x		x									x	x		x	x	x			x		x	x
Confidentiality / Integrity								x				x		x	x			x	x	x	x		x		x	
Politeness / Courtesy				x					x						x			x	x	x	x		x		x	
Trust				x											x			x	x	x	x	x		x		x
Well-dressed Employees				x	x										x			x	x	x	x		x			
Accessibility / Availability							x									x		x	x	x	x			x	x	
Up-to-date Equipment				x											x			x	x	x	x		x			
Individual Attention				x											x			x	x	x	x		x			
Visually Appealing Materials				x											x			x	x	x	x		x			
Encouraging Feedback						x		x			x		x			x							x			
Accurate Information	x			x				x										x					x			x
Lead-time / Cycle-time	x	x							x		x														x	
On-time Delivery / Reliability	x	x									x						x									x
Accuracy of Service/Order	x	x							x		x															x
Product/Service Quality	x	x							x								x									
Training						x				x			x													x
Managing Suppliers		x							x		x															
Functionality / Hardware Quality / Infrastructure						x												x								x
Leadership						x											x									x
Speed of Processing	x	x							x																	
Interpersonal Skills				x																				x		
Reputation of Purchasing	x																									x
Accountability				x																						x
Rewards										x																x
On-time Information																	x									
System Integration																										x
Customisation																								x		
System Reliability																										x
System Security																										x
Ease of Use																										x
Interactions with Purchasing	x																									
Shared Goals / Cooperation																										x
Culture							x																			
Individual Attitudes							x																			
Understanding Needs				x																						
Attention to detail																										
Proactive Decision Making																										
Dealing with Complexity		x																								
System Capacity																										x

Table 2. Relevant variables from *Information Systems* literature

VARIABLE NAME	Bailey & Pearson '83	Baroudi & Orlikowski '88	Doll & Torkzadeh '88, '98	Davis '89	DeLone & McLean '92, '03	Kettinger & Lee '94, '97, '99	Kettinger et al. '95	Pitt et al. '95, '97, '99	Myers et al. '97	Van Dyke et al. '97, '99	Jayasuria '98	Watson et al. '98	Jiang et al. '00, '02	Somers et al. '03
Quality / Provision of Information	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Responsiveness	x					x	x	x	x	x	x	x	x	x
Helpfulness	x					x	x	x	x	x	x	x	x	
Friendliness	x	x				x	x	x	x	x		x	x	
Empathy	x	x				x	x	x	x	x		x	x	
Flexibility						x	x	x	x	x	x	x	x	
Dealing with Problems						x	x	x	x	x	x	x	x	
Information Accuracy / Accurate Records	x		x		x	x	x		x				x	x
Support Availability						x	x	x	x	x	x		x	
Service Reliability / Support Reliability						x	x	x	x	x		x	x	
Well-dressed Employees						x	x	x	x	x		x	x	
Up-to-date Equipment						x	x	x	x	x		x	x	
System Reliability	x			x	x	x	x		x			x		
Visually Appealing Materials						x	x	x	x	x		x	x	
Politeness / Courtesy						x	x	x	x	x		x	x	
Individual Attention						x	x	x	x	x		x	x	
Trust						x	x	x	x	x		x	x	
Timely Information	x	x		x	x	x	x							
Customisation / Configurability	x				x	x	x							
System Speed	x				x	x	x							
Ease of Use			x		x				x					x
Complete Information					x	x	x		x					
Encouraging Feedback		x				x	x					x		
Training		x				x	x					x		
Access / Availability / Convenience	x				x	x	x							
System Integration	x					x	x							
Reporting / Management Information			x						x					x
Navigation			x	x	x									
Reliable / Unbiased / Trustworthy Information	x	x		x										
Talking User's Language						x	x				x			
Hardware Quality / System Quality / System Design	x	x			x									
Communication of Problems											x	x		
Content / Database Contents			x		x									
Visual Appeal of System	x													
Competence	x													
Timing of Training		x												
Approach to Training		x												
Format of Information			x											
Server Reliability									x					
Time Saving				x										

Table 3. Relevant Variables from E-SQ Literature

VARIABLE NAME	Rice '97	Chen '99	Barnes & Vidgen '00, '01, '02a+b	Lederer et al. '00	Lin & Lu '00	Liu & Arnett '00	Lociancono et al. '00, '02	Zeithaml et al. '00, '02a + b	Wolfinbarger & Gilly '01, '03	Yoo & Donthu '01	Koufaris '02	Yang & Jun '02	Zhu et al. '02	Trocchia & Janda '03	Voss '03	Yang et al. '03	Gounaris & Dimitriadis '03	Bansal et al. '04	Lim & Dubinsky '04	Long & McMellon '04	Sweeney & Lapp '04	Abdinnour-Helm et al. '05	BizRate.com	Gomez.com
Communication / Information Quality		x	x	x	x	x	x		x			x	x	x	x	x	x	x	x	x	x	x	x	x
Navigation	x		x	x		x	x	x	x				x	x	x	x	x	x	x	x	x			x
Visual Appeal / Aesthetics		x	x	x		x	x	x	x			x		x		x	x	x	x	x				
Confidentiality / Personal Information Security			x			x	x	x	x			x	x	x	x	x	x		x	x			x	x
Server Speed / Access Speed	x			x	x	x	x	x	x				x		x	x	x			x	x			
Transaction Security						x	x	x	x			x	x	x		x	x		x	x				
On-time Delivery			x				x	x	x			x		x	x	x		x	x	x				x
Ease of Use	x		x				x		x		x		x			x				x	x	x	x	x
Order Accuracy			x						x			x	x	x	x	x		x		x			x	x
Responsiveness								x	x			x	x		x	x	x	x		x			x	
Search / Finding Information	x					x		x	x		x				x			x	x	x	x			
Efficiency / Processing Speed								x	x	x					x	x	x		x	x	x			
System Reliability			x		x	x		x	x				x	x	x	x				x				
Support Availability								x	x			x	x			x	x			x				
Dealing with Problems						x		x	x				x	x		x				x				
Information Accuracy			x	x		x											x			x	x	x		
Content / Selection / Variety	x								x			x		x				x	x					x
Complete Information			x	x		x			x								x					x	x	
Customisation / Configuration / Personalisation			x			x		x	x			x			x									
Support Flexibility						x		x	x				x			x				x				
Support Reliability												x	x			x		x		x				x
Concern & Empathy									x				x			x	x			x				
Encouraging Feedback												x				x			x	x				
Reputation of Business			x													x			x					x
Lead-time / Fulfilment															x	x		x						x
Knowledge															x	x		x		x				
System Quality / Capability						x							x				x							x
Ease of Understanding				x								x				x								
Excitement / Enjoyment	x	x				x										x								
Friendliness																x				x				
Stock Availability								x					x											
Timely Information				x																			x	
Relevant Information			x			x																		
Proactive Service																								x
Trust							x								x									
Structural Design & Layout	x																							
Server Reliability																					x			
Number of Process Stages																						x		
Number of Catalogues																			x					
Self Learning																					x			
Up-to-date Equipment																					x			
Training																x								
Compensation								x																
Ease of Cancellation																						x		
Returns Policies																								
Order Tracking						x																		

Table 4 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 <i>FMS</i> Integration	Extensive	Limited	None	Limited
Use of Reporting Functionality	High	High	Low	Medium

Table 5 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 6 EPQ Factor Correlation Matrix

Factor	1.	2.	3.	4.	5.	6.
1. Professionalism	1.000	.485	.589	.458	.342	.452
2. Processing	.485	1.000	.394	.604	.483	.588
3. Training	.589	.394	1.000	.348	.228	.426
4. Specification	.458	.604	.348	1.000	.455	.567
5. Content	.342	.483	.228	.455	1.000	.394
6. Usability	.452	.588	.426	.567	.394	1.000

Table 7. Pearson Correlation: EPQ Scale & OEPQ Rating

	OEPQ Rating	EPQ Score (Ave 6 Factors)	Professionalism	Processing	Training	Specification	Content	Usability
OEPQ Rating	1	.698(**)	.669(**)	.561(**)	.549(**)	.527(**)	.397(**)	.414(**)
EPQ Score	.698(**)	1	.756(**)	.779(**)	.701(**)	.762(**)	.706(**)	.762(**)
Professionalism	.669(**)	.756(**)	1	.478(**)	.623(**)	.463(**)	.351(**)	.443(**)
Processing	.561(**)	.779(**)	.478(**)	1	.379(**)	.641(**)	.513(**)	.596(**)
Training	.549(**)	.701(**)	.623(**)	.379(**)	1	.332(**)	.270(**)	.401(**)
Specification	.527(**)	.762(**)	.463(**)	.641(**)	.332(**)	1	.479(**)	.558(**)
Content	.397(**)	.706(**)	.351(**)	.513(**)	.270(**)	.479(**)	1	.480(**)
Usability	.414(**)	.762(**)	.443(**)	.596(**)	.401(**)	.558(**)	.480(**)	1

** Correlation is significant at the 0.01 level (2-tailed).

Table 8. Linear Regression: EPQ Score (Ave 6 factors) to OEPQ Rating

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1(a)	.698(a)	.487	.486	.897

a Predictors: (Constant), EPQ
 b Dependent Variable: OEPQ Rating

Table 9. Stepwise Regression: EPQ Factors to OEPQ Rating

Model (e)	R	R Square	Adjusted R Square	Std. Error of the Estimate
1(a)	.669(a)	.448	.446	.931
2 (b)	.723(b)	.523	.520	.866
3 (c)	.736(c)	.542	.537	.851
4 (d)	.745(d)	.556	.549	.840

a Predictors: (Constant), Professionalism
 b Predictors: (Constant), Professionalism, Processing
 c Predictors: (Constant), Professionalism, Processing, Training
 d Predictors: (Constant), Professionalism, Processing, Training, Specification
 e Dependent Variable: OEPQ Rating

Table 10. EPQ Regressions ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression (a)(b)	237.155	4	59.289	84.121	.000(d)
Residual	189.593	269	.705		
Total	426.748	273			

a Predictors: (Constant), Professionalism, Processing, Training, Specification
b Dependent Variable: *OEPQ Rating*