

**TECHNOLOGY IN PURCHASING:
IMPACTS ON PERFORMANCE AND FUTURE CONFIDENCE**

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Abstract

This study investigates how top Finance & Accounting managers perceive the performance implications of adopting technologies to improve Purchasing processes. Based on a large-sample (454) survey, we employ multivariate data analysis techniques to specifically provide insights into how e-Purchasing impacts organizational performance. We model a theoretical construct of e-Purchasing and empirically confirm our literature-based hypotheses that e-Purchasing strongly and positively correlates with the integration between the Finance and Purchasing departments, improves the operational performance within these departments, and positively affects the confidence of managers in future organizational performance in the face of internal and external risk. We discuss implications for purchasing & supply researchers and practitioners as well as areas for further research.

Keywords: e-Purchasing, Internal Integration, Empirical Research Methods.

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Introduction

The potential benefits of e-Purchasing (EP) for firms' operational and financial performance are an open and ongoing research question. A better understanding of these benefits is critical for purchasing & supply researchers and practitioners as they continue to guide and prepare the purchasing function for the challenges of the future. Having gained in popularity over the last decade, EP solutions are offered by leading ERP suppliers, such as SAP and Oracle and various specialist vendors, and have been adopted across all major industries and countries. Early in 2010, analysts of technology research firm Forrester estimated that the global EP market would reach almost \$4bn in sales during that calendar year (Bartels 2010).

The term EP refers to the information technologies that automate supply chain processes and associated finance processes in a comprehensive manner ("purchase-to-pay").¹ While proponents of EP have long argued qualitatively in favor of its benefits, we are unaware of any empirical evidence regarding its actual impact on the operational performance of the two affected corporate functions, Procurement and Finance, and on organizational performance overall.² Indeed, Narasimhan, Jayaram and Carter (2001) and Gonzalez-Benito (2007) point out that few papers analyze the effect of purchasing on performance. This paper investigates the

¹ A term closely related to EP, and often used interchangeably with it, is that of e-Procurement. However, EP is more comprehensive as it not only refers to e-Procurement but also comprises related products such as e-Sourcing, contract life-cycle management, automated spend analysis, accounts payable management, supplier risk management, and so on (Bartels, 2010). Depending on their functionalities, these products can automate some or all of the purchasing-related processes in Procurement (e.g., supplier transactions, purchase approvals, purchase order generation and submission) and Finance (e.g., requisition orders, invoice payment, contract matching, travel and expense processes), and cover both direct (production related) and indirect (non-production related) "spend".

² Typically cited benefits of EP are: streamlined processes, accelerated reconciliations, optimized payment and settlement procedures, improved working capital management, increased integration across functional departments, freed resources to be allocated to more value-adding activities, improved management of spend and supply chain risks, and centrally stored and administered procurement data which can be used to consolidate suppliers, negotiate better prices and conditions, etc.

underlying dimensions of EP, i.e., which processes firms automate with EP, and how adopting this technology contributes to improve current and future performance.

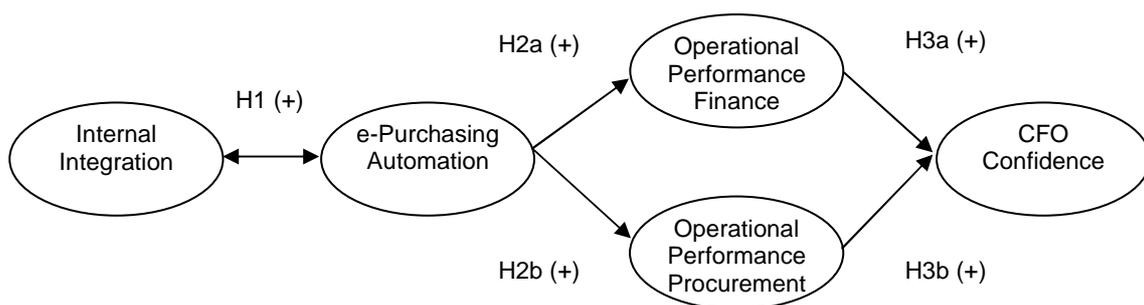
We address these issues by conceptually modeling and empirically examining the perceptions of EP by top Finance and Accounting managers (CFOs, Finance Directors, etc.). Understanding Finance’s view of EP is relevant for purchasing & supply researchers and practitioners for three reasons. First, purchasing processes in Procurement and Finance are inextricably linked: while one department ensures the flow of goods and services, the other manages the associated flow of funds. Second, Finance controls the corporate ‘purse strings’, exerting considerable influence on *future* decisions about purchasing; perceptions about the *current* benefits of *past* investments in technology will feed back into these decisions. Third, Finance is uniquely positioned to understand EP’s ultimate consequences for the financial performance of a firm.

Conceptual Model and Hypothesis Development

We develop a structural research model (Figure 1) that relates the automation brought by EP to integration, operational performance, and CFO confidence as a proxy of expected future organizational performance of the firm. This model is grounded in existing literature and based on the probable notion that, instead of any direct, objectively measurable relationship existing between information technology and firm performance, there is instead a complex relationship moderated by managerial actions and perceptions (Chapman and Kihn, 2009). To account for this moderating role of managers, we measure subjective perceptions throughout, rather than actual, objective performance.³

Figure 1

Structural Research Model



³ We do so for two reasons. First, operational and financial benefits of EP are difficult to measure objectively, as they arise over multiple years and are confounded by other factors that influence performance. Second, user perceptions are important even if objective measurement is possible because they have the potential to feed back into future-period performance.

e-Purchasing Automation

The literature develops various arguments about the role of information technology in managing operations in general and purchasing in particular.

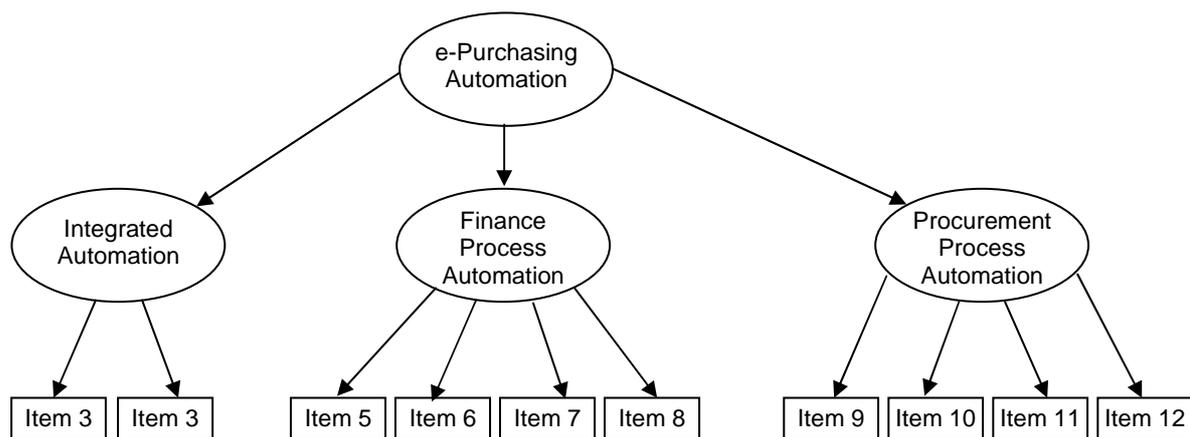
EP modifies purchasing processes in the two affected departments and serves to improve multiple dimensions of performance.

Managerial perceptions are shaped by EP's critical underlying dimensions and how they actually modify concrete, identifiable operational processes. As we perceive a gap in the literature relating to these underlying dimensions, we define a theoretical construct of them (Figure 2):

Proposition: e-Purchasing Automation can be characterized by separate underlying dimensions relating to Finance Process Automation, Procurement Process Automation and Integrated Automation.

Figure 2

Structural Research Model



e-Purchasing Automation and Internal Integration

Researchers have long argued for internal integration between departments to achieve better economic performance (Flynn, Huo and Zhao 2010; other). Following Flynn, Huo and Zhao (2010), we define internal integration as the degree to which two organizational units strategically collaborate with each other and collaboratively manage their inter- and intra-unit processes to provide maximum value to the firm. Internal integration constitutes an important part in comprehensive supply chain integration, complementing and linking firms' external integration across multiple "arcs" along the value chain (Frohlich and Westbrook, 2001).

In addition, researchers have argued that technology plays an important role in achieving such integration. By removing complexities and information asymmetries, EP has the potential to act as an integrative technology (Vickery, Jayaram, Droge and Calantone, 2003) that enables not only improvement of processes *within* organizational units but also integration of processes *between* them. Indeed, the argument goes that the integration of processes between organizational units constitutes the main benefit of technology adoption. Because of this

integrative role, we expect the CFOs to report a link between perceived EP Automation and the perceived integration between Finance and Procurement.

H1: e-Purchasing Automation is positively correlated with the integration between the Finance and the Procurement departments.

e-Purchasing Automation and Operational Performance

Research has shown that internal integration moderates corporate performance (Flynn et al., 2010), but there exists little evidence relating to how this happens, e.g., the contribution of specific technologies or specific process improvements in this relationship. The little literature that exists argues for a positive effect of EP on firm performance (Narasimhan et al., 2003), but there is a lack of empirical evidence demonstrating such an effect on operational performance *within* departments.

We argue for a positive relationship between EP automation and operational performance in each of the two affected departments taken individually. After all, EP automation simplifies and accelerates a variety of processes across both Finance and Procurement functions such as: purchase order tracking, access to catalog hosting services, auditing processes, and supplier evaluation processes.

However, as our study explicitly adopts the CFO perspective, we expect that the impact of EP on improving operational performance in these two functions is not perceived symmetrically (e.g., due to incomplete information or reporting bias). Rather, we expect that the CFO is not in a position to evaluate the impacts of EP in the Procurement department.

H2a: CFOs perceive a positive impact of e-Purchasing Automation on current operational performance in the Finance department.

H2b: CFOs perceive no discernable impact of e-Purchasing Automation on current operational performance in the Procurement department.

Operational Performance and CFO Confidence

To make business sense, EP has to contribute to the generation of economic value for the firm and its stakeholders. As EP structurally changes purchasing processes, its performance implications probably persist over time, and future performance implications are not objectively measurable today. At the same time, and particularly in the current economic and business climate, concurrent manifestations of economic success, such as changes in share value, revenues, or accounting profit, are too ‘noisy’ to constitute reliable measures of the long-term performance implications of EP. Therefore, we model the construct of CFO Confidence as a proxy of expected future performance of the departments and the firm.

Managers use EP information and observed process improvements as input variables to form expectations about the future and to make further value-generating decisions. Confidence influences managerial decision-making and hence future performance. Particularly in the current economic and business climate, CFO confidence about the future has important ramifications for continued operations, for example for budget allocations to continued improvement, capacity increases or project roll-outs. Given that various dimensions of operational performance are leading indicators of future financial performance (Kaplan and

Norton, 1996), we expect that CFO confidence is influenced by the CFO's perception of the current operational performance of the two departments:

H3a: Current operational performance in the Finance department has a significant positive effect on CFO Confidence about future performance.

H3b: Current operational performance in the Procurement department has a significant positive effect on CFO Confidence about future performance.

Research Methods

This study is based on an international telephone survey of top Finance & Accounting executives holding a position of CFO, Financial Director, or similar job title that clearly indicates managerial responsibility for the corporate finance and accounting function. Trained interviewers at a market research firm conducted questionnaire-based telephone interviews with such executives until a target sample of 550 was achieved. This target was set for the purpose of statistical power and was spread across twelve major economies to moderate possible country biases.⁴ In addition, to ensure that target firms were large enough to have formal purchasing management in place, we restricted sample inclusion to firms with at least 1,000 employees and US\$250 million annual turnover. Following this process, we obtained a resulting data set of 454 usable observations. We assessed these data and did not find any discernable patterns in missing data.

To measure our constructs, respondents were asked to rate the extent of automation within their organizations, regarding integrated automation, finance process automation and procurement process automation. Interviewees also answered questions about their finance and procurement departments, including the extent of integration, perceived operational performance, and confidence. Except for integrated automation, each construct has three or four items. We also construct a second order factor: e-Purchasing automation, which consists of three underlying dimensions including integrated automation, finance process automation and procurement process automation. Descriptive statistics and survey questions are presented in Table 1.

⁴ The twelve survey countries are Germany, France, USA, United Kingdom, Australia, Belgium, as well as the four Scandinavian and the three Benelux countries.

Table 1

Descriptive Statistics of Observed Variables

Questions	Items	Mean	Standard deviation	Valid N
The number of employees.	1 Number of employees	12,600	0.7	454
Your organization's turnover.	2 Turnover	US\$925 million	1.2	454
Rate the extent of the procurement and finance integrated automation.	3 Procurement integrated automation level.	2.37	0.92	454
4-point scales. (a)	4 Finance integrated automation level	2.47	0.85	454
Rate the extent of automation of the following finance and procurement process. 4-point scales: 1 for not at all, 2 for partly, 3 for mostly, and 4 for completely.	5 Requisition order	2.71	0.97	405
	6 Invoice processing	2.89	0.94	441
	7 Contract matching	2.46	0.97	401
	8 Travel and expenses	2.41	1.06	419
	9 Purchase approvals	2.84	0.99	419
	10 Purchase order submission	2.83	0.95	430
	11 Purchase order generation	2.86	0.98	428
Did you take actions on the following issues in the past 12 months? Yes/no: 1 for yes, and 0 for no.	12 Supplier transactions	2.69	0.92	419
	13 Acting on improving communications between finance and procurement functions in the past 12 months	0.38	0.49	424
	14 Acting on increasing integration between finance and procurement systems in the past 12 months	0.34	0.47	418
	15 Acting on removing complexity from finance systems and business processes	0.36	0.48	420
	16 Operating cost management of finance department	5.20	1.08	454
Rate the performance of finance department in the following aspects. 7-point scales: 1 for poor, and 7 for excellent.	17 Accuracy within finance function	5.49	1.02	454
	18 Efficiency of finance department	5.23	1.09	454
	19 Levels of control within finance department	5.30	1.03	454
Rate the performance of procurement department in the following aspects. 3-point scales: 1 for room for improvement, 2 for adequate, and 3 for excellent.	20 Identifying cost savings opportunities	1.80	0.71	454
	21 Negotiating better prices from suppliers	1.87	0.73	454
	22 Sourcing through preferred suppliers	1.98	0.68	454
	23 Improving spend visibility	1.70	0.68	454
Rate your confidence in the following aspects at this point in time. 7 points-scale: 1 for not at all confident, and 7 for highly	24 Confidence in finance performance	5.41	1.03	454
	25 Confidence in organizational performance	5.31	1.07	454
	26 Confidence in procurement performance	5.02	1.10	454

Note: (a) 1 for mainly manual but with some use of automation, 2 for mainly automated but with some use of manual process, 3 for fully automated and partly integrated with other enterprise systems, and 4 for fully automated and tightly integrated with other enterprise systems.

Using empirical multivariate data analysis techniques (Hair, Black, Babin and Anderson, 2010), we then evaluated the measurement and structural models. Results suggest a strong fit between our data and our proposed model. Structural equation modeling (SEM) analyses were conducted using AMOS with the covariance matrix as input and maximum likelihood methods. A confirmatory factor analysis verified the measurement model and found a good overall fit (see Table 2.) ($\chi^2=379.62$; d.f.=237; $p=0.00$; comparative fit index (CFI)=0.95; Tucker-Lewis Index (TLI)=0.93; Root Mean Square Error of Approximation (RMSEA)= 0.04). All standardized

loadings exceeded .45 ($p < .01$) and the constructs' Cronbach's alphas ranged from .58 to .79, suggesting reliability and validity for all underlying factors.

Table 2

Results of Confirmatory Factor Analysis

Construct	Cronbach's alpha	Items	Standardized loadings
e-Purchasing automation		Second-order results	
		Integrated automation	0.49
		Finance process automation	0.97
		Procurement process automation	0.95
Integrated automation	0.79	3 First-order results	
		4 Procurement integrated automation level	0.88
		4 Finance integrated automation level	0.74
Finance process automation	0.72	5 Requisition order	0.73
		6 Invoice processing	0.63
		7 Contract matching	0.59
		8 Travel and expenses	0.53
Procurement process automation	0.76	9 Purchase approvals	0.72
		10 Purchase order submission	0.65
		11 Purchase order generation	0.64
		12 Supplier transactions	0.61
Integration	0.66	13 Acting on improving communications between finance and procurement functions in the past 12 months	0.73
		14 Acting on increasing integration between finance and procurement systems in the past 12 months	0.60
		15 Acting on removing complexity from finance systems and business processes	0.56
Finance performance	0.79	16 Operating cost management of finance department	0.72
		17 Accuracy within finance function	0.70
		18 Efficiency of finance department	0.69
		19 Levels of control within finance department	0.69
Procurement performance	0.71	20 Identifying cost savings opportunities	0.83
		21 Negotiating better prices from suppliers	0.65
		22 Sourcing through preferred suppliers	0.58
		23 Improving spend visibility	0.53
Confidence	0.58	24 Confidence in finance performance	0.70
		25 Confidence in organizational performance	0.53
		26 Confidence in procurement performance	0.47

Notes: Loadings are standardized estimates; all are significant at $p < .01$; Fit indices: $\chi^2 = 379.62$; d.f. = 237; $p = 0.00$; comparative fit index (CFI) = 0.95; Tucker-Lewis Index (TLI) = 0.93; Root Mean Square Error of Approximation (RMSEA) = 0.04.

We further used SEM to confirm our path model and to identify the hypothesized relationships between the underlying dimensions. Fit statistics of the structural model indicate good fit: $\chi^2 = 391.49$; d.f. = 243; $p = 0.00$; CFI = 0.94; TLI = 0.93; RMSEA = 0.04.

Preliminary Results

We find evidence that supports the proposition and hypotheses of our model at the highly significant level. Evaluating the individual paths of the model, we find that correlations and all standardized path coefficients provide significant support for our proposition and hypotheses at $p < .01$ (Table 3). First, EP automation and internal integration are positively associated. Second, the effect of EP automation on operational performance is direct and positive for Finance and non-significant for Procurement. Third, operational performance in each department has a strong positive effect on CFO confidence.

Table 3

Path Model Results

Paths	Correlations
H1: Integration \longleftrightarrow e-Purchasing automation	0.28*** (a)
	Standardized path coefficients
H2a: e-Purchasing automation \rightarrow Finance Performance	0.19***
H2b: e-Purchasing automation \rightarrow Procurement Performance	Not significant (b)
H3a: Finance performance \rightarrow Confidence	0.53***
H3b: Procurement performance \rightarrow Confidence	0.24***

Notes: Parameter estimates are standardized estimates. Fit indices: $\chi^2=391.49$; d.f.=243; $p=0.00$; comparative fit index (CFI)=0.94; Tucker-Lewis Index (TLI)=0.93; Root Mean Square Error of Approximation (RMSEA)=0.04

*** Significant at $p < .01$.

(a) With covariance significant at $p < .01$.

(b) The hypothesis was tested by adding this single path to the model. No significant improvement in fit was observed when the path from *e-Purchasing automation* to *Procurement performance* was estimated. ($\Delta \chi^2 = 0.91$; Δ d.f. = 1; $p > .01$). This path is not significant and thus H2b is supported.

Conclusions and Managerial Implications

This study achieves its aim of increasing understanding of the benefits of adopting e-Purchasing (EP) technologies for firms. By studying the perspective of non-purchasing decision makers (top Finance & Accounting managers) towards EP, we contribute to the purchasing and internal supply chain literature in three ways.

First, we develop a robust framework of EP with specific Purchasing and Finance processes as its underlying key dimensions. This framework can help managers and academics to better appreciate EP and to improve the way in which these systems are implemented and managed. Second, we extend the descriptive arguments from the literature and find empirical support for

CFOs' perception that EP positively impacts integration between the Finance and Procurement departments and operational performance in these departments. Third, we provide empirical evidence that, by means of improving operational performance, EP indirectly affects managerial confidence about uncertain future performance.

We conclude that EP constitutes an important technological managerial tool for improving integration across functions and performance within functions, as well as for driving future organizational performance. Furthermore, we find that such technologies can help drive future confidence in the face of both internal and external risk.

Several avenues of potential further research emanate from this study. For example, researchers could adopt a similar 'outside-looking-in' approach to examine the perspectives -towards Purchasing or Supply Chain Management in general- of decision makers in other functions. Similarly, further investigation into this study's framework is warranted to identify additional causal relationships with broader or objective measures of organizational performance that would allow for a comprehensive evaluation of the benefits of e-Procurement.

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