7. E-Business and Project Procurement

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Chapter Introduction

E-business in its variety of forms that use information communication technologies (ICT) has changed the way that business transactions can take place (Sawhney and Parikh, 2001). E-Procurement has drastically altered the value generation equation by ICT reducing transaction costs (Duyshart, 1997; Duyshart, Mohamed, Hampson and Walker, 2003) and facilitating internet commerce (Lawrence, Lawrence, Newton, Dann, Corbitt and Thanasankit, 2003). In today’s market, many companies present themselves to the world via their internet site, they tender and respond to tenders use web enabled technologies, manage and control their accounting and information exchange using electronic means and they also use groupware internet technologies for sharing knowledge, decision making, coordination and project control. Moving from paper-based to object oriented data models has transformed much of the procurement process and improves supply chain integration.

![Figure 7-1 - e-Business Trajectory](image)

There has been a clear journey along a value curve over time for many companies that suggests the following trajectory: stand alone data/information processing (for internal applications); communication and information/data exchange between
business units within an organisation; processing transaction data (e.g., electronic data exchange EDI) between organisations; relationship marketing processes that bind parties more closely together using customer relationship management (CRM) applications and inter-operability of data exchange; and e-business (Sharma, 2002). Also the journey takes us from substantially paper-based to fully integrated electronic form of information exchange, financial transactions, coordination and monitoring and control of resources and activities. This is illustrated in Figure 7-1.

The literature presents case study examples of e-business for major companies, such as BHP Billiton1 one of Australia’s largest companies and a major global resource company (Chan and Swatman, 2000) as well as medium-sized construction companies such as Kane Construction2 in Australia who are typical of many organisations that undertake projects using ICT not only present themselves to potential customers and supply chain partners but also as part of a portal that allows them to interact with their supply chain using e-business applications. This particular organisation uses its web presence to project its corporate image and market its services. Kane Construction’s web site3 provides an example of how this project-based organisation can interact with the world as well as presenting its e-face to prospective clients and supply chain partners who may use e-business as a matter of course.

The relevance of linking e-business to procurement in a book such as this, relates to general changes in procurement patterns that includes closer alignment (and hence the need for ICT interoperability) as well as business process alignment. Companies that use ICT as a ‘given’ may be unlikely to want to deal with organisations that have failed to develop e-business capability or might choose to exploit a superior ICT capability. The rationale is that much of the value that integrating organisations in a supply chain through common platform ICT with interoperable data provides a critical competitive advantage (Sawhney and Parikh, 2001). The nature and extent of this capability varies amongst organisations involved in projects and so this chapter seeks to: help us understand what is meant by e-business; how it operates so that we can gain an historical perspective and better appreciate this evolving business paradigm; and to be better prepared for e-business demands in a turbulent, demanding and highly competitive global business environment. Finally, government has seen e-business as a strategic interest for procurement and have established or sponsored organisations to help develop standards and to promote e-procurement. The Australian Procurement and Construction Council Inc3 is one example (Australian Procurement & Construction Council Inc and DOLAC, 1997).

This chapter is presented in three broad sections. A vignette at the end of the chapter presents a scenario and prompts relevant questions flowing from that scenario.

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1 http://www.bhpbilliton.com/bb/home/home.jsp access date May 27th 2006
The first section deals with definitions commonly used, a brief description of the evolution of e-business with respect to project procurement, drivers and inhibitors, legal issues and issues about system compatibility (both from a business function and technology viewpoint). The purpose of this section is to familiarise readers with the main e-business issues that relate to project procurement. The second section deals with the role of ICT portals in project procurement. This ranges from technical developments such as wireless, portals, and facilitating technological infrastructures to the business systems and regulations that need to harmonise with technology advances to enable e-business to be embraced and to facilitate data-mining. The systems and regulation issues that are discussed revolve around government policy, legal aspects and business process alignment issues that make effective use advantages that e-business offers. The third section provides readers with an historical perspective of e-business for project procurement. In this section the trends that developed in the 1990’s, when e-business took off as a concept, through to the early part of this decade will be discussed. The discussion continues to the present with a perspective of current examples of how e-business has evolved. Finally in this section, we speculate about how project procurement may be undertaken in coming years. Of course our experience of history is that change overlaps with few if any schisms. The Stone Age did not end because we ran out of stones (Lovins, 2000). Similarly, while the picture we paint from the 1990’s may be familiar to some readers in 2006-7, others may see the 2010 speculations as short term plans within their own workplace.

**Fundamentals of Procurement using E-Business**

The above section intimated what e-business means and a history of its development was briefly provided. Before proceeding further we will provide definitions and a more detailed history of this trend. First definitions, there are many derivations of the term e-business terms that may be confusing, so a few definitions are provided to clarify what we are discussing in this chapter.

**Fundamentals**

Poon and Swatman (1999) describe e-commerce as sharing business information, maintaining business relationships and conducting business transactions using internet-based technologies. The focus is clearly upon using e-technologies to conduct business transactions where purchases and payments are made electronically. However, as using e-commerce does not necessarily gain an organisational a competitive advantage because it is an enabling or facilitating technology and not a solution as pointed out by Barnes, Hinton and Mieczkowska (2004). They undertook a series of case studies of 12 e-businesses and compared how these businesses linked their e-commerce activities with their full business operations such as the front order-entry and procurement of resources area, logistics, operations management, product/service delivery and the strategic alignment of all these aspects. They adapted a 1980’s four-stage maturity model of organisational strategic role and contribution of the operations function (Hayes and Wheelwright, 1984) to evaluate maturity of e-business. This approach
helps us better understand e-business development stages and indicates where various e-business forms fit into the Figure 7-1 e-business trajectory.

Stage 1 relates to inadequate technology holding back operations. Organisations may use e-commerce applications but they technology or its integration with the logistics and delivery side may cause problems, bottlenecks and inefficiencies. For example an e-business system may be used to generate business (sales, commitments to project or whatever) but this part of the business system does not ‘talk’ to the production end so delivery suffers. Stage 2 follows industry norms and best practice but as an unthinking follower so the results can be hit and miss—perhaps as good as many but not gaining any clear competitive advantage because the overall strategy has not yet been fully developed or implemented. Stage 3 may have addressed the need to integrate e-commerce with e-operations, perhaps through an enterprise resource planning system (ERP) that is internally focussed to address efficiencies and thus derive competitive advantage through a cost advantage. This stage can be described as deploying e-business because business activities are e-enabled in a well linked manner and linked to the business strategy. Stage 4 represents a more transformational stage where the integration at stage 3 is present but it allows greater engagement with external stakeholders so that new opportunities are searched for, the linked strategy is more outward looking and leads the organisation to greater differentiation and focus on potential market niches.

Christopher Barnatt (2004) provides a useful historical account of how e-business has emerged. He traces the origins back to a fiction writer William Gibson who in a book written in 1984 (now updated (Gibson, 2004) to reflect upon current developments emerging from the fantasy of the original edition), first coined the term cyberspace to describe the consensual hallucination of an abstract electronic world that human beings could occupy across computer networks. Barnatt (2004: p80) also provides an evolutionary maturity model in four stages. In Stage 1 he discusses how in the early 1990s the electronic frontier first mooted by Gibson could be conceptualised as a business model with the advent of the concept of ‘virtual’ communities, businesses and teams and the increasing use of Lotus Notes as a groupware tool. Businesses still interacted with the client and customer using traditional technologies. During the second half of the 1990s, Stage 2 emerged with the rise and fall of the dotcom. The dotcoms used purely Internet based e-commerce technologies to undertake on-line business activities while traditional businesses did business with customers in an off-line and the term ‘bricks’ or ‘clicks’ as shorthand ways to differentiate these two radically different business models. In the aftermath of the dotcom collapse, which was attributed to poor business sustainability issues, the Stage 3 emerged as an integration stage. This stage represents an evolution towards e-business where the on-line and off-line customers were able to conduct business with traditional businesses that had embraced e-commerce and were integrating these technologies with their operational business processes—thus moving towards e-business. Stage 4 represents the current mid 2000’s situation where many ‘traditional’ organisations are now using multiple integrated on-line and off-line interfaces that customers can use to respond
to a customer’s preferred interaction with these companies. This stage also relates well to the Stage 4 situation described by Barnes et al. (2004).

We can see from this discussion, a range of possible ways of understanding e-business from its pure focus on e-commerce tools for interacting with a client to procure goods or services to a fully integrated suite of software tools and enabling systems and business processes that allows seamless electronically enabled procurement through delivery processes that have been strategically thought through and aligned to the delivery mode. Thus e-business can be seen to refer to the integration of e-commerce with electronically enabled business processes to deliver goods and services. E-business maturity can be measured in terms of the levels of integration of processes from procurement to delivery and its interaction with development of business strategy from reactive through to proactive.

**Forms of E-Commerce and E-Business**

We have introduced some fundamental concepts and this now allows us to understand how e-commerce and e-business may be undertaken. We can now consider some of the many e-procurement derivatives that are explained below. Interaction between customers and suppliers (and all participants within a supply chain) can be enabled through information, files and transactions being transmitted electronically by:

- **P2P** - Peer to peer networks where individuals deal with other individuals within a network. The company PayPal⁴ has recently established a P2P payment system and there are a number of P2P file swap networks in existence;
- **B2C** - Business to customer. Selling on line to individuals or organisations such as Amazon for books, CDs etc;
- **B2G** - Business to government. This is widespread in tendering and across the Globe this is becoming a common feature. For example the Commonwealth of Australia⁵ whose purpose is for citizens to obtain information as well as be able to transact business and search for tender requests or to respond electronically to tenders etc.
- **C2G** - Citizens to government. Many governments have extensive web sites for interacting with citizens to provide information and to receive feedback.
- **C2C** - Consumer to consumers. In many ways, EBay is a C2C facilitator as its business model it to allow consumers to interact as if in an open (physical) market place swapping, bartering and buying and selling through an on line intermediary. Hobbyists and people interested in memorabilia also get together to interact and swap/buy making transactions through using the e-facilitator;
- **C2B** - Consumer to business. This may use the reverse auction model offered by a number of organisations including airline discounters where bidders set their price limit and the intermediary facilitates subscribing businesses to decide whether to accept these bids. Some organisations have sophisticated electronic

agents that allow consumers configure their options to order items. Dell\(^6\) is one of many that has this capacity.

- **G2G** – Where governments can be linked communication between these entities can be invaluable. In Australia, like the USA, Germany and other countries with a federal and state (or province) constitution, this kind of cross-government electronic interaction is most useful. Governments also interact as mentioned earlier with business in G2B and with consumers in G2C transactions.

### E-Procurement Drivers and Inhibitors

E-procurement has created new enablers for providing information (about products, services, companies, corporate actions etc.) and communication (audio, video and data in real-time or near-time) in addition to facilitating a transaction (purchase, auction or other forms) between businesses and their customers. Through computer networks (extranets - business specific interactions) and the Internet in particular, businesses and consumers can obtain information cheaper and faster. In many cases they can communicate at virtually no cost\(^7\) and transact instantaneously.

While e-commerce is typically associated with the emergence of the Internet, it dates back to the facilitation of transactions in the 1970s using EDI standards for electronic invoicing. Many banks and their business partners have been extensively using electronic funds transfers since the 1980s as a fast and cost efficient payment model.

E-procurement can entail various procurement facilities from electronic order systems (whether used in online stores or electronic exchanges), to electronic market places and desktop purchasing systems.

E-procurement yields a series of benefits:

- Reduction in (administrative transaction and back-office) costs;
- Improvement of process efficiency;
- Shortening of order fulfilment cycle times;
- Improved commercial relationships with suppliers;
- Lowering of inventory levels;
- Improvement in management of the supply chain; and
- Lower price paid for goods.

However, e-procurement is not a one-fits-all approach, due to the following disadvantages:

- Significant increase in IT maintenance costs, ongoing management and updates, standardisation of processes between differing systems and general interoperability issues;
- Significant upfront cost for enablement;

\(^6\) [http://www1.ap.dell.com/content/default.aspx?c=au&l=en&s=gen](http://www1.ap.dell.com/content/default.aspx?c=au&l=en&s=gen)

\(^7\) However the cost for establishing the infrastructure for eBusiness may also be quite expensive, because while the transaction cost might be very low, it is not zero (e.g. procuring market data etc.)
• IT security risks; and
• Increase in prices paid for goods is possible, especially for small order volumes.

The main driver for e-procurement is cost reduction achievable through process automation, reduced inventories, identification of and procurement at lowest market prices for commodities and the better use of economies of scale and other effects.

Five e-procurement models and their impact on projects are explained as follows. These present not only how e-commerce transactions are conducted but also the ways in which it enables the procurement transactions to trigger e-business processes for delivery of products or services.

**e-Sourcing**
Strategic sourcing is a systematic process for reducing the total cost of externally purchased goods or services, at a defined quality level. e-Sourcing is the automation of this process. It allows identifying new suppliers for a specific category of purchasing requirements using internet technology across spatial boundaries. Benefits of e-Sourcing include increased decision-making flexibility and (potentially) lower prices through a broader range of suppliers. However, sales personnel are often more effective at negotiating the best deal possible with a customer than a customer can confronting an electronic system, especially for non-commoditised offerings with many and varied options available. Also, large companies are unlikely to start undertaking business with unknown suppliers, which to them can constitute a large risk factor, though preferred supplier lists may alleviate this risk.

For the procurement of project services, e-Sourcing may not be a relevant approach, due to their characteristic as a “unique endeavour”. However, project organisations may use e-Sourcing for the efficient procurement of commodities required as factor inputs on projects.

**e-enabled (reverse) auctions**
In a typical auction, a seller puts up an item for sale, multiple buyers bid for the item and the highest bidder will buy the goods at a price determined by the bidding. In a reverse auction a buyer issues a request for quotations to purchase a particular item. Multiple suppliers quote the price at which they are willing to supply the requested item or service. The transaction is awarded to the supplier that provided a combination of the lowest price or best service delivery (time, quality assurance etc).

e-enabled auctions can be found in many industries (automotive, aviation, chemical, construction, health care, food and beverage, agriculture), horizontal marketplaces and apply to B2B, B2G, B2C and C2C markets. Global e-Exchanges like Auto Exchange

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and AUTOVIA\(^9\) have attracted automotive supplier and customers alike, due to the commoditised nature of the products and services in this industry.

There are many claims for cost savings from e-enabled auctions: One report from the consulting group IDC indicates that “\textit{when asking 68 purchasing managers about the amount of savings generated by using e-procurement applications in the past 12 months, 44\% said they were able to reduce their costs between 1\% and 4\% of their budget. Another 13\% said the range was between 5\% and 9\%}” (IDC and Pang, 2001: p3). However, e-enabled auctions are not the silver bullet of procurement: some of the savings from using reverse auctions are absorbed by higher cost related to errors in supplier data, post-auction negotiation, quality problems of new and unknown suppliers, late deliveries or non-delivery and other factors. A functioning market place for e-enabled auctions should minimize the risks by inviting only pre-qualified suppliers which meet certain criteria regarding quality and the ability to deliver.

The biggest drawback of the approach is that the diminishing buyer-supplier relationships may cause harm in the long run. Since a supplier loses what the buyer gains from a game theoretical perspective where some form of retaliation is likely to happen: add-on services, maintenance and support beyond the contractually agreed service levels and follow-up contracts are likely to be higher priced than in a traditional buyer-supplier relationship. For a project business, this insight is very relevant: if a sustainable relationship is intended, a relationship-minded procurement approach is more likely to succeed. Other project scenarios, such as a one-time transaction may warrant using e-enabled auctions.

\textit{Web-based Enterprise Resource Planning}

Web-based Enterprise Resource Planning (ERP) procurement modules create and approve purchasing requisitions, place purchase orders and record the goods and services receipt using a software system based on Internet technology. It describes, essentially, the integration of ERP solutions based on SAP, Oracle, Peoplesoft, JD Edwards (both now absorbed by Oracle) or other platforms, which used to be insular solutions restricted to the company using the ERP system, with its suppliers and customers. Typically, transactions are facilitated through Electronic Data Interchange, using standards such as EDI ANSI X12, EDIFACT and most importantly the current \textit{de facto} standard, XML, which are supported by recent versions of ERP solutions. In order to effectively and efficiently use web-based ERP, functioning ERP systems must be in place, clear buyer-supplier processes (workflows) have to be defined and implemented and a high-volume interaction between the buyer and long-term suppliers is meaningful, to recover implementation cost and realize efficiency gains. Project organizations, which meet these criteria will benefit from web-based ERP.

\(^9\) \url{http://www.autoviauk.com/index.htm}
As a result of web-based ERP integration efforts, buyer-supplier relationships are typically strengthened, which makes this e-Procurement approach suitable for relationship businesses.

In a Delphi study of 23 Dutch supply chain executives about the impact of ERP on supply chain management, that is of itself an important procurement choice consideration, reveals some interesting findings that are relevant for future e-business considerations (Akkermans, Bogerd, Yucesan and van Wassenhove, 2003: p284). Their findings report that there are five main issues facing these supply chain executives:

1. further integration of activities between suppliers and customers across the entire supply chain;
2. on-going changes in supply chain needs and required flexibility from IT;
3. more mass customisation of products and services leading to increasing assortments while decreasing cycle times and inventories;
4. the locus of the driver’s seat (the group ‘in charge’) of the entire supply chain; and
5. supply chains consisting of several independent enterprises.

Their study revealed an only modest role for ERP in improving supply chain management due to the current (at the 2003 time) focus of ERP as being in integrating and harmonising business processes within an organisation rather than across the supply chain. This they maintain presents considerable inhibitors for innovation within firms, however, they flag a move towards ERP re-focussing itself towards a supply chain with provision for facilitating either common standards or common interface protocols that allow different firms within a supply chain to gain advantage from information, data and knowledge flows across the chain. This interesting aspect may be more dominant at the time of publication or shortly thereafter of this book. The promise that ERP systems offers is that those firms that link into an ERP enabled supply chain may be able to be both innovative and effective—they may be able to further stretch improvement boundaries while maintaining benefits of data, information and knowledge transfer. For a useful review of the history and analysis of critical factors relating to ERP readers can refer to (Al-Mashari, Al-Mudimigh and Zairi, 2003). They present a model of a taxonomy for ERP critical factors (Al-Mashari et al., 2003) that is somewhat similar to other studies into the diffusion of innovation, for example see Peansupap and Walker (2005).

The second main finding is that the panel experts saw only a modest role for ERP in improving future supply chain effectiveness and a clear risk of ERP actually limiting progress in SCM (Akkermans et al., 2003). ERP was presented as offering a positive contribution to only four of the top 12 future supply chain issues that were identified in their study: (1) more customisation of products and services; (2) more standardised processes and information; (3) the need for worldwide IT systems; and (4) greater transparency of the marketplace. Implications for subsequent research and management practice are discussed. The following key limitations of current ERP systems in providing effective SCM support emerge as the third finding from this
exploratory study: (1) their insufficient extended enterprise functionality in crossing organizational boundaries; (2) their inflexibility to ever-changing supply chain needs, (3) their lack of functionality beyond managing transactions, and (4) their closed and non-modular system architecture. These limitations stem from the fact that the first generation of ERP products had been designed to integrate the various operations of an individual firm. In modern SCM, however, the unit of analysis has become a network of organisations, rendering these ERP products inadequate in the new economy.

The key lesson that can be gathered from the ERP literature is that it has substantial potential to influence procurement decisions based upon e-business form integration and harmonisation that can gain strategic ICT and Its related competitive advantage to participating organisations (and that includes the client in an outsourcing procurement arrangement or internally where projects are being managed from inside an organisation).

e-MRO
Similar to web-based ERP, e-MRO (Maintenance, Repair and Operating) enables non-product related MRO supplies. Channels for e-MRO include direct or desktop purchasing systems (DPS), standardised catalogues (e.g. at buyer’s site), broker intermediaries (Application Service Providers, which purchases goods on the buyer’s behalf within certain price limits) and supply-side shop systems.

Like web-enabled ERP, e-MRO is suitable for processes that show high standardisation, little human agent involvement and a supply-side focus on price.

Advantages of e-MROs include:
- Straight-forward set-up for standardised purchasing processes of e-goods;
- Potential realisation of significant cost savings; and
- Upgrade of purchasing agents to fulfil more complex and demanding tasks.

Downsides are:
- No personnel interaction between contracting parties
- No discretion over quality and prices
- No complex decision making possible
- Content rationalization leads to potential loss of valuable product information
- Across-the-board lack of Universal Product Codes (UPC)

For project organizations, the implications are the same as for web-enabled ERP.

e-Informing
e-Informing describes the gathering and distributing purchasing information both from and to internal and external parties using web technology. In this context, channels like email, brochure-ware websites, permission marketing, online newsletters, listserv discussion groups, online chat rooms are used. Typical problems of e-Informing
surround reliability and relevance of information found. A number of online research, data and news services, which emerged from the market research community, have established information services about companies, their performance, feedback from customers and records of corporate action which allow much faster evaluation of existing and potential suppliers.

e-Informing is critical for the project procurement process as it enables inexpensive and immediate access to information about business partners.

**e-Procurement Implementation**

This should follow general PM best practices and can be summarised as comprising five distinctive phases should be considered for any e-Procurement implementation:

1) Defining objectives and a strategy for the effort
   As with any business improvement effort, objectives and a strategy should be defined upfront. Is the effort merely geared at cost savings? How will this change effort impact the supplier relationships of the company? Which products and services should be bought/sold through e-Procurement channels, and which should not? Can we achieve further process improvement and reduce the number of defects in the procurement process? These and other questions should be answered prior to pursuing the transformation effort.

2) Establishing a business case for gains from e-procurement
   As discussed before, business benefits from e-Procurement will not materialise for every procurement scenario. A quantitative business case will help identifying the merits and measure their achievement during and after the improvement project.

3) Process Re-engineering
   As mentioned before, the primary benefit from e-Procurement implementations may reside in the improvement of internal or buyer-supplier processes, since these processes typically involve frequent manual interaction and maybe barely standardised or even defined. A re-engineering effort for these processes should be conducted with the emphasis on optimal interaction between buyer and supplier, with information technology as a constraint. A lesson learned from e-Procurement projects, is that they are often assigned to a chief information officer (CIO) or chief technology officer (CTO) of a company and therefore IT centric. Implementing existing inefficient processes into a new technology platform will only partially (or not at all) realise the potential gains from e-Procurement enablement. e-Procurement bares the potential to radically improve process management through workflow definition and (automated) workflow management.

4) Technical Implementation
The implementation of e-Procurement solutions, such as web-enabled ERPs can come at substantial cost. Provided the company already possesses a modern ERP system, e-Procurement capabilities will be embedded or easy to add through additional modules or (web) services. If, however, an older or proprietary ERP solution is used, substantial custom development of e-Procurement functionality and especially interfacing capabilities to electronic markets or the systems of the business partners may be required, which may destroy the business case for the implementation. Lastly, training of the procurement stakeholders, ongoing support and maintenance also have to be considered as part of the implementation cost. As in any IT implementation, user acceptance, component and integration testing will be required to assure a functioning platform from day one.

5) Change Management

Lastly, process and system changes as described bring significant change to an organisation. In order to achieve acceptance of the e-Procurement solution, change management plans have to be developed and executed to achieve adaptation of the e-Procurement solution by the procurement staff. Since change management always constitutes a challenge, this component of the effort can be critical to the success of the project.

Legal, Ethical and Security Issues

Undertaking e-business transactions with partners or procuring goods or services using e-business entail considering legal and ethical obligations (though these may be complicated by jurisdiction issues). In theory, trading using e-business should be conducted under the same rules and regulations as with paper-based, word-of-mouth or telephonic systems. The main complication that e-business presents is centred on copyright, ownership of data/information, and matters of censorship.

Another aspect is fraud. Fraud was mentioned in Chapter 4 and reference was made to the KPMG survey\(^\text{10}\). Wilson (2004: p2) argues that fraud can be understood by considering the Cressey’s Fraud Triangle model that posits fraud to occur where there is opportunity, pressure and rationalisation. Pressure comes from the fraudster’s motivational drives be that greed, need, malice or ego. Rationalisation derives from the individual’s ethical stance and as explained in Chapter 4 people may be moral chameleons and thus join in a fraudulent act with others rationalising it to be an act that is congruent with the norms of the group or, as is more commonly the case, it may be an individual who rationalises the act as ‘pay back’ at someone or an organisation for a perceived injustice or because of some other sense of the act being ‘not immoral, unethical or illegal’. These two drivers depend upon the individual. The third part of the triangle relates to opportunity and that has procurement and e-business ramifications. A procurement system may afford opportunity for corrupt or unethical practices such as collusion, bribery. E-business affords the opportunity to

hack into systems, manipulate transactions and commit other fraudulent acts. It is for this reason, and the widening vulnerability of individuals and organisations through electronically linked devices, systems and databases that behoves us to ensure that procurement systems design-in and enact appropriate security and protection measures—these go beyond what is legally required to what is sensible and prudent.

A further issue is the degree to which locking in a supply chain to a specific set of tools or approaches can restrict competition or collaboration. In an interesting example, while not related to e-business but shares common issues, a study of 30 projects associated with the Taipei Mass Rapid Transit (MRT) program showed that the government’s deliberate restrictive procurement practices locked out local contractors for bidding and when these practices ceased costs for the same type of work dropped an average 26% (Wei, Raymond and Ahmad, 1999). The issue related to prequalification criteria that favoured large multi-national contractors with high levels of technical and management expertise that should have provided excellent value for money as well as knowledge transfer. However, due to political factors at the time, many global companies did not find tendering for the work attractive so that the pool of potential bidders was drastically reduced thus leading to higher bids. A similar danger present itself when a common set of e-business tools are required to be used that may restrict potential supply chain partners’ ability to collaborate through these strict pre-qualification hurdles being in place.

Finally, there are valid concerns about the ownership and right of use of e-collected meta-information such as details about searches undertaken using search engines. Indeed it has been speculated that the meta-data about each individual using the search engine Google currently comprises a massive (as far we know) untapped information base that can be mined for sale as marketing data for e-businesses (Carlisle, 2005). Organisations such as Boeing have already seen the value in selling meta-data derived from facilities management and maintenance feedback information to clients thus transforming itself from a manufacturer, to services and facilities management organisation and then to consultant and targeted information/knowledge provider—it the final transformation it uses a range of data mining techniques to use historical repair, maintenance and other data about its customer’s use of its products and services to enable it develop new information and knowledge based business activities (Szymczak and Walker, 2003). To enable customer data, in whatever form that takes, to be used either for project effectiveness improvement or for additional business opportunities requires acknowledgement of data-information ownership together with access and use rights. This project procurement concern should be addressed, to facilitate informed consent of knowledge and information to be shared.

Compatibility and Interoperability Issues - Information Modelling
This section discusses and explores how procurement choices can change the relationship between parties in a supply chain so that intensions (the concept and design of a change action, product or service) are effectively translated into delivery
of a valuable outcome. Often in construction and manufacturing for example, the process required by the procurement choice imposes barriers to creativity stemming from the original concept to be transformed into a product that retains the creative value envisaged. We will now explain how compatibility or incompatibility between sub-systems (that is interoperability issues) can enhance or inhibit the delivery of value encapsulated in the conceptual design being transformed into the change, product of service project outcome. The core issue from this perspective is how in e-business can the supply chain use a common platform for developing design information that can be used seamlessly in the production phase? The solution to this problem that can transform the way that projects are designed and physically delivered is through a common information model. To do this all the supply chain must be working on the basis that information is shared and automatically translated from one user to the next. This is an interoperability issue. Recent research and development work on the development of information modelling is now presented to explained, using the construction industry as its focus.

Building Information Modelling (BIM) is a fundamentally different approach to project design and implementation (or architecture/engineering and construction from a building industry perspective). It can be said that the traditional way of documenting information has not fundamentally changed in the last 500 years when symbolic language and orthographic drawing methods where used to design and construct the buildings of the renascence period. Orthogonal methods provided the communication means for master builders to represent compressed information. Drawing was then introduced as a method of projection in which an object is depicted on a surface using parallel lines to represent its shape onto a bi-dimensional plane. With the advent of Computer Assisted Design (CAD) in the 1980’s (arguably computer assisted drafting or drawing - but not design) a new means to produce and re-produce orthogonal drawings emerged. Although it offers clear improvements to using ink and paper, drawing as the communication medium has changed only from physically using drawing paper on drawing boards to producing digital CAD drafted drawings. This new CAD medium has provided improvements for access, replication and sharing of building geometrical information however CAD drawings are still generated using straight and curved lines. Thus, while information contained in project CAD drawing documentation has become much more complex and the medium to generate and share documents has evolved, but the method to represent it has not substantially changed for over five centuries.

Building Information Modelling (BIM) is a method to represent building geometrical information in a three-dimensional (3D) space, thus generating objects instead of orthogonal drawings. In a BIM environment individual 3D objects also become the repositories of embedded information and attributes related to a particular building material or appliance. Completed project information or documentation can be stored in a single-centralised database or federated databases where information is saved by individual teams in specialised domains. If BIM is generated applying consistent rules and protocols BIM files can be shared across various software packages. This would include the ability to display and modify information in a range of formats according
to users’ role within a project or within the organisation. Various software applications could import a single file and view/perform cost tabulations, 2D floor plans and 3D flow diagrams, also interact with performance dashboards where a range of scenarios could be explored with the client or team members.

Therefore, generating BIM in consistent ways is important as it enables the exchange of information across software applications enabling improved design decisions and collaboration amongst project team members. The Standard for the Exchange of Product Model Data which reached the status of Draft International Standard in 1994 (STEP ISO-10303) is amongst the better known standards in industry. The STEP standard has successfully been implemented in mechanical engineering and manufacturing for over two decades now. However, this standard has proven to be less popular in the building and construction - perhaps as a consequence of its more casual contractual nature in which the industry operates. As a response to this, an industry-purpose standard emerged about a decade ago, this is called Industry Foundation Classes (IFCs). The IFC standard was developed by the International Alliance for Interoperability (IAI) and is defined as follows11:

“...Industry Foundation Classes (IFCs) are data elements that represent the parts of buildings, or elements of the process, and contain the relevant information about those parts. IFCs are used by computer applications to assemble a computer readable model of the facility that contains all the information of the parts and their relationships to be shared among project participants. The project model constitutes an object-oriented database of the information shared among project participants and continues to grow as the project goes through design, construction and operation.”

The IFC has not seen its full potential so far, some impediments might include fear of losing intellectual property (IP) through sharing project information. Originally BIM data access was restricted to a common single data repository—with all its attendant trust and security implications. This is not currently the case. Data can now be locally stored and distributed and accessed according to individual project teams/roles. In this way the IFC standard for interoperability has evolved since the time when there was no Internet broadband and the storage mechanisms comprised central data repositories. Trust and security issues remain as current impediments for BIM adoption because designers still fear losing intellectual property.

Since the emergence of the International Alliance of Interoperability (IAI) in 1995, various generations of IFCs have appeared including IFCs 1.0 in 1997, IFCs 2x edition 2 released in May 2003 including the more recently Industry Foundation Classes eXtensible Markup Langage (ifcXML) that uses extensible mark-up language (XML) (Nisbet and Liebich, 2005). This means that the standard for data storage and interoperability is now aligned with today’s web development, thus this standard is more likely to reach a wider audience. This should accelerate its pool of potential users across design, client and contracting organisations and into a wider supply chain.

The active promotion of BIM, interoperability and the IFC standard by the EU Software Copyright Directive has been instrumental in promoting BIM and interoperability at a European level. Lueders (1991: p3), in demystifying IP and security issues cites the directive12 explains interoperability between computing components as being “the ability to exchange information and mutually to use the information which has been exchanged”. This does not by definition mean that each component must perform in the same way, or contain all of the same functionality, as every other one does.

In a more global perspective, the IAI has lobbied for and promoted the use and adoption of IFCs (and more recently for Internet-based exchange methods IFC ifcXML and the semantic web) to improve representation and interpretation issues (Nisbet and Liebich, 2005). These may include:

- Automatic compilation of bills of material in digital form as input data to cost estimations and time scheduling. The quantities can then be used for production preparation and on call deliveries from the manufacturers. (savings - shorter time and fewer errors);
- Automatically generated foundation for climate and energy simulation of all the spaces. (savings - shorter time, better solutions and energy savings during the lifetime); and
- Fewer co-ordination errors (savings - reduced redesign and re-construction)

The European Interoperability Framework (EIF) definition identifies three aspects to Interoperable BIM (Lueders, 2005):

- Technical - linking up computer systems by agreeing on standards for presenting, collecting, exchanging, processing, transporting data.
- Semantic - ensuring that transported data shares the same meaning for link-up systems.
- Organisational - organising business processes and internal organisation structures for better exchange of data.

Examples of BIM adoption aligned with web technologies include:

1. Singapore’s “ePlan Check” a government driven initiative which automates the review process for drawings and checks planning proposals more accurately and in less time approving or rejecting them. This is because parametric information loaded into a system (i.e. Government e-planning);
2. ‘HITOS’ a Norwegian governmental initiative to contextually and geographically assess building proposals in a BIM, specially on areas of urban context and geographical information (GIS); and

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12 See http://europa.eu.int/smartapi/cgi/sga_doc?smartapi!celexapi!prod!CELEXnumdoc&numdoc=31991L0250&model=guichett&lg=en
3. Finland also leads in the adoption of BIM and has developed a series of IFC compliant software applications including thermal and environmental analysis software such as Riuska and Ecotect.

In Australia the Coperative Research Centre for Construction Innovation (CRC-CI) in collaboration with the Commonwealth Scientific and Industrial Research Organisation (CSIRO) has developed and tested a set of IFC compliant BIM tools and applications. Some include LCAdesign for the assessment of greenhouse emissions and embedded energy assessment, specially during the selection of materials and building methods. Other CRC-CI/CSIRO developed application development include the ‘Contract Planning Workbench’ (CRC-CI 2002-056-C)\textsuperscript{13} which links 3D models with work schedules (also referred as 4D models). In specific the construction planning workbench automates the production of schedules with visualising building site progression, especially for in-situ concrete structures. A current project includes the BIM Estimator which automates quantity take-off in bridge design for the Queensland Department of Main Roads (CRC-CI 2006-037-D)\textsuperscript{14} are two amongst several IFC compliant software applications recently developed in Australia.

Other leading BIM development and implementation by private initiatives include Gehry Technologies with SOM architects who are currently implementing BIM methodologies for building design and document management. A current project includes a high rise building in Hong Kong which uses Digital Project (DP) as its BIM platform. DP is based on CATIA by Dassault Systems\textsuperscript{15} which is a leading design software utilised in the aerospace and automotive industries. DP is a software application which performs as CATIA’s interface for architects, structural engineers, building services engineers, contractors and fabricators. SMO architects reportedly\textsuperscript{16} have improved their relationship with the client and contractors. BIM methods are also enabling SOM to improve communication and collaboration amongst architects, engineers and team members improving thus design decisions and collaboration amongst team members. These improvements would include the use of BIM as a construction planning and communication tool including the use of work space allocation in building sites. This is done with zoning by colour coding - for instance, work space demarcation and materials. This has direct implications for site safety, engineering communication and logistics.

A reoccurring question posed by most design parishioners exposed to BIM is whether BIM is worth the trouble. Interestingly, anecdotal reports indicate that BIM will not be

\textsuperscript{13} See CRC-CI 2002-056-C. Cooperative Research Centre for Construction Innovation. Contract Planning Workbench \url{http://www.construction-innovation.info/index.php?id=32}

\textsuperscript{14} See CRC-CI 2006-037-D. Cooperative Research Centre for Construction Innovation Automated Estimator Commercialisation \url{http://www.construction-innovation.info/}

\textsuperscript{15} See \url{http://www.3ds.com/products-solutions/plm-solutions/catia/overview/}

\textsuperscript{16} See GT 2006 Gehry Technologies - Digital Project. \url{http://www.gehrytechnologies.com}
an option in the near future but suggest that it will is expected to evolve to be the
method and industry standard. The question then becomes how to accelerate its
adoption by the industry at large? Impediments such as the fear of losing intellectual
property, training issues and cost concerns are amongst the main concerns for design
consultants to adopt BIM (see Chapters 8, 9 and 13 for more discussion on innovation
and culture implications). However, according to Gallaher, O’Connor, Dettbarn Jr. and
Gilday (2004), interoperable BIM documentation will be required by most private and
public client organisations. Various official reports suggested on the cost of ignoring
interoperability among software systems used in the construction industry such as
architectural and engineering tools, project programming, costing and scheduling tools
(Gallaher et al., 2004). Their report suggests that the cost of non-interoperability is
about $15.8 billion US in the US alone. Arguable, those organisations not looking to
implement interoperability will have to pay a higher cost. Although there is no hard
evidence to back up statement there will be a cost for ignoring it.

BIM/IFCs compliant software includes Autodesk® Revit®, Nemetscheck® Archicad,
Vector Works and Bently® TriForma®. Other standards for Interoperability include
Autodesk Design Web Format (DWF®) which is a shareware that enables users of other
CAD applications that do not offer built-in DWF publishing, such as Bentley®
MicroStation® and Solidworks®, to create DWF files. The fundamental difference
between BIM and standards such as DWF is in the form and nature of the data because
CAD layered drawings are not understood by BIM as a data object.

Some value propositions for the adoption of BIM are offered:

- Spending more time on design and less on documentation;
- Intensifying collaboration because BIM models contain information supplied and
  needed by all participants in a project—until recently BIM implementations
  mainly focused on using 3D models to improve drawing production, but the real
  promise of BIM lies in its application across the entire project team, especially
  in the area of improved building performance;
- Automating 2D drawing production;
- Automating links between specifications and drawings;
- Improving the integrity and accuracy of information
- Improving visualisation and communication, especially for contractors, builders
  and other stakeholders;
- Encouraging the design team to think about an integrated design practice and
  integrated design process as this forces all design consultants to think about
  practical construction implications as they design;
- Being an enabler for innovation;
- Parametric planning becoming a natural interface with GIS systems;
- Intensifying involvement of architects and other designers in construction as
  they will be modelling virtual buildings;
- Improving direct control of computer aided manufacturing (CAM) and
  fabrication (previously known as CAD/CAM)—this has already been used
successfully on the National Museum of Australia for example (Walker, Hampson and Ashton, 2003: p251-254);
• Improved explorations of form resulting in more innovative yet practical design;
• Modelling sustainability; and
• Mass customisation.

A fundamental change in industry has to happen if BIM is to work. Change can come from: Government enforcement; client organisations identifying added value through it use; the private sector identifying business opportunities through its use; or simply through general education across users and designers. Suggested value propositions for education include meeting the following needs:

• For greater understanding, among students and graduates, of the process implications of design upon construction delivery:
• For integrating design and construction courses;
• For promoting 3D thinking among students;
• For facilitating a culture of collaboration through integrated learning by the various disciplines involved in design and delivery of construction projects;
• For teaching BIM tools and applications for students to be ready to use them;
• For understanding of buildability principles;
• For improving decision making risk/benefit assessment - define/foresee impacts;
• For introducing project management principles (4D modelling, that is integrating 3D design with project management tools); and
• For students to better understand the construction process and site logistics through simulation and visualisation.

CAD has, perhaps, been the major problem for BIM adoption as drawings have been invariably committed to a hard copy version at numerous (if not at every) stage of a construction project. BIM also supports automation of drawings and blueprints production, for example there is no need to draw floor plans, cross sections or isometrics but only select and print various views from the BIM model. Another fundamental difference between CAD and web enabled BIM is the ability to implement new approaches for design assessment and obtaining planning permission.

One of the main fears expressed by many design consultants is risk exposure to losing their design and intellectual property. This has also been discussed and demystified. First, access to data and project information can be restricted by password control in a similar fashion to that currently used by project Intranets. Second, from a legally perspective, breaking into systems is no different to a bugler breaking into an office to steal information. Third, BIM and interoperability are not synonymous with cloning—interoperability means that building components, which may differ in functionality, can share information and use that information to function accordingly.
Researchers who have studied this area of interest for over a decade\textsuperscript{17} suggest that the key to improve construction productivity relies upon its ability to operate more efficiently and effectively with less information waste and more knowledge sharing. Information being transposed as is currently often the case, even with CAD, results in the potential for miscoding, mistaken interpretation and other errors of transposition. Additionally, needless multiple handling of information and data is a waste of time and energy. Similarly, as has been discussed in Chapter 8 and 13, knowledge sharing to achieve innovation is best facilitated through collaborative problem solving—BIM facilitates this. In relation to electronic information management, especially in the form of web-enabled building information modelling, this means that managing and coordinating, not only blue prints, but all documentation and project information from design to property maintenance phases. This presents a unique and new opportunity to diverse industries such as property, construction and project management. It is expected that electronic information management can provide commercial efficiencies through more effective project procurement and supply chain management. This is fundamentally different to CAD, even web enabled CAD (Design Web Format DWF®).

The Internet-enabled BIM, as a network enabled environment, remains in its infancy but we will see the situation swiftly change in the near future. This principle is now giving rise to many new services previously tied to the physical value chain and has resulted in completely new value chains are being created. These include online BIM building product catalogues enabling engineers and architects to build BIM models and run simulation and visualisation scenarios, it also facilitates prototyping and codes and specification checking. Internet developments are offering new means for project collaboration, not just in collocated groups but also in virtual global team-working and supply chain integration in a truly e-commerce environment.

Figure 7-2 illustrates how the BIM concept in the Architect/Engineer/Construction (AEC) and Facilities Management (FM) professional group has been evolving and diffusing over time. It indicates BIM evolving from initial IFC central databases to e-catalogues then into geographical information systems (GIS) into e-business as ifcXML facilitates opportunities for the expansion of BIM capabilities using web technologies.

\textsuperscript{17} For further details on standards, many papers and reports see http://www.iai-international.org/Resources/Related_PublicationsSources.html
To conclude, we argue that the Industry Foundation Classes (IFCs) and the Standard for the Exchange of Product model data (STEP - ISO) are the most promising standards for Interoperability in the property and construction sectors. The move towards ifcXML aligns with major Web development initiatives and we envisage that ifcXML will become one of the main enablers for its speedy adoption and dissemination.

For those interested in learning more about BIM model viewers you can link to:
- IAI Karlsruhe, Germany at http://www.iai.fzk.de/ifc

For further information about interoperability, readers can access the IAI - International Alliance for Interoperability http://www.iai-na.org

**The Role of IT/ICT Portals in Procurement**

Perhaps one of the most practical developments over recent years is the way that web portals have dominated the user interface between system and user, and user and user. During 1997 and 1998 research into use of ICT by major construction industry contractors and consultants in Australia and Hong Kong revealed that most parties were only somewhat aware (having heard of or read about) intranets but very aware uses frequently as a matter of course) the Internet (Walker and Rowlinson, 1999: Chapter 8). Now, moving on a decade they appear ubiquitous for many if not most commercial, government and not-for profit organisations—Arthur Tatnall reports that when undertaking a Google search for the word “portal”, that it revealed 35.6 million hits. He explains the term from its archaic roots meaning ‘an entrance or gateway’ and he discusses nine types of portals (Tatnall, 2004: p3-7) that we expand upon:
1. Mega portals that link users to other portals that can be highly extensive. There seems to be a trend for much cross indexing of web links between organisations so that most portals now share this extensive means of linking those who conduct searches or seek information to relevant portal links;

2. Vertical industry portals that are based around specific players, such as the construction procurement portal SITE\(^\text{18}\) also these can be part of a value chain gaining access to special areas of business transaction through an extranet of linked internet web sites;

3. Horizontal portals when used by a broad base of users across a horizontal market for example a site that links a range of businesses in a physical location to promote e-commerce such as Buzewest as described in Pliaskin and Tatnall (2005) a wider scale network portal of this type would be Vicnet\(^\text{19}\) the Victorian (Australia) web site that aims to links a state-wide range of businesses as well as other useful community information

4. Community portals often set up my community groups to foster a specific interest for example one portal, communitybuilders.nsw\(^\text{20}\), is a site that helps people in communities to set up community activities explain how to encourage volunteering and provide a range of access to electronic resources and services that do not quite fall into a for-profit activity. These sights might also link to media outlets such as radio or print, or may contain blogs;

5. Enterprise information portals (EIP) that are often gateways to a corporation contains the sort of information that interested parties can download such as annual reports, newsletters, an email access point for further information etc. The global construction group Bovis Lend Lease provides a good example\(^\text{21}\) where a whole series of information, particularly under their ‘publications’ or ‘newsroom’ areas, is readily available. Apart from immediate responsiveness from requesting a download (annual report for example) the saving to both reader and host corporation is considerable as it eliminates the need for staff producing and packing off hard copy materials;

6. E-marketplace portals as described earlier in this chapter, Pliaskin and Tatnall (2005: p6) provide an example of the Swiss company ETA\(^\text{5A}\) Fabrique

\(^{18}\) [http://www.cite.org.uk/](http://www.cite.org.uk/) which is described by its home page as CITE is a collaborative electronic information exchange initiative for the UK construction industry where data exchange specifications are developed by the industry for the industry, enabling the industry to move forward together.

\(^{19}\) [http://www.vicnet.net.au/](http://www.vicnet.net.au/) its stated reason for being on its home page states “The Vicnet Division provides community internet services to Victorian not-for-profit organisations. Through Vicnet, the State Library of Victoria delivers information and communication technologies, and support services which aim to strengthen Victorian communities. Vicnet works with a wide range of not-for-profit community organisations including sporting, recreational, education, multicultural, health and arts groups. It also provides services to the government, education and welfare sectors.


d’Ebauches\textsuperscript{22} that manufactures watches as a group of individual companies and presents itself through this portal as a united front to customers as well as its suppliers;

7. Personal/Mobile portals this is a wide and expanding area of development. Pliskin and Tatnall (2005: p6) note that this technology is being embedded in mobile phone technology. That book, published in 2005, indicates how quickly things have moved as now we see Blackberry\textsuperscript{TM} and many major mobile phone manufacturers offering web through phone, video messaging and a host of services. Some of the more remarkable developments include taking mobile phone technology and personal data assistants (PDAs) and linking them to home appliances such as a robot dog that can wander throughout an area like a watchdog, sense danger (in terms of traces of smoke etc) and be accessed entirely by a mobile phone portal\textsuperscript{23}. Clearly this has major project procurement implications as more integrated and e-connected components restrict the number of providers and forces many organisations into highly relationship-based transactions.

8. Information portals are moving beyond the printed media offering e-mags and e-newspapers\textsuperscript{24}. The more widespread use of digital ration and TV streaming as well as podcasting has revolutionised many media outlets. The Australian Broadcasting Commission (ABC) Radio National (RN) has provided transcripts of programs for several years\textsuperscript{25} and they have extended this to listening to programs that have been set up for streaming as well as automatic links between iPods and the ABC RN web site so that as soon as you link your iPod to the internet it automatically downloads programs that you have specified as being made available to you. With a trend towards organisations in the supply chain feeling the need to provide current information and communicate 24/7 then this technology will most likely move from being generated by media outlets but also many other organisations.

9. The final portal type identified by Pliskin and Tatnall (2005: p7) is specialised/niche portals that cater for special interest groups. This type of portal merges with the notion of communities of practice (COPs) and ICT tools that support these. An example of one of these in the UK construction industry using the product Sigma Connect that connects the workforce within an organisation or across a range or organisations via the portal to share knowledge and maintain social contact (Jewell and Walker, 2005).

The role and functioning of portals is rapidly changing with new ideas, products and services coming on stream constantly. All of these offer opportunities to rethink how

\textsuperscript{22} http://www.eta.ch this is a highly sophisticated looking site that links
\textsuperscript{23} See http://web-japan.org/trends/science/sci030414.html Japanese companies seem to be concentrating heavily on providing innovative services for elderly or disabled people living alone that are linked to mobile phone technology.
\textsuperscript{24} See http://www.printdirect.com/
\textsuperscript{25} See http://www.abc.net.au/rn/tranlist.htm and http://www.abc.net.au/rn/backgroundbriefing/ for downloading sound and podcast files.
the entire communication aspect of project procurement will function. In Chapter 3 we discuss stakeholder and their influence upon projects. Maintaining contact with stakeholders to provide information and data about projects is already becoming a key competence of PM (PMI, 2003;2004). Using portals to do this is the next logical step.

**e-Procurement Trends and Emerging Themes**

Organisations have recognised the benefit of e-Procurement and spent significant efforts and funds on implementing e-Procurement solutions. It is foreseeable that electronic procurement will become ‘business as usual’ and the term e-procurement will disappear.

Over the past five to ten years, e-Procurement was mostly focused on eSourcing, achieving cost savings due to the achievement of greater information efficiency and better use of economies of scale. Greater information efficiency, since potential suppliers beyond spatial boundaries could be sought and finding the “best price” for a certain commodity required less time and search cost.

Similar to B2C price search mechanisms, such as Pricegrabber, Froogle, Epinions and Shopping.com, pricing information for businesses has overall become more transparent. Similar to the B2C search engines, besides net price, additional information on product availability and shipping costs as well as customer satisfaction feedback maybe available. Industry portals typically provide contact information, and in some cases, directly allow price queries. There are, however, barriers to the adaptation of the B2C model: often goods are not commodities, but highly customised and therefore not easily comparable. Up-front pricing for custom-engineered goods continues to require a request for proposal (RFP) process in order to define the requirements, which lead to a certain price for a certain scenario. Further complexity emerges from taxes, tariffs and export restrictions in international transactions, which cannot always be anticipated and may significantly impact cost, scope and timeline for delivery.

A better use of economies of scale through centralized procurement in large corporations or government entities or purchasing alliances for smaller businesses, which allowed generating economies of scale, similar to larger entities.

One example for such use of economies of scale is Marketplace@Novation, a purchasing alliance of approximately 2500 health care organizations in the United States. According to company sources (www.novationco.com/about/fact_sheet.asp) Novation maintains agreements with over 500 suppliers and distributors of medical, laboratory and safety equipment, capital equipment and services, office supplies and other goods and services. The combined purchasing power of this eSourcing provider amounts to US $25bn in annual purchases. According to an early study in 2000, the initial 31 hospitals to join this alliance saved approximately $12m annually, a
substantial amount of their procurement-related expenses, which spurred rapid growth of the service.

Three major trends could further propel e-Procurement:
- Seamless Process Integration;
- Further Reduction of traditional procurement activities; and
- Comprehensive Decision Support

(1) Seamless Process Integration and Process Outsourcing
While e-Procurement efforts over the past ten years have focused on purchase transactions, these transactions needs to be integrated into the larger picture of the end-to-end supply chain.

For example, a radio frequency identification (RFID) enabled inventory management system in a warehouse may enable a more responsive and highly automated procurement process. Shelf-mounted readers will detect the removal of a palette containing boxes of a product and report the reduction in inventory to the procurement system. Based on this real-time inventory data and assumptions of future demand, which may result from buying trends, developed from historical and seasonal information commodities can now be ordered automatically, based on rules defined by the procurement officer. Such rules can look as follows: “procure x amount of product y to be delivered no later than on date z at the lowest possible price point, using a preferred vendor list”. Such automation of the actual procurement process allows procurement officers to focus on high-value activities, such as the definition and validation of procurement strategies. Even greater precision will be achieved with a more granular tracking of commodities: as costs for RFID tags and readers continue to decline and large wholesalers and retailers (e.g. Wal-Mart) aggressively push their suppliers towards the adoption of RFID, box- and item-level tagging will allow the most accurate and timely prognosis of product demand.

In other applications, where RFID tags are integrated into the product, will also allow triggering early procurement. For example, tags which monitor wear and tear on mechanical equipment will permit more precise maintenance forecasts: a machine operator would identify early wear on machine tools or motors; a fleet operator could more accurately predict the need for tire replacements (and orders) based on actual wear rather than mileage-based estimates.

Such a seamless process integration, where human intervention is limited to exception cases and process control will allow to further increase savings from e-Procurement, since:
- standardized procurement tasks can be further automated;
- procurement specialists can focus on
  - the definition and implementation of procurement strategies rather than order execution. Such strategies include vendor and product/service
selection, standards scenarios for procurement, vendor due diligence and market analysis;
  o exceptional cases, which require special attention, due to large orders, ‘unusual requirements’, orders which are critical to the success of the business etc.; and
• order processes can be accelerated, which in return allows lower inventories and therefore further reduced inventory cost.

From a technical perspective, such process integration is catalysed by web services, which allow the integration among heterogeneous and distributed systems. Due to the nature of web services, which are independent from programming languages, hardware platforms and operating systems true interoperability can be achieved.

(2) Further Reduction of traditional procurement activities,
If for an organisation procurement is rather an auxiliary than a core process, the entire process may be outsourced and managed by a service provider with specialty expertise in e-Procurement (see: The Next Level of E-Procurement, Laura Powell, Public Utilities Fortnightly; Nov 2006; 144, 11; pg. 20-21). Besides the core expertise in e-Procurement, such a service provider can offer two additional cost-related benefits: (a) through providing additional economies of scale, e.g. by establishing eMROs and (b) by executing remaining manual procurement activities in low-cost locations off-shore.

Another change related to traditional procurement activities is the replacement of human negotiating processes through e-Negotiations. e-Negotiations are executed through electronic agents, who exchange offers (quotes), acquire market information and subsequently engage in negotiations towards an acceptable agreement for detail on eNegotiation strategies. Advanced eProcurement systems enable e-Negotiations and allow to input RFQ parameters as well as negotiating rules, thresholds etc.

(3) Comprehensive Decision Support
Lastly, e-Procurement will further accelerate information efficiency of markets, allow better analysis of supplier satisfaction, market prices, terms and conditions and other procurement parameters. In return, this information will allow further fine-tuning of procurement decisions, whether executed by procurement specialists or through electronic agents.

As stated before, procurement specialists will be less involved in transactional processes around the order execution, but rather focus on strategic procurement aspects, such as selection of preferred vendors, default procurement methods and negotiation strategies etc.

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26 see the research work of Prof. John Debenham, University of Technology, Sydney, e.g http://www-staff.socs.uts.edu.au/~debenham/papers/ES03.pdf
Successful e-Procurement initiatives will hinge on the ability to build scalable and adaptable solutions, which will grow and develop with changing business needs and allow for new procurement mechanisms, which cannot be foreseen at this point. In this regard, process maturity and the ability to use ICT effectively and efficiently can become a critical business success factor.

Lastly, decision making will be assisted by continued development of e-tool that measure, monitor and compare procurement options. For example the construction industry uses a ‘bill of quantities’ that is a schedule of all items comprising the project scope to assist in cost management at the design stage. This will be extended to provide similar information on project scope in terms of water use impact, embodied energy and CO₂ footprint impact.

Chapter Summary
In this chapter we began with Figure 7-1 that illustrated how many organisations are moving along a trajectory of increasing integration of common information, knowledge and data. The current term that most people recognise as describing this process is e-business that has moved beyond transfer of financial data and information such as invoices, bills, payments etc to transfer of complex models of the project outcome that can be viewed by all participants in a way that suits their needs.

We explained some of the fundamental terms in current use that describes the various forms of e-commerce that is an important part of e-business. We discussed drivers and inhibitors of e-business and also discussed legal, security and ethical issues. The movement of organisations, in supply and value chains, along the e-business maturity continuum led us to discuss an important barrier that is being overcome through great research and development effort into interoperability so that a project can reduce information and management effort waste be caused through re-creating information models at each step in a supply chain. We devoted a substantial part of the chapter to interoperability issues. This is because a common platform for representing an electronic form of project design (that can be presented to supply chain parties in the form, shape and structure that best suits their use of the information) provides an exciting opportunity to substantially eliminate current information duplication and waste practices. It also offers many improvements in visualisation and simulation modelling. A BIM can be used to measure a project’s environmental ‘footprint’. This could provide a powerful e-business application to facilitate development of the kind of instruments and decision support tools able to determine the basis for a carbon trading currency that (as was mentioned in Chapter 4 carbon emission control is an important emerging triple bottom line issue) will need to be addressed in making project procurement choices.

The section on the role of IT/ICT portals linked previous concepts to a tool, portals that allow a convenient interface between users and the various e-business
applications. These will and are, governed by the design of security and access designed by portal developers. Monitoring and tracing user preferences and search patterns can help such systems to customise the appearance of the portals to fit the user’s habits as we experience when using standard packages such as MS Word that can ‘remember’ the latest nine documents accessed for example. However, as was indicated in the section on legal, ethical and security issues, users continually leave a trace of data on preferences and search history that can be mined to target and shape business opportunities. This aspect of business development may not be welcomed by users—customers or supply chain participants. This is because it could represent an infringement of privacy or cooption of intellectual property relating to user habits and preferences and so procurement systems need to address this important and potentially contentious side affect of e-business applications. This section offered a natural prompt for us to discuss future and emerging e-business trends.

The key theme to this book is project procurement and a recurring element has been value that can be realised through collaboration and information and knowledge sharing and use. We have endeavoured to discuss the wide and disparate topic of e-business with a focus on how it can be used in a project procurement context. Our research into this interesting and evolving topic area leads us to believe that e-business can enable improved procurement systems, however, the implications for PM and all in the supply chain is that participants will need to be ICT literate and will also need to accommodate fears of sharing data, information and knowledge so that supply chain management becomes value chain management linked to a procurement choice that demands participants are linked through protocols that allow this to happen.

**Vignette**

The election of 2010 devastated the government of Howard Shrub, president of ‘Emuland’, as satirists referred to the country whose government had steadfastly refused to acknowledge rising electoral concerns about climate change, sustainability and offshore outsourcing that had left many companies hollowed out shells with small numbers of very highly paid senior managers based in regional headquarters and hoards of resentful ex-employees. Many of the recently unemployed had been forced to down-scale their expectations of a career through taking less attractive jobs when changing employment. Their vote was their sole legal remaining means of protest. Shrub, retired to his ranch, many of his erstwhile government colleagues sought refuge in returning to their electoral homes as quietly as possible. The new government, elected with a massive majority based on a platform of radical change, set about trying to implement its political agenda through a series of innovative infrastructure projects. The Public Private Partnership (PPP) approach was still deemed viable by the new President Greenyard administration but it was considered to need a radical overhaul. A few pilot demonstration projects had been mooted as an innovative way forward, validated by the election promises made in the winning campaign that was still fresh in everyone’s minds.

One of the program of projects that Greenyard announced was the expansion of an integrated public transport system in Sunburne, the capital city of one of the southern states. The vision for that program was not only to improve transport but also to move the nation towards
complete energy self-sufficiency. This was to be a 15-year program of integrated projects to change the transport culture of the millions of citizens that had overwhelmingly voted for policy transformation. For several years an increasing number of them were using gasoline-electric hybrid cars. Also these commuters had the capacity to use their residential solar panels to power their cars, and home, and feedback surplus energy into the power grid.

A new 200 kilometre mid-city rail beltway was to be constructed to link the spoke-and-hub rail line configuration that currently existed. The beltway was to use an above ground electric monorail system. Fourteen new stations were to be constructed with park-and-ride facilities for commuters to reach stations by bike or car and the cars had docking stations where they could be recharged. Those participating in residential energy-cogeneration to feed the electricity power grid could gain benefit from an electronic metering system that calculated debits and credits for parking offset by power generation from electricity co-generation.

A bill was quickly passed by Greenyard’s government affecting construction of the stations. The bill required permits for all new buildings to be issued only when the owners provided a sustainability plan that projected its carbon emission ‘footprint’, specified counter measures, as well as an electricity co-generation implementation plan. Generous credits were indicated as an incentive and increasingly severe penalties for non-compliance were proposed over a 10-year period. A further requirement was imposed upon those parties in any supply chain that would be involved in the pilot projects (and inferred for most future projects) was that all project design documentation would be based upon a commonly accessible BIM and that a new project portal development was part of the ‘project’ to link not only the supply chain for the pilot project delivery, but also citizens to be able to gain information from government and feed back comments and suggestions as it was being developed and delivered and operated.

This program was linked into an industry renewal strategy that aimed to turn ‘Emuland’ into a highly e-business and ICT literate nation. A significant barrier to participation in any government project was lack of ability to work to the new procurement policies. The industry renewal policy aimed to refresh the nation’s capacity, motivation and ability to develop solar energy farming technologies. It had once been a world leader before the Howard Shrub government had ignored supporting or nurturing this sector preferring to rely on offshore solar and alternative energy developments. An education and training renewal strategy was aimed at providing the necessary support to upskill citizens and business.

The pilot projects, particularly the Sunburn Public Rail Transport Beltway project, was recognised as a very expensive but valuable learning exercise to trigger ambitious innovation on a scale never attempted before. With an overwhelming political mandate and a realisation that a step-change was desperately needed, Greenyard anticipated that his government had at least two if not three or more terms of office to clearly demonstrate positive results and radical transformation. Procurement policies held a pivotal place in Greenyard’s government strategies.

Issues to Ponder
1 - Provide examples of 3 forms of e-business that is inferred in this vignette.
2 - Discuss the 3 most important drivers and barriers to the proposed adoption of e-business as indicated in the program.
3 - The PPP approach would tend to severely narrow the field of potential participants in such an ambitious and bold program. Provide 3 examples and discuss their implications of legal, ethical and security issues that you feel may challenge the development of this project.

4 - The above project assumes that a BIM can be provided to link project participants. Discuss what you consider are the 3 most value-adding advantages that it may produce. Also, highlight three challenges to its use and how these may be mitigated.

5 - The project has an extremely long time horizon for its implementation. Discuss the most important (in your opinion) example of emerging trends that may significantly impact upon this vignette program in terms of facilities management, collaborative decision making and the balance of on-shore and off-shore supply chain participation.

References


Interoperable Delivery of European eGovernment Services to public Administrations, Businesses and Citizens.: 1-23.