e-Procurement Implementation: Critical Analysis of the Impact of Success Factors on Project Outcome

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Twenty-first century has seen the migration of many governance functions and services to the Internet. The terms like e-governance and m-governance are no longer unfamiliar words but are a political reality. The adoption of e-procurement by government entities to optimize and economize public procurements has been the buzzword of transparent governance. In fact, e-procurement has been touted as the panacea for issues like corruption and bureaucratic red-tapism. Literature is replete with studies which underline numerous benefits of migration of procurement functions to the Internet. However, e-Government Procurement (e-GP) has not taken off in India, though it is an integrated mission mode project as a part of the National e-Governance Project (NeGP) launched by the Government of India in 2006. A recent review of the e-procurement implementation by the Government of India brought out that the progress of e-procurement project implementation has been dismal. Against this backdrop, the study aims to identify the Critical Success Factors (CSF) for e-procurement project implementation. The research methodology followed included a detailed analysis of e-procurement CSFs reported in research literature and qualitative study of a few successful e-procurement implementations in India. The study concludes that the existing CSFs and their study models do not take the cultural and project context dimensions into account. Therefore, the existing body of knowledge does not aid managerial decision making. Finally, the paper brings out research gaps and suggests directions for future research.

Introduction

Based on the overall flow of materials, companies can be seen as being composed of three primary processes: purchasing, manufacturing and distribution (Thawiwinyu and Laptaned, 2009). In the parlance of purchasing, direct procurement addresses all components and raw materials that are used in the manufacturing process of a finished product such as sheet metal, semiconductors and petrochemicals, whereas indirect procurement relates to products and services for Maintenance, Repair and Operations (MRO), and focuses on products and services that are neither a part of the end product, nor are resold directly (Puschmann and Alt, 2005).

For companies to remain cost-competitive in the market, they must reduce the costs of their components and materials by sourcing from least-cost suppliers. One method to achieve this is through open bidding via the Internet (Yu *et al.*, 2008). This migration of procurement functions to the Internet is known as e-procurement. Scholars have defined

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e-procurement as an "Internet-based purchasing system that offers electronic purchase, ordering processing and enhanced administrative functions to buyers, suppliers (Panayiotou *et al.*, 2004) and management" (Atkinson, 2007). In basic terms, e-procurement can be defined as "using Internet technology in the purchasing process" (Boer *et al.*, 2002). e-Procurement is changing the way businesses purchase goods. Nowadays, since most products and services are procured using electronic data interchange and the Internet, the application of e-procurement is inevitable in both manufacturing and services (Gunasekaran and Ngai, 2008). e-Procurement is gaining popularity in business practice and the benefits encourage its adoption in a variety of areas, including IT purchases. (Ronchi *et al.*, 2010).

Research Methodology

The objective of the study is to investigate and analyze the critical factors that play a major role in successful e-government procurement implementations. The research entails compilation of e-procurement Critical Success Factors (CSFs) by triangulation of extensive literature review, qualitative case study (of successful e-government procurement implementation by the State Governments of Andhra Pradesh and Chhattisgarh in India), and informal interaction with few domain experts/stakeholders. For undertaking qualitative analysis of the selected case studies and literature review, we employed template analysis. Template analysis is the process of organizing and analyzing textual data according to themes. This can be text produced or used in the context of the evaluation irrespective of the evaluation activity. Sections of the text are described and organized according to themes considered to be important to the evaluation. This involves indexing sections of the text to be relevant to a particular theme. Unlike the quantitative approach of content analysis, developing the codes is part of the analysis process. These codes are known as 'templates'. The coding structure tends to be hierarchical with sub-themes emerging within themes (Crabtree and Miller, 1999; and Gibbs, 2007). We used the following degree of criticality test propounded by Williams and Ramaprasad (1996) for the identification of CSFs from the literature and qualitative case study. Those factors which are both necessary for and associated with success have been selected as a CSFs.

- Factors linked to success by a known causal mechanism;
- Factors necessary and sufficient for success;
- Factors necessary for success; and
- Factors associated with success.

Dimensions of e-Procurement

e-Procurement has been classified and defined by many authors. Some of them covered in Table 1 below are by no means exhaustive but give an idea of the plethora of terms and perspectives used in literature.

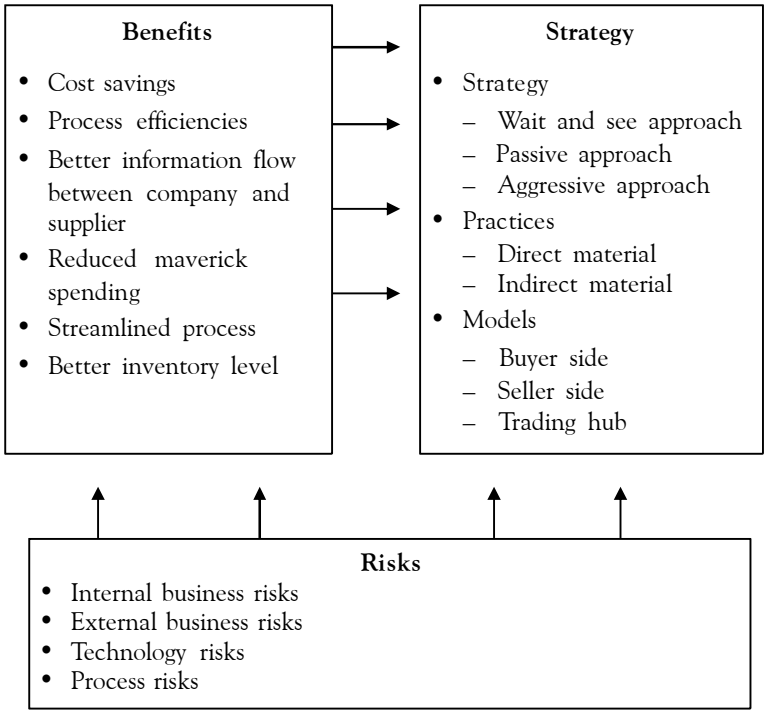
Table 1: Dimensions of e-Procurement in Literature		
Study	**Classification Based on**	**Dimensions**
(a) Kaplan and Sawhney (2000)	B2B marketplace activities	(a) MRO hubs (b) Yield managers (c) Exchanges (d) Catalog hubs
(b) Gebauer and Segev (2001)	Methods and importance of procurement	(a) Direct and indirect procurement (b) Strategic and transactional procurement
(c) Gebauer and Zagler (2000)	Type and focus of procurement	(a) Type of transaction, i.e., sourcing versus buying; (b) Main focus of the procurement, i.e., product cost, process costs
(d) Hawking *et al.* (2004)	Focus and source of procurement	(a) Indirect procurement: non-production goods (b) Direct procurement: raw materials, parts and assemblies (c) Sourcing: identification, evaluation, negotiation of products and supplies for both indirect and direct supply chain
(e) Dai and Kauffman (2002)	B2B e-market functions	(a) Aggregation (e-catalogs) (b) Matching (exchanges, e-auctions, e-reverse auctions) (c) Facilitation (MRO hubs)
(f) McLaren *et al.* (2002)	Relationship and degree of formality in procurement functions	(a) Type of relationship (many-to-many, one-to-many, one- to-one) (b) Degree of inter-organizational integration (tight versus loose) (c) Uniqueness of processes (standardized versus customized)
(g) Davila *et al.* (2003)	Adoption of Technology	(a) e-Procurement software. (b) Internet market exchanges (central virtual market) (c) Internet B2B auctions (d) Internet purchasing consortia
(h) Neef (2001)	From end users' perspective	(a) Buy-side desktop requisitioning (b) Buy-side centralized procurement management (c) Sell-side applications

Table 1 (Cont.)

Study	Classification Based on	Dimensions
(i) Yen and Ng (2003)	e-Commerce	(a) Pre-procurement (sourcing) (b) Procurement (quotation, negotiation, order placement, and transaction) (c) Post-procurement (delivery)

Parida *et al.* (2006) suggested a model (Figure 1) to describe e-procurement solution from various perspectives.

Figure 1: e-Procurement Study Model



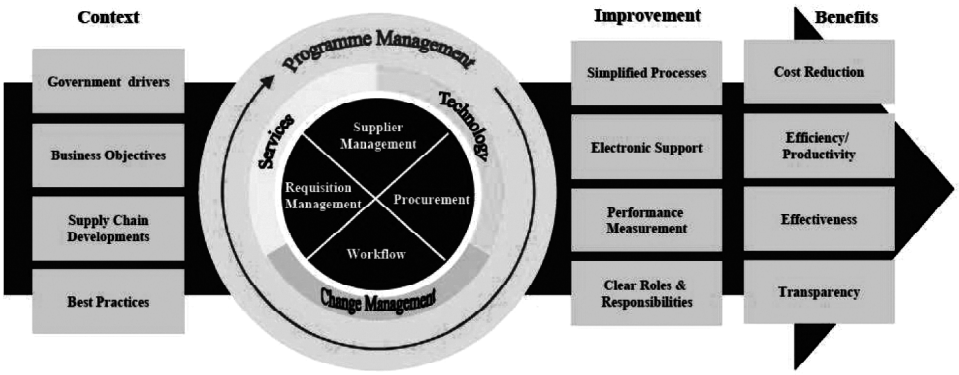
Source: Parida et al. (2006)

Benefits of e-Procurement

e-Procurement results in profitability, control and simplicity in the process of corporate procurement (Khanapuri *et al.*, 2011). Research also indicates that e-procurement leads to reduction in lead time and cost of procurement and enhanced transparency (Bof and Previtali, 2010). Some of the benefits of e-procurement are at the strategic level, such as fraud prevention and company reputation, and are highly intangible, but have a significant

impact on an organization and its future (Piotrowicz and Irani, 2009). Studies have also underscored the potential of e-reverse auctions to reduce purchasing prices for organizations and especially those with low levels of purchasing volume (Adebanjo, 2010). Also e-procurement applications have a positive impact on issues such as employees' satisfaction, job formality, work and business relationships (Aslani *et al.*, 2008). The migration of procurement functions to the Internet had a profound impact on reducing the prevalent corruption in public procurements (Panda and Sahu, 2010). Research has indicated that the cost benefit was the main driver for companies to implement e-procurement. Other benefits included were transparency and visibility across process, better internal and external relations and streamlined buying process (Parida *et al.*, 2006). Panayiotou *et al.* (2004) summed up the expected benefits of e-procurement implementation for an organization in Figure 2.

Figure 2: Expected Benefits of e-Procurement



Source: Panayiotou et al. (2004)

e-Procurement in the Public Sector

The quest to improve the government service delivery is becoming an important agenda for most governments (Kaliannan *et al.*, 2009). Governments of both developed and developing countries have embraced the Information and Communications Technology (ICT) to improve the quality of public service, increase public access to information and to energize more participation in civic affairs. There has been a great deal of criticism and negative perception that public procurement management at present is neither efficient nor effective (Moon, 2004). Such criticism and negative public perception force governments to find new and innovative approaches for promoting better and more efficient procurement management. As Information Technology (IT) has become a possible solution for many administrative problems in the public sector, e-procurement has emerged as an innovative alternative to achieve a better and more cost-efficient system.

Adebiyi *et al.* (2010) define Electronic Government Procurement (e-GP) as online application of information technology and infrastructure to the management, processing, evaluation and reporting of government procurement. Government procurement represents 18.42% of the world Gross Domestic Product (GDP). It is used by government agencies and other actors of procurement community in conducting all activities of the Government Procurement Process Cycle (GPPC) for the acquisition of goods, works, and consultancy services with enhanced efficiency in procurement management. The e-GP system can lead to an improved management of government procurement processes, thereby ensuring transparency, monitoring, control, fair selection of bidders, reduced cost of transactions and increased efficiency. According to Bof and Previtali (2010), in the public sector, e-Procurement is a collective term for a range of different technologies that can be used to automate the internal and external processes associated with the sourcing and ordering process of goods and services.

Purchasing and procurement may have more of a strategic character in the private sector than in the public sector. MacManus (2002) underlined four traditional procurement principles governing public spending which are not applicable to the corporate sector: (1) low bid wins, and that is a must; (2) separation between the vendor and user is desirable to avoid claims of favoritism; (3) fixed price and fixed term contracts are best for government; and (4) open access is absolutely imperative in all situations.

Research indicates that any e-Gov project has 70% chances of failure (Vaidya *et al.*, 2004). The same is true for the adoption of e-procurement for public procurements. For example in India, while the Government of India launched National e-Governance Plan (NeGP) in 2006 to promote e-Gov in the country (with e-GP as an integrated MMP), not much progress has been made since then. Various government orders on the subject issued during 2006-07 still remain unimplemented. There have been very few successful e-GP implementations in India. Some of them are by the Governments of Andhra Pradesh, Chhattisgarh, Karnataka, Kerala and few corporations/departments like the Indian Railways, Municipal Corporation of Delhi, Director General of Supplies and Disposal and Metal Scrap Trading Corporation Ltd. (DIT, 2011). Therefore, it becomes imperative to identify the factors which influence e-GP project outcome from research literature and successful e-GP implementations.

Critical Success Factors of e-Procurement

The need to document the success factors and experience sharing has been underlined by Davila *et al.* (2002) who noted that e-procurement technologies will become an important part of the supply chain management, and that the rate of adoption will accelerate as aggressive adopters share their experiences and perceptions of low risk. e-Procurement technologies are still perceived to involve significant risks. From a technology point of view, the lack of an overall accepted standard is holding back a sizeable number of companies from adopting technologies.

Rockart (1982) first used CSF in the context of information systems and project management. A number of researches have been subsequently reported in this field. Identifying and communicating the CSFs ensures that everyone in the program team is focused. Pinto and Slevin (1987) defined a model of a project implementation success as $S = f(x_1, x_2, ..., x_n)$ where S is project success and x_i the CSF i. They postulated that project success is contingent upon addressing CSFs associated with the nature of that project. Consequently, a number of structured researches have been conducted since 1982 for identification of CSFs for various types of projects. Some of the projects where CSFs have been reported upon are supply chain management, e-commerce, ERP and e-procurement. Some of the important studies are tabulated in Table 2.

Table 2: Important Studies Identifying e-Procurement CSF Original Table

S. No.	Study	Context	Identified CSF
1.	Chang and Wong (2010)	Adoption of e-procurement and impact of e-marketplace on firm performance	• Trust is a moderating variable between the relationship of e-procurement adoption and e-marketplace participation
2.	Angeles and Nath (2005)	B2B e-procurement	• Rationalized management of suppliers • BPR • Influencing end-user/employee procurement-related behaviors; • Technology planning with suppliers and using intelligence in designing the software and mining the data it produces; and • Supporting e-procurement
3.	Bof and Previtali (2007)	Organizational pre-conditions for e-procurement in governments	• Availability of managerial/ technical competencies • Process re-engineering • Change management • Adequacy of suppliers and IT solutions • Availability of IT infrastructure
4.	Cimander *et al.* (2009)	Cross-border e-procurement in Europe	• Technical interoperability • Legal harmonization • Employment of Digital Signatures
5.	Croom and Brandon (2005)	e-Procurement implementation in UK public sector organizations	• Economic benefit • Accurate forecast of contract volume • Establishing the purchaser-supplier connectivity

Table 2 (Cont.)

S. No.	Study	Context	Identified CSF
			• Close integration with finance systems • Organizational commitment • Inclusive project implementation team
6.	Dooley and Purchase (2006)	Electronic procurement intention	• Internal organizational support • Integration with suppliers' electronic systems • Supplier readiness • Perceived improvements to purchasing tasks
7.	Engström *et al.* (2009)	Impact of e-procurement implementation on the purchasing process	• Focusing on people involved in the implementation of e-procurement • Educating people • Strategic decisions regarding the degree of centralization • Compliance with regulations and policies
8.	Esteves and Pastor (2000)	ERP	Divides CSFs into a matrix of: • Strategic versus tactical • Operational versus technological
9.	Gunasekaran and Ngai (2008)	Adoption of e-procurement in Hong Kong	• Educating end users • Adequate financial support • Availability of interoperability and standards • Top management support and commitment • Having suitable security systems
10.	Kaliannan *et al.* (2009)	Adoption Factors of Malaysian e-procurement project, known as e-Perolehan.	**Organizational Factors**: • Organizational leadership • Organization perceived usefulness • Organization perceived ease of use • Organization facilitators **Technological Factors**: • IT infrastructure • IT Skills • e-Perolehan Capability **Environmental Factors**: • Government policy and regulations

Table 2 (Cont.)

S. No.	Study	Context	Identified CSF
			• Government advocacy • Industry acceptance
11.	Khanapuri *et al.* (2011)	Factors that can provide impetus to e-procurement implementation in India	• Cost savings, • Centralization of procurement • Re-engineering of process • Budgetary control • Supplier management • Change management, • Knowledge pool, • Maturity of market place, • Legal framework
12.	Klafft (2009)	Success factors and technology acceptance	Trust-building measures for partners.
13.	Lee *et al.* (2008)	Procurement reform through e-procurement	• BPR • Inter-agency coordination • Government push first, but citizen pull later • Mandatory use of e-procurement • Evolutionary approach to implementation change management • End user training • Attention to user complaints and requests • Continuous monitoring of system performance
14.	Moon (2005)	Diffusion of e-procurement practices and its determinants	• Capacity enhancement of quality of the systems, procurement officers • Technical • Cooperative relationships between govt. agencies, vendors, and application service providers • Addressing security and fraud related issues
15.	Panayiotou *et al.* (2004)	Maximizing possibilities of a successful procurement implementation	• Efficient processes • Monitoring and evaluation systems • Training
16.	Parida and Parida (2005)	Comparative evaluation of e-procurement implementation in Indian	• Managerial commitment • User friendliness of the e-p solution • Change management

Table 2 (Cont.)

S. No.	Study	Context	Identified CSF
		and Swedish	• User uptake • Addressing technological and security related risks in the beginning of the project
17.	Puschmann and Alt (2005)	Electronic support of internal supply chains in multinational companies	• Realignment of the purchasing organization • Embracement of suppliers at an early stage • Central supplier, content and catalogue management • Standardization of services • Integration of the e-procurement system with other relevant systems • Use of standards • BPR
18.	Quayle (2005)	Business issues affecting e-procurement implementation in SME	• Leadership • Strategy • Marketing • Waste reduction • Financial management • Research and development • Supplier development • Staff development
19.	Reunis *et al.* (2004)	e-Procurement Adoption Model (EPAM)	• Communication • Involvement • Usefulness/relative advantage • Change strategy
20.	Somasundaram and Damsgaard (2005)	Diffusion of electronic public procurement in Denmark	• Knowledge building and deployment • Subsidy • Mobilization • Standard setting • Innovation directive
21.	Teo *et al.* (2009)	Factors associated with the adoption of e-procurement in Singapore	• Firm size • Top management support • Perceived indirect benefits • Business partner influence
22.	Vaidya *et al.* (2004)	E-P initiative in public sector	• End-users' uptake and training • Supplier adoption • Business case and project management

Table 2 (Cont.)

S. No.	Study	Context	Identified CSF
			• System integration • Security and authentication • Re-engineering the process • Performance measurement • Top management support • Change management • e-Procurement implementation strategy • Technology standards
23.	Vaidya *et al.* (2006)	Evaluation of e-GP CSFs from implementation and project outcome perspective	• Security and authentication • Technological standards • System integration • Top management support • User uptake and training • Business case/project management • Supplier adoption • Change management • Re-engineering of the process • Performance measurement • e-Procurement implementation strategy • Systems and technology
24.	Veit *et al.* (2011)	e-Procurement adoption at the level of German municipalities	• Perceived risks • Local provider acceptance • Perceived benefits • Peer influence • Financial resources • Political commitment • Centralization • Employee acceptance
25.	Williams and Hardy (2007)	e-Procurement issues in Australia	• Supplier readiness • Availability of audit trail • Adequate technological infrastructure to support e-procurement • Skill level of staff • Management support
26.	Leipold *et al.* (2004)	World Bank e-Procurement for the selection of consultants	• End-users uptake and training • Supplier adoption • Business case and project management

Table 2 (Cont.)

S. No.	Study	Context	Identified CSF
			• System integration • Security and authentication • Re-engineering the process • Performance measurement • Top management support • Change management • e-Procurement implementation strategy • Technology standards
27.	Panda and Sahu (2011)	e-GP implementation in India	• Project implementation committees • Business process re-engineering • Deployment methodology (preferably PPP) • Incremental project evolution • Change management • Technical architecture of system • Security and integrity of data
28.	Koorn *et al.* (2001).	e-Procurement and online marketplaces	Technology, standards and controls expertise and experience

Apart from the CSFs brought out above, an important CSF for the success of e-procurement adoption is to address the internal service quality attributes of e-procurement processes (Croom and Brandon, 2007). Kurnia and Md. Rahim (2007) underlined the problems of implementation and integration of the existing infrastructure and security, and control risks were holding back companies from wide usage of e-procurement. But above all, lack of managerial commitment hinders the adoption process. Vaidyanathan and Devaraj (2008) indicated strong support for the relationships between information flow process quality, logistics fulfillment quality processes, and e-procurement satisfaction performance. One of the important findings of their study is that fulfilled order timeliness has a significantly greater impact on satisfaction, than the fulfilled order accuracy. Reddick (2004) indicated a positive support for e-procurement on the state management capacity and IT management capacity, indicating that high performing management is a critical catalyst for e-procurement development. Brandon-Jones (2009) brought out that commitment of internal users towards systems and contracts is a pre-requisite for the realization of e-procurement system benefits. Therefore, it was suggested that organizations planning e-procurement implementation must carefully consider the expectations of their user base since level of compliance is

influenced by the user perceptions of the system. According to Thai (2001), similar to other systems, the public procurement system's ability to accomplish procurement policies/goals is influenced by its environment, which in turn influences its environment (e.g., government procurement may improve socioeconomic environment as intended). The environment influencing the public procurement system includes many types: market, internal environment, legal environment, political environment, and socioeconomic and other environment.

Many studies have underlined that ensuring faster adoption of e-procurement requires the considering and addressing of politico-legal structural factors that are specific to a particular political and administrative context. It requires political will power to ensure administrative and legal interventions (Carayannis and Popescu, 2005; Henriksen and Mahnke, 2005; Kierkegaard, 2006; and Panda and Sahu, 2011). In fact, the Government of India (GoI) has also realized the importance of Business Process Reengineering (BPR) and change management as perquisites for successful implementation of any e-governance project. Reports outlining the strategies and guidelines to deal with them have been issued by the GoI (DARPG, 2010a and 2010b).

Firms need to identify and understand the CSFs and outcomes of web-based supply chain collaboration and address them effectively to ensure that the promised benefits can be realized and failures can be avoided, and to encourage top management toward more collaboration with business partners using Web-based technology (Al-Omoush, 2008). Extending the work of Leipold *et al.* (2004), Vaidya *et al.* (2006) and Al-Omoush (2008), we could find literature support for 11 CSFs and associated sub-factors which could have a bearing on the e-procurement project outcome. They include the seven CSFs identified by Al-Omoush (2008) and the CSFs identified by authors during qualitative case study of successful e-procurement implementation in India (Panda and Sahu, 2011). These CSFs are explained in subsequent paragraphs.

Top Management Support

Success of any project outcome to a great extent depends upon the top management buy in. Push of the top management and political will have been found to be the most important factors for successful implementation of e-procurement in the Indian states of Chhattisgarh and Andhra Pradesh. Setting up milestones, committing necessary resources and mandating use of e-procurement requires commitment of the top leadership to the system. Shaking the bureaucratic slumber and ensuring critical inter-departmental coordination (necessary for effective e-procurement implementation) requires push from top leadership (Table 3).

e-Procurement Implementation Strategy

Once having decided to implement e-procurement solution, it is imperative that way ahead is planned by the organization concerned, keeping in view the opportunities and

Table 3: Literature Support for Top Management Support	
Sub-Factor	**Study**
Understanding of the capabilities and limitations of IT	Finnegan and Golden (1996), Somers and Nelson (2001), Eid *et al.* (2004), Ngai *et al.* (2004), Ranganathan *et al.* (2004), Jeon *et al.* (2006)
Approval from top management	Nah *et al.* (2003), Loh and Koh (2004), Croom and Brandon (2005), Parida and Parida (2005), Kampstra *et al.* (2006), Dooley and Purchase (2006), Plant and Willcocks (2007), Gunasekaran and Ngai (2008), Kaliannan *et al.* (2009), Panda and Sahu (2011)
Identification of the project as top priority	Nah *et al.* (2001), Nah *et al.* (2003), Vakola and Wilson (2004), Loh and Koh (2004), Plant and Willcocks (2007)
Systems alignment with business strategy	Ho and Pardo (2004), Gunasekaran and Ngai (2004a), Dooley and Purchase (2006), Kampstra *et al.* (2006), Bricknall *et al.* (2007)
Allocation of appropriate resources	Parr and Shanks (2000), Nah *et al.* (2001), Vakola and Wilson (2004), Eid *et al.* (2004), Gunasekaran and Ngai (2004b), Croom and Brandon (2005), Gunasekaran and Ngai (2008), Kaliannan *et al.* (2009)
Establishment of appropriate work culture	Presutti (2003), Ngai *et al.* (2004), Eid *et al.* (2004), Forman and Lippert (2005), Paper and Chang (2005), Kampstra *et al.* (2006), Kim (2006), Dooley and Purchase (2006), Lee *et al.* (2008), Engstrom *et al.* (2009), Kaliannan *et al.* (2009), Panda and Sahu (2011)
Source: Adapted from Leipold et al. (2004), Vaidya et al. (2006) and Al-Omoush (2008)	

symbiotic relationships. The implementation strategy should take into account the opportunities that would be available once e-procurement solution is in place. Major benefits from e-procurement are likely to accrue to the government from the aggregation of demands of all departments. It would facilitate optimization of costs due to bulk procurement and thus, would help government to leverage its buying power with prospective suppliers. However, the aggregation of demands remains a major hurdle due to vested departmental interests, perceived loss of authority and effort required in achieving it. The need for demand aggregation should also be weighed against the degree of decentralization desired for purchases (Table 4).

Business Case and Project Management

The successful initiation and subsequent progression of the e-procurement project requires making a strong case in favor of migration of procurement functions to Internet. The inertia of procurement officers and other people associated with procurement functions can only be broken by making a strong case which necessitates identification of business drivers and accruable benefits of the system verses cost of project implementation. The efficacy of the

Table 4: Literature Support for e-Procurement Implementation Strategy	
Sub-Factor	**Study**
Sound procurement practices	Moon (2005), Carpineti (2006), Bof and Previtali (2007) and (2010), Coscia (2008), Hardy and Williams (2008), Esteves and Pastor (2000)
Opportunities for aggregation	Angeles and Nath (2005), Croom and Brandon (2005), Dooley and Purchase (2006), Gupta (2007), Batenburg (2007), Chen *et al.* (2009), Panda and Sahu (2011), Khanpuri *et al.* (2011)
Relationships with industry and small businesses	Croom and Brandon (2005), Dooley and Purchase (2006) Al-Omoush (2008), Amelinckx *et al.* (2008), Bof and Previtali (2010), Chang and Wong (2010), Panda and Sahu (2011)
Source: Adapted from Leipold et al. (2004), Vaidya et al (2006) and Al-Omoush (2008)	

system can be proven by undertaking pilot projects which would allay all fears and counter arguments put forth by potential opponents to the e-procurement system. The identification of business/change management risks and implementation of risk mitigation plans is very important to deal with temporary setbacks that the organization might face (Table 5).

Table 5: Literature Support for Business Case and Project Management	
Sub Factor	**Study**
Identification of business drivers	Benslimane (2004), Lian and Laing (2004), Kaliannan *et al.* (2009), Mamillapalli (2010), Ronchi *et al.* (2010), Sahu *et al.* (2010)
Business process assessment and requirement	Presutti (2003), Santema (2003), Vaidya *et al.* (2004), Engström *et al.* (2009), Kaliannan *et al.* (2009), Srivastava (2010)
Return on Investment (ROI)	Koorn *et al.* (2001), Capgemini (2004), Brandon (2005), Kelkar (2010), Croom and Khanpuri *et al.* (2011)
Total Cost of Ownership (TCO)	Hultman (2005), CeG (IIMA) (2007), Al-Omoush (2008), Amelinckx *et al.* (2008), Martínez-Martínez (2008), Lou (2009)
Risks identification and management	Davila (2002), Croom and Brandon (2005), Parida and Parida (2005), Schapper (2006), Foerstl *et al.* (2010), Panikar (2010)
Pilot projects	Gebauer (2002), Ramsay and Croom (2008), Lee *et al.* (2008), Panda and Sahu (2011)
Source: Adapted from Leipold et al. (2004), Vaidya et al. (2006) and Al-Omoush (2008)	

Business Process Re-Engineering

Implementation of manual procedures in e-procurement system often leads to unmanageable and inefficient system flow. Therefore, it is important that the organization undertakes a fresh look at all the procurement functions/processes. The inefficient and non value adding processes must be purged, while mandatory processes must be optimized for e-use. The importance of substantial business process re-engineering has been underlined in successful e-procurement implementations in India (Table 6).

Table 6: Literature Support for Business Process Re-Engineering

Sub-Factor	Study
Diagnostic and analysis of the processes	Ramamurthy *et al*. (1999), Angeles and Nath (2005), Bevilacqua *et al*. (2005), Trkman and Groznik (2006), Bof and Previtali (2007), Plant and Willcocks (2007)
Redesign of business processes	Ramamurthy *et al*. (1999), Somers and Nelson (2001), Panayiotou *et al*. (2004), Ranganathan *et al*. (2004), Angeles and Nath (2005), Beresford *et al*. (2005), Trkman and Groznik (2006), Bof and Previtali (2007), Lee *et al*. (2008), Khanpuri *et al*. (2011)
Contributions of IS managers	King (2001), Galliers and Leidner (2003), Lai and Mahapatra (2004), Paper and Chang (2005), Bof and Previtali (2007)
Integrated supply chain processes	Skjoett *et al*. (2003), Grossman (2004), Gunasekaran and Ngai (2004b), Angeles and Nath (2005), Auramo *et al*. (2005), Defee and Stank (2005), Sanders and Premus (2005), Simatupang and Sridharan (2005a)
Collaborative process improvement	Finnegan and Golden (1996), Skjoett *et al*. (2003), Angeles and Nath (2005), Lambert *et al*. (2005), Simatupang and Sridharan (2005a), Tummala *et al*. (2006), Bof and Previtali (2007)
Continuous process improvement	Nah *et al*. (2001), Skjoett *et al*. (2003), Panayiotou *et al*. (2004), Beresford *et al*. (2005), Defee and Stank (2005), Tummala *et al*. (2006), Trkman and Groznik (2006), Panda and Sahu (2011)

Source: Adapted from Leipold et al. (2004), Vaidya et al. (2006) and Al-Omoush (2008)

Technology Standards

Since the e-procurement system would undergo vertical and horizontal integration across systems and enterprises, it is imperative that the system be built around well-accepted technical content and process/procedural standards. Additionally, since the system has to meet legal requirement of audit-ability, etc., it must also comply with legal/administrative frameworks prevalent in the country. The system should be developed around open source technologies and standards. Hardware optimizations such as active-active failover, load balancers, proper sizing of servers and finally disaster recovery of the setup should be

planned and implemented. The interface design should be intuitive, easy to use and with proper upward-downward navigation. Efforts should be made to reduce the number of mouse clicks required for getting the required information. The interface of the system should be optimized for faster access over slow Internet speeds. Exhaustive FAQs and contextual as well as structured help should be prepared and be made available (Table 7).

Table 7: Literature Support for Technology Standards

Sub-Factor	Study
Technical standards	ADB (2004), Baghdadi (2004), Angeles and Nath (2005), Moon (2005), Knut (2009), Cimander *et al.* (2009), Engstrom *et al.* (2009), Bhatnagar (2010), Panda and Sahu (2011)
Content standards	ADB (2004), Döring *et al.* (2006), Engstrom *et al.* (2009)
Process and procedural standards	Presutti (2003), ADB (2004), Angeles and Nath (2005), Somasundaram and Damsgaard (2005), Dias and Rafael (2007), Gunasekaran and Ngai (2008), Cimander *et al.* (2009), Gunasekaran *et al.* (2009), Kaliannan*et al.* (2009), Panda and Sahu (2011)
Compliance with the standards frameworks	ADB (2004), Panda and Sahu (2011), Chauhan (2010), Döring *et al.* (2006), Knut (2009), Cimander *et al.* (2009), Engstrom *et al.* (2009), Gunasekaran and Ngai (2008), Kaliannan *et al.* (2009), Khanpuri *et al.* (2011), Lee *et al.* (2008)
Interoperability	ADB (2004), Chauhan (2010), Panda and Sahu (2011)

Source: Adapted from Leipold et al. (2004), Vaidya et al. (2006) and Al-Omoush (2008)

Security and Authentication

If reliability, security and confidentiality of financial data like bid amount, etc. are not ensured, e-procurement system may actually promote corruption contrary to its stated benefit. The system and the data contained in it should be well protected by putting information security related hardware (intrusion prevention system, antivirus gateways, centralized logging, etc.), software solution and (preventive and detective) information security procedures. The selection and employment of appropriate security controls for an information system are important tasks that can have major implications on the operations and assets of an organization. Security controls are the management, operational, and technical safeguards or countermeasures prescribed for an information system to protect the confidentiality, integrity and availability of the system and its information (Table 8).

System Integration

For an e-procurement system to be effective and ultimately be successful, it is important that the system is integrated with the existing IT systems, specially financial systems. It is also very important that the information shared in real-time across systems is reliable

Table 8: Literature Support for Security and Authentication	
Sub Factor	**Study**
Software, hardware availability and reliability	Ramamurthy *et al.* (1999), Gunasekaran and Ngai (2004a), Ngai *et al.* (2004), Loh and Koh (2004), Kaynak *et al.* (2005), Bof and Previtali (2007), Moon (2005), Panda and Sahu (2011)
Web-based systems reliability	Soliman and Janz (2004), Gunasekaran and Ngai (2004a), Goo and Nam (2007), Wong *et al.* (2007)
Web-based systems scalability	Ball *et al.* (2002), Galliers and Leidner (2003), Soliman and Janz (2004), Wong *et al.* (2007)
Security of Web-based systems	Khosrow and Herman (2001), Kim and Im (2002), Umble *et al.* (2003), Gunasekaran and Ngai (2004a), Chuang and Shaw (2005), Moon (2005), Parida and Parida (2005), Gunasekaran and Ngai (2008), Cimander *et al.* (2009), Panda and Sahu (2011)
IT previous experiences	Morgan and Bridgewater (2004), Gunasekaran and Ngai (2004a), Zou and Seo (2005)
Source: Adapted from Leipold et al. (2004), Vaidya et al. (2006) and Al-Omoush (2008)	

and accurate. All the stakeholders should have controlled access to the e-procurement system data (Table 9).

Table 9: Literature Support for System Integration	
Sub Factor	**Study**
Supportive cultural environment	McIvor *et al.* (2003), Presutti (2003), Chin *et al.* (2004), Vakola and Wilson (2004), Angeles and Nath (2005), Moon (2005), Parida and Parida (2005), Li *et al.* (2007)
Information accuracy	Umble *et al.* (2003), Simatupang *et al.* (2004), Cooper and Tracey (2005), Blackhurst *et al.* (2006), Weippert *et al.* (2002), Tsai *et al.* (2005)
Real-time information sharing	Simatupang *et al.* (2004), Gunasekaran and Ngai (2004b), Balasubramanian and Tewary (2005), Tsai *et al.* (2005), Blackhurst *et al.* (2006), Cimander *et al.* (2009)
Reliability of information	Kim and Im (2002), Weippert *et al.* (2002), Simatupang *et al.* (2004), Auramo *et al.* (2005), Wei and Wang (2007)
Sharing of sensitive information with stakeholders	Li and Williams (1999), Sherer (2003), Soliman and Janz (2004), Angeles and Nath (2005), Bagchi and Skjoett (2005), Cooper and Tracey (2005), Dooley and Purchase (2006)
Information accessibility	Loh and Koh (2004), Gunasekaran and Ngai (2004a), Angeles and Nath (2005), Boyer and Hult (2005), Defee and Stank (2005), Peansupap and Walker (2005)
Source: Adapted from Leipold et al. (2004), Vaidya et al. (2006) and Al-Omoush (2008)	

Change Management

Support to the concept, implementation and effective utilization of the e-procurement systems by stakeholders (suppliers, departmental users, etc.) is a must. Effective change management plan in terms of imparting training to stakeholders of the system like internal users, vendors, etc., and institutionalized mechanism for obtaining feedback from stakeholders is necessary for smooth roll out of the system. Setup of help desk system or call center, online help, contextual help and FAQs must be available in the online e-procurement portal. Making irreversible changeover to e-procurement is normally the vital first step (Table 10).

Table 10: Literature Support for Change Management

Sub-Factor	Study
Identification and management of key stakeholders	Esteves (2000), Presutti (2003), Angeles and Nath (2005), Cai (2005), Moon (2005), Bof and Previtali (2007), Lee *et al.* (2008), Kaliannan *et al.* (2009), Klafft (2009), Bhatnagar (2010), Kalsi (2010), Schooner *et al.* (2008), Khanpuri *et al.* (2011), Panda and Sahu (2011)
e-Procurement impact assessment	Al-Omoush (2008), Aslani *et al.* (2008), Brandon (2009), Kaliannan *et al.* (2009), Bof and Previtali (2010), Bhatnagar (2010)
Identification and mitigation of potential barriers	Carayannis and Popescu (2005), Kshetri (2007), Bof and Previtali (2007), Gunasekaran and Ngai (2008), Van (2009), Panda and Sahu (2011)
Effective management of organizational resistance	Angeles and Nath (2005), Parida and Parida (2005), Kamann (2007), Bof and Previtali (2007), Al-Omoush (2008), Lee *et al.* (2008), Kaliannan (2009), Panda and Sahu (2011), Khanpuri *et al.* (2011)

Source: Adapted from Leipold et al. (2004), Vaidya et al. (2006) and Al-Omoush (2008)

Performance Measurement

For ensuring that e-procurement system yields intended results, it is important that the system objectives are clearly spelt out, measurement of accomplishment undertaken and if necessary, course correction is implemented. These clear milestones would also encourage stakeholders to works towards their achievement (Table 11).

Training and Education

Since the e-procurement system entails a quantum jump in terms of technology, it is important that stakeholders of manual procurement system are appropriately facilitated to absorb the technology. The smooth change over to new system and its acceptability by stakeholders to a great extent would depend upon the training imparted for it. A well thought out and supportive environment must be created so that all problems faced by the system users are addressed in a time-bound and user-friendly manner (Table 12).

Table 11: Literature Support for Performance Measurement	
Sub-Factor	**Study**
Sharing a clear understanding of the objectives and goals	Soliman *et al.* (2001), Kanji (2002), Umble *et al.* (2003), Simatupang and Sridharan (2005a), Kaliannan *et al.* (2009)
Measurement of performance against the objectives and goals	Nah *et al.* (2001), Loh and Koh (2004), Panayiotou *et al.* (2004), Croom and Brandon (2005), Tummala *et al.* (2006), Lee *et al.* (2008)
Identification of measurable performance indicators	Soliman *et al.* (2001), Mason and Lefrere (2003), Loh and Koh (2004), Panayiotou *et al.* (2004), Frolick and Ariyachandra (2006), Tummala *et al.* (2006)
Alignment of compensation and rewards with performance evaluation	Nah *et al.* (2001), Stank *et al.* (2001), Umble *et al.* (2003), Panayiotou *et al.* (2004), Defee and Stank (2005), Min *et al.* (2005), Simatupang and Sridharan (2005a), Lee *et al.* (2008)
Guiding the stakeholders to improve overall performance	Nah *et al.* (2001), Chin *et al.* (2004), Panayiotou *et al.* (2004), Loh and Koh (2004), Simatupang and Sridharan (2005a), Jonsson and Gunnarsson (2005), Angeles and Nath (2005), Kaliannan *et al.* (2009)
Source: Adapted from Leipold et al. (2004), Vaidya et al. (2006) and Al-Omoush (2008)	

Table 12: Literature Support for Training and Education	
Sub-Factor	**Study**
Training and learning how to operate new IT tools	Ngai *et al.* (2004), Somers and Nelson (2001), Eid *et al.* (2004), Umble *et al.* (2003), Dowlatshahi (2005), Loh and Koh (2004), Engstrom *et al.* (2009), Gunasekaran and Ngai (2008)
Understand how the system will change business processes	Somers and Nelson (2001), Nah *et al.* (2001), Presutti (2003), Loh and Koh (2004), Yang *et al.* (2006)
Investment in knowledge capital	Gunasekaran and Ngai (2004a), Somers and Nelson (2001), Dowlatshahi (2005), Zou and Seo (2006), Umble *et al.* (2003), Angeles and Nath (2005), Engstrom *et al.* (2009), Gunasekaran and Ngai (2008), Khanpuri *et al.* (2011)
Supportive environment	Presutti (2003), Nix *et al.* (2004), Peansupap and Walker (2005), Zou and Seo (2006), Yang *et al.* (2006), Gunasekaran and Ngai (2008), Lee *et al.* (2008), Engstrom *et al.* (2009), Panda and Sahu (2011)
Developing own in-house training	Ramamurthy *et al.* (1999), Nix *et al.* (2004), Ngai *et al.* (2004), Zou and Seo (2006)

Table 12 (Cont.)

Sub-Factor	Study
Continuous learning and training	Somers and Nelson (2001), Eid *et al.* (2004), Panayiotou *et al.* (2004), Zou and Seo (2006), Gunasekaran and Ngai (2008), Lee *et al.* (2008), Engstrom *et al.* (2009), Panda and Sahu (2011)
Source: Adapted from Leipold et al. (2004), Vaidya et al. (2006) and Al-Omoush (2008)	

Adoption by Stakeholders

Suppliers are the most important stakeholders in the ensuring success of an e-procurement solution. They must be involved in every step of system implementation. They should be encouraged to use the system and provide feedback for its improvement. The system should be designed to be simple yet effective for use by a not so tech-savvy supplier (Table 13).

Table 13: Literature Support for Adoption by Stakeholders

Sub Factor	Study
Reliability of participants	Ratnasingha (1998), Sherer (2003), Hsieh and Hiang (2004), Forman and Lippert (2005), Ibrahim and Ribbers (2006), Tummala *et al.* (2006), Chang and Wong (2010)
Competence and compatibility of of partners	Wong *et al.* (2005), Dooley and Purchase (2006), Ibrahim and Ribbers (2006), Angeles and Nath (2007a), Bof and Previtali (2007), Kaliannan *et al.* (2009), Chang and Wong (2010)
Vulnerability to additional risks	Balasubramanian and Tewary (2005), Lin *et al.* (2005), Yeh (2005), O'reilly and Finnegan (2005)
Continuous communication	Angeles and Nath (2005), Croom and Brandon (2005), Defee and Stank (2005), Yeh (2005), Chu and Fang (2006), Engstrom *et al.* (2009)
Explicit procedures to monitor participant performance	Simatupang and Sridharan (2005a), Angeles and Nath (2005), Balasubramanian and Tewary (2005), Forman and Lippert (2005), Skjoett *et al.* (2005), Yeh (2005)
Perceived satisfaction	Ibbott and O'Keefe (2004), Parida and Parida (2005), Wong *et al.* (2005), Chu and Fang (2006), Tummala *et al.* (2006), Kaliannan *et al.* (2009)
Source: Adapted from Leipold et al. (2004), Vaidya et al. (2006) and Al-Omoush (2008)	

Research Gaps

Though lot of research has already been carried out in the area of CSF identification and their evaluation framework, however, these studies are limited in scope because they were conducted in different national culture. According to Azadegan (2008), the faster pace of

technological evolution has made adoption of new technologies, such as those used for electronic procurement, a common practice. But not all firms uniformly adopt all technologies. This difference in adoption of e-procurement system is, among other things, influenced by national culture. Batenburg (2007), in his study, found that there are differences with respect to e-procurement adoption based on national culture, and that firms from countries with a low uncertainty avoidance such as Germany and the UK are the early adopters of e-procurement, while countries that are less reluctant to change such as Spain and France have lower adoption rates. This aspect of impact of national culture on project adoption has also been underlined by Tas and Genis (2008) in their study that analyzed the relationship between efficiency of e-procurement systems and Hofstede's (2001) cultural dimensions of countries. They concluded that the effect of cultural dimensions on participation of enterprises to e-commerce differs by the size of the enterprise and the sector that the enterprise belongs to. Therefore, the existing literature is based on measurement of CSF outcome and e-GP adoption. They lack specifics to the Indian context and public procurement policies and are not relevant to the Indian context due to difference in the enabling environment like IT infrastructure, penetration of Internet and IT literacy.

It is well known that project environment also affects project outcome (Thai, 2001). Joo and Kim (2004) also brought out that innovation, environment and organization characteristics are determinants for the adoption of an e-marketplace. The findings of their study indicate that external pressure and organizational size have a positive relationship with the organizational adoption of e-marketplaces.

Conclusion

As brought out above, it is clear that environmental factors affect the success of e-procurement system; therefore, 11 CSFs enumerated above must be tested against environmental and cultural factors. Some of the CSFs and their sub-factors identified by the authors may not be relevant for a particular project context due to their overall impact on project outcome. For example, transparency and top leadership support are likely to be more relevant in countries where corruption is prevalent. The same factor may have marginal impact in countries which figure low on corruption perception index of transparency international.

Directions for Future Work: In addition, the existing literature indicates the flat nature of CSF. However, case studies in India undertaken by authors indicate that importance of CSF changes through the lifecycle of project implementation. Therefore, further studies are needed to test the impact of CSFs on a particular stage of project implementation. As it is clear from the discussions above, the existing literature cannot be used for managerial decision making as the existing body of e-procurement CSF lacks project execution contexts like cultural dimensions, project stage etc. As we know, all projects evolve over a period of

time from simpler architecture and functionalities to complex ones. Therefore, the tabulation of CSF in terms of e-procurement stages (as suggested by Layne and Lee, 2001) would be beneficial. ⌘

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