CHAPTER 2

LITERATURE REVIEW

The broad aim of a literature review is to critically review the relevant literature with respect to the area of interest – in this case e-Procurement to identify key themes and general areas of concern, and in so doing, to identify productive avenues for further research. As specified by Miles & Huberman (1994), ‘every researcher, no matter how unstructured or inductive, comes to the fieldwork with some orienting ideas’, as drawn from the literature. According to Hart (1998), additionally, the review process should produce an understanding of important inter-relationships between the specific the subjects of interest. In this case, because of the relatively modest amount of academic literature, explicitly addressing the applicability of electronic procurement to the Kuwait Construction Industry, this review also draws upon practitioner and governmental sources regarding the business benefits, business models and technical architectures for e-Procurement.

The conceptual framework of a Venn diagram is often an effective means of organising literature review. Hofstee (2006) propose the funnel method to structure the literature review as an alternate organisational framework for literature reviews (Figure 2.1). A simple way of looking at the literature review process is as a funnel that is used to draw out the proposed course of action for the research. The width of the funnel represents the number of publications that are available and the depth represents increasing or decreasing specialisation or relevance.

A Funnel Method of literature review has been used as a literature review model in this research to present the literature related to Procurement process for construction projects, various e-Procurement models, e-business applications in construction industry (Figure 2.2).
Figure 2.1 – A Funnel Method of Literature Review (Hofstee, 2006)

Literature Survey broadly covered the following focus areas:

- Supply Chain Management
- Construction Supply Chain Management
- B2B e-Commerce
- E-Procurement
- e-Procurement for Construction Projects

Figure 2.2 – Funnel Method of Literature on e-Procurement for Construction Project
The available / collected literature (more than 150 Nos.) can be broadly grouped under following categories:

<table>
<thead>
<tr>
<th>Table 2.1</th>
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<tr>
<td>Development of e-Procurement Research</td>
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<tr>
<td><strong>Research prior to Year 2000</strong></td>
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<tr>
<td><strong>Research between Year 2000 to 2004</strong></td>
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<td><strong>Research between Year 2005 to 2010</strong></td>
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It is evident from the literature survey that research on B2B e-Commerce has begun during late 90’s, gained its momentum during year 2000 to 2004 and the trend continues.

**Figure 2.3 – Growth of e-Procurement Research**

2.1 SUPPLY CHAIN MANAGEMENT

Supply chain management (SCM) can be defined in terms of the managerial decisions that create and regulate the supply chain. Among these decisions are sourcing, forecasting, batch sizing, safety-stock setting, order timing and locating stock. In recent years, SCM has emerged as a critically important aspect of a Construction contractor’s business viability. Competitive advantage can be achieved through: 1) reducing or avoiding material shortages that delay projects and degrade the reputation of the contractor, and 2) reducing or avoiding excess material stock
that is costly to store, transport and finance. Supply chain management is an emerging area of practice in the construction industry worldwide. It is based on similar concept that has been widely and successfully used in the manufacturing industry.

Christopher’s (1992) definition of Supply Chain Management (SCM) goes beyond the idea of a dyadic, merely transactional relationship between buyers and sellers throughout the supply chain with a unidirectional flow of information and a reverse flow of materials.

Cooper and Ellram, (1993) views the entire supply chain (Table 2.1), rather than just the next part or level, and aims to increase transparency and alignment of the supply chain’s co-ordination and configuration, regardless of functional or corporate boundaries.

Persson (1997) concluded that supply chain management is a homogenous management concept. The overall objective of supply chain management is to contribute to improvements in the company’s bottom line or profitability.

Robinson and Kalakota (2000) viewed the supply chain quite simply as a “process umbrella” under which products are developed and delivered to customers. According to Mentzer John, et al. (2001) “A supply chain is defined as a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer”. Depending on how complex the supply network is, Mentzer (2001) has defined three types of supply chains:

- Direct supply chain, which consists of a company, a supplier, and a customer.

- Extended supply chain, which includes suppliers of the immediate supplier, as well as customers of the immediate customer.

- Ultimate supply chain, which includes all the organizations involved in all the upstream and downstream flows.
Handfield (2002), defines Supply chain management is the integration and management of supply chain organizations and activities through cooperative organizational relationships, effective business processes, and a high level of information sharing to create high performing value systems that provide member organizations sustainable competitive advantage. A supplier for this company has his own set of suppliers that provide input (also called second tier suppliers). Supply chains are essentially a series of linked suppliers and customers until products reach the ultimate customer.

According to the Supply Chain Council (http://www.supply-chain.org), the supply chain encompassed every effort involved in producing and delivering a final product or service, from the supplier’s supplier to the customer’s customer.

Leijeuen et.al (2005) listed the viewpoints encountered in the industry and 4C’s in supply chain management these are: communicative, coordinated, collaborative and co-operative.

Anderson et.al.(2007) published seven principle of supply chain management, these principle were seven time tested and offer value to the organization to adopt the SCM in their organizations. They describe that each principle can provide three types of benefits these are: revenue growth, asset utilization and cost reduction.

2.2 SUPPLY CHAIN MANAGEMENT IN CONSTRUCTION

Construction research involving the supply chain concept is a relatively new field, having explicitly emerged in the mid 1990s. According to Stukhart (1995), Construction materials constitute a major cost component on any construction project. The total cost of installed materials (or Value of Materials) may be 50% or more of the total cost, the efficient procurement and handling of material represent a key role in the successful completion of the Construction work.
As specified by Vrijhoef, R., (2000) and Koskela (2000), the Construction supply chains have been associated with make-to-order supply chains. Typically, a make-to-order delivery process begins at the customer, through the entire supply chain from initiation to hand over, back to the customer. Thus a construction make-to-order supply chain converges on the construction site where the one-off final product is assembled. O’Brien et al., (2002) observed SCM observed as an emerging field of research and potential source of improved performance for the construction industry but less attention has been devoted to investigating the management of the construction supply chains. Similar to the mainstream management literature, it is evolving with corresponding influences from the theory of production, distribution and strategic procurement (Male, 2003).

Vrijhoef, R., (2000) and Koskela (2000) have also identified 4 main roles of SCM in construction (Figure 2.4). Firstly, the focus is on the impact of the supply chain on site activities. Secondly, the focus is on the supply chain itself, with the goal of reducing costs, especially those relating to logistics and lead-time inventory. Thirdly, the focus is on transferring activities from the site to earlier stages of the supply chain. Fourthly, the focus is on integrated management and improvement of the supply chain and site production to reduce total costs and duration. The four roles are not mutually exclusive. Practically all the four roles of SCM are simultaneously applied, in order to improve both the efficiency and efficacy of the main contractor’s supply chain.

Source: (Koskela 2004).

Figure 2.4 Generic configuration of a traditional supply chain in residential building
2.3 PROCUREMENT & E-PROCUREMENT

2.3.1 Procurement

Bell and Stukhart (1987) defined procurement as an integrated co-ordination, the material management system or MMS, which includes materials’ take off, purchasing, expediting, receiving, warehousing and distribution and even contract administration. Procurement activities are an inseparable part of any organization. It has been inferred from findings of Min and Galle (1999) that in larger organizations, purchasing activities get complicated when various goods and services are needed for different departments and sections. Procurement in general is an activity to get or bring about something by some efforts. Since procurement was used to be called as “Purchasing”, the researchers and corporations pay little attention to this process. In fact, Purchasing just refers to the actual activities of buying materials.

As per the findings of Kalakota and Robinson (1999), Procurement, which has a broader meaning, encompasses all activities involved from obtaining materials and services to managing their inflow into an organisation toward the end user. It includes purchasing, transportation, warehousing, and moving goods towards the production process. Integrated Procurement is a closed-loop process that begins with the requisition and ends with the payment (Figure 2.5). Procurement has already transformed into a concept combine with technologies, marketing, and business strategies.

![Diagram of Procurement Chain](image)

Figure 2.5 The Procurement Chain (Source: Kalakota and Robinson, 1999)
Segev et al., (2001) specified that in general, there are two types of operating procurement: production-related goods and non-production-related goods. Production goods include raw materials, components, assemblies, and other items needed to produce a finished good. Non-production goods are items that businesses need to run day-to-day business operations: capital equipment; MRO (Maintenance, Repair and Operating) products; office capitals, stationeries, scientific or industrial supplies; travel and entertainment. Van Weele et al. (2003) defines procurement process in six steps: specifying procurement strategy, selecting right suppliers, contracting, ordering products and services, expediting and control of deliveries, and follow up. The Figure 2.6 illustrates the complete procurement process.

According to Harink (2003), procurement process is generally categorized into two sub processes:

- Procurement transaction process: It is about transaction-oriented procurement
- Procurement management process: It consists of activities for management of procurement transaction process.

![Procurement Management Process](image)


Figure 2.6 Procurement Model

High construction productivity depends heavily on having sufficient project resources on time. Procurement as an important process, which is responsible for getting the materials and equipment from the design stage to the construction site on time to meet the project schedule (Naief, 2002), is worthy of paying more attention to. In this chapter, after an overview of procurement process, the characteristics of procurement in construction project and the problems existed in practice were studied.
2.3.2 E-Procurement

In the mid-1990s, a new electronic sourcing tool emerged that has had, and is continuing to have, a profound impact on the way in which firms source goods and services from current and potential external suppliers. This tool, while known by other names (e.g., “online negotiation”) is the electronic reverse auction (e-RA). The findings of CAPS Research (2002), indicates that for a growing number of buying firms, e-RAs have found an appropriate niche in their strategic sourcing toolkit, allowing them to efficiently source goods and services that are highly standardized, have sufficient spend volume, can be replicated by a reasonable number of qualified competitors, and have insignificant switching costs.

Chaffey (2002), defines E-Procurement as the “electronic integration and management of all procurement activities including purchase request, authorization, ordering, delivery and payment between a purchaser and a supplier”. Six forms of e-Procurement are described by de Boer et al.(2002); (i) electronic-Maintenance Repair and Operations (e-MRO), (ii) web-based Enterprise Resource Planning (ERP), (iii) electronic-sourcing (e-sourcing), (iv) electronic-tendering (e-tendering) (v) electronic-reverse auctioning (e-reverse auctioning) and (vi) electronic-informing (e-informing). Both e-MRO and web-based ERP are built on a web-integrated enterprise resource planning system. The difference between the two is that e-MRO focuses on the procurement of MRO items whereas web-based ERP focuses on direct materials. Harink (2003) identifies e-procurement forms for automating different steps in procurement process. E-sourcing, e-tendering, e-reverse auctioning, e-contract management, e-ordering, and web-oriented ERP are the identified forms of e-procurement. In figure 2.7 the positioning of these e-procurement forms are plotted on the procurement process.
Figure 2.7 E-Procurement Tools in e-Procurement Process (Harink, 2003)

Turban et al., (2005) indicates that by automating processes and workflows associated with purchasing, the firm expects to increase the productivity of its purchasing agents, lower purchase prices of different types of goods and services, streamline the information flow, business processes, and workflows involved in purchasing, eliminate maverick buying (i.e., buying from unauthorized vendors), reduce order fulfillment and processing times, reduce the number of suppliers the firm is dealing with, streamline invoice reconciliation and dispute resolution, reduce the administrative processing cost per purchase order, integrate budgetary controls into the procurement process, minimize human errors in the buying and shipping processes, and monitoring and regulating buying behaviour.

T. S. Chandrashekar, Y. Narahari, Charles H. Rosa, Devadatta M. Kulkarni, Jeffrey D. Tew, and Pankaj Dayama (2007), studied Auction-based mechanisms are extremely relevant in modern day electronic procurement systems since they enable a promising way of automating negotiations with suppliers and achieve the ideal goals of procurement efficiency and cost minimization. A clarification of the relationship and the definition of these terminologies are shown in the figure 2.8. e-Business is more than e-commerce since it focuses on functions, while e-Commerce is a subset of e-Business focusing on the sales aspects of e-Business.
Aberdeen (2007), Research of enterprises’ experiences with Internet-based procurement automation technologies indicates that companies have been able to achieve significant cost and process benefits by automating key procurement activities. As a result of their e-procurement initiative, enterprises, on average, displayed a 35% improvement in spend under management, with a 41% reduction in maverick spend. Additionally, enterprises reduced their requisition-to-order cost by approximately 100%, and more than halved their transaction cycle time.

2.4 E-PROCUREMENT IN CONSTRUCTION INDUSTRY

Veeramani et al., (2002), specified that the potentials of e-commerce technologies applications in the construction industry include: E-marketing; E-selling/e-procurement of goods and services; E-collaboration; E-finance; and E-customer services and relations. A construction project is a complex activity involving several participants; for example, the client, architect, structural engineer, fabricator and the contractor. It is team efforts, involving several, inter organizational activities and dialogue.
Traditional communication and document exchange models were often manual and hence slow. The traditional means of communication involves producing numerous paper copies of documents and drawings. Management of these loose documents is often very time-consuming and tedious.

From the researches of Elliman & Orange (2003) it has been noted that despite the benefits of e-commerce technologies to the construction industry, there are many challenges in its applications. In many instances, the potential of e-commerce technologies has yet been fully and properly utilized, as many companies are simply utilizing various technologies to automate existing processes without analysing the company’s objectives and realistic needs. In addition, significant people and culture issues need to be addressed to overcome resistance to change and achieve radical revision.

The identification of the drivers and barriers to e-procurement in construction is vital to gaining an understanding of how the benefits of e-procurement can be used to increase its uptake and to provide a model to embed e-procurement. Perera et al (2007) identified a methodology to produce an e-capability maturity model for construction organisations using drivers and barriers to e-procurement.

A limited study had been carried out in this field; Eadie et al (2007) carried out a preliminary study into drivers and barriers in construction and ranked these from a Northern Irish Public Sector Contractor’s perspective. The study applied drivers and barriers identified from other industries to e-procurement in construction and produced a ranking of the importance of drivers and barriers.

The drivers and barriers commented on by Martin (2008) were also analysed to identify those which are applicable to construction; the relevant ones were subsequently added to Eadie’s list of drivers and barriers. It was felt a more rigorous verification of the application of general e-procurement drivers and barriers to construction e-procurement may provide a clear outlook for the potential for the advancement of e-procurement in construction.
2.5 E-PROCUREMENT MODELS IN RELATION TO OTHER INDUSTRIES

Literature review reveals that despite the fact several models and varying factors exist, the core of most of the models is the view of management of people, process and technology that leads successful implementation of e-procurement. Bingi, Mir, and Khamaleh (2000) found that the major concerns that face electronic commerce adoption are the absence of the technological infrastructure needed to support business operations, information security, and privacy of exchange.

Boyler and Olson (2002) proposed a model that focuses on two broad factors namely Purchasing Company and Internet Factors that predict outcomes of performance improvements from e-procurement implementation.

According to Subramaniam, C. and Shaw, M.J., (2002), the Business-to-businesses processes differ along several dimensions, such as specificity, structuredness, variation in demand, frequency of orders, value of product, amount of human intervention required, and complexity. The realized value of e-Procurement depends not just on the complexity of the procurement process, but also on the transaction volume of this procurement category. Moderately complex items (i.e., MRO, office equipment, software, and services) had the potential to return higher benefits than simple or more complex items. More complex purchases require more time and effort to be set up in an e-procurement system, and deciding which item to Web-enable at earlier stages depends on the distribution of transactions of different complexity.

Subramaniam and Shaw (2002, 2004) propose that both buyer and seller can achieve lower transaction cost and error cost in a web-based e-Procurement environment and also asserted that the reduction of these costs will have a positive effect on corporate performance. Past research on the value impacts of e-Procurement has focused on the benefits for a single company through case studies. This phenomenon can be attributed to the complex inter-organizational environments where loyalty of business partners might be questionable and decentralized coordination and decision making mechanisms which are more susceptible to supply chain uncertainties.
Croom and Johnson (2003) model comprises of drivers of Internal Service, which define the relationship between three dimensions of internal service delivery (Customer satisfaction, Procurement Compliance and Cost Reduction) which highlights the central role Internal customer (staff) in e-procurement implementation. It is essential to provide evidence for e-Procurement non-adopters that the new technology will not undermine the security and privacy requirements of their organizations. This can be achieved through enhancing trust between buyers and suppliers as well as establishing physical evidence that demonstrates the new platform security.

According to A. Davila, M. Gupta, and R. Palmer (2003), the benefits can materialize in a reduction of purchasing transactions costs, order fulfilment and cycle time, a reduction of the number of suppliers or even a reduction in the price paid, and the number of staff to support purchase transactions.

The hesitation to adopt e-procurement, for example, does not stem from expected difficulty or constraints, but arises due to being unaware of clear anticipated benefits. The model proposed by Dooley and Purchase (2006), enforces the view that attitude towards ecommerce can be tracked using 4 factors namely Internal organization Support, Integration with Supplier, Supplier Willingness, supplier / buyer relationship and Perceived Improvements to procurement tasks.

Vaidiya et al., (2006) proposed a model focusing on factors that impact level of user and supplier satisfaction leading to e-procurement implementation in public sector. It is especially evident when suppliers may be hesitant or even unable to meet business customers’ systems’ integration requirements without guarantees of future revenue streams (Sigala 2006). According to A. Soares - Aguiar and A. Palma-dos-Reis (2008) the main benefits of e-procurement are an increase in firms’ competitiveness through cost reduction and/or boosted efficiency with inbound logistics.
The variables which impact on the uptake of e-procurement were divided into two sections. These are the determinants of whether the implementation of e-procurement will be successful or not. Depending on their actions, these variables can either act as drivers promoting e-procurement or as barriers causing challenges to its embedment within the organisation. Those actions which produce a positive result will be denoted by the term Drivers and conversely those producing a negative effect as Barriers.

As summarized in Table 2.2, it has been noted from the literature review that most prior studies have been conducted on questionnaire-based surveys of private sector organisations, focussing upon a conceptualisation of e-procurement, and addressing range of potential adoption factors. Consequently, this study will be conducted through the use of field work and surveys, which is generally accepted as superior to empirically investigate the research questions.

### Table 2.2
An analysis of prior studies of the factors affecting the uptake of e-procurement

<table>
<thead>
<tr>
<th>Contribution</th>
<th>Sector</th>
<th>Research Method</th>
<th>Study Themes</th>
<th>Focus of Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min &amp; Galle (2003)</td>
<td>Private</td>
<td>Questionnaire, Survey</td>
<td>Organizational size, sector and a restricted range of benefits and inhibitors</td>
<td>Internet EDI</td>
</tr>
<tr>
<td>Hartley (2004)</td>
<td>Private</td>
<td>Questionnaire, Survey</td>
<td>Organizational size and a restricted range of benefits</td>
<td>E-auction</td>
</tr>
<tr>
<td>Kothari et al (2005)</td>
<td>Private</td>
<td>Survey</td>
<td>Applicability of e-procurement to the hotel industry</td>
<td>Adoption of e-procurement in the hotel industry</td>
</tr>
<tr>
<td>Gunasekaran et al (2009)</td>
<td>Private</td>
<td>Survey</td>
<td>Perceived barriers, critical success factors and perceived benefits of e-procurement for Hong Kong companies</td>
<td>Adoption of e-procurement</td>
</tr>
</tbody>
</table>
2.6 COMMODITY PROCUREMENT SPEND DIMENSIONS

According to OGC (2002), three interrelated groups of Commodity Dimensions are relevant to an spend analysis of the applicability of e-Procurement. The spend criteria has been graphically represented in Figure 2.9.

![Figure 2.9: Commodity Spend Dimensions (Source: OGC, 2002)](image)

Products in the low price/low strategic importance quadrant also tend to be of low complexity. The products with the highest complexity are found in the opposite quadrant, the region of high value strategic purchases. In the remaining areas, complexity varies but tends to increase along the price/importance diagonal.

- Characteristics specific to the product supply
  - Complexity (Low/High)
  - Price (Low/High)

- Characteristics related to the product demand
  - Strategic importance (Low/High)
  - Repeat Purchase (Low/High)
2.7 PROCUREMENT SPEND

Spending analysis is the process of aggregating, cleansing, classifying, and analysing corporate spending data for the purposes of reducing costs and improving operational performance (Aberdeen, 2002).

Spend analysis (and the visibility it enables) provides the necessary foundation for procurement organizations seeking to make better, more informed sourcing decisions (Aberdeen, 2007). Savings are typically achieved by (1) identifying opportunities to aggregate spend and negotiate superior contracts, (2) identifying and reducing non-compliant or “maverick” spend, and (3) improving procurement operations and supplier performance.

According to a survey conducted by Aberdeen Group (2002) on the Procurement Spend Analysis, it has been noted that one-third of enterprises do not have a formal program in place to manage spend analysis for the enterprise. It has been estimated that inadequate spending analysis capabilities are costing businesses $260 billion in missed savings opportunities annually. In short, spending analysis is a corporate epidemic that is keeping enterprises from controlling cost maximizing performance.

While many still work to manage their spend data and gain some modicum of visibility into and understanding of their expense base, they lack the basic framework that formalizes the various activities involved in review and management of spend data. Only 60% of enterprises utilize manual tools and services to collect and analyse spend data, limiting visibility and ultimately leaving money on the table.

Rowena Ward (2004), specified that undertaking a Procurement Spend Analysis at the earliest stage of an e-Procurement Project in an organisation will benefit. There are three core areas of spend analysis - visibility, analysis and process. By leveraging all three, companies can generate answers to the crucial questions affecting their spending, including (Figure 2.10):

- What am I really spending?
- With whom am I spending it?
- Am I getting what’s been promised for that spend?
According to Donna Villamil (2005), spend analysis tools have been purchased by the organizations who wish to analyze their internal purchasing data. While this traditional practice focuses on the value of a detailed spend analysis to the buying organization, more suppliers are starting to see the value in it as well. In fact, suppliers are willing to partially or fully sponsor spend analysis solutions for their customers. Suppliers see it as a modest investment compared to the potential returns from understanding their customers’ purchasing statistics. This new perspective is fuelling the trend of supplier-sponsored spend analysis.

According to ICG Commerce (2005), a high-level spend analysis is a critical first step in any procurement strategy. ICG Commerce, have analyzed over $100 billion in spend over the past 12 months alone for companies ranging from $250 million in revenues to $26 billion. Without exception, the results of this brief analysis are eye opening and more accurate than internal category volume projections. In order to have a successful strategic sourcing program, it is essential to follow three steps. First, you must baseline your current spend to achieve complete enterprise-wide visibility. In order to know exactly who you are spending your money with, an adequate analysis must be done of your supply chain to provide detailed vendor visibility, leverage spend to negotiate enterprise-wide cost savings, and increase communication between procurement and accounts payable.
The various commodities procured by Construction Material Buyers for their construction projects can be broadly grouped into Engineered Materials with a unique assigned number (or tag) such that they can be uniquely identified throughout the entire life of the Project, Bulk items that are manufactured to industry standards and purchased in bulk quantity. (e.g., pipes, cables, fittings, conduits, etc) and Pre-Fabricated Items that are typically fabricated as per engineered specifications at a fabrication shop or shop site separate from the Project site.

2.8 PROCUREMENT PORTFOLIO MODELS

The most famous purchasing portfolio is probably the Kraljic matrix which was first published in Harvard Business Review in the article Purchasing must become supply chain management in 1983. The matrix introduced a model to classify the company’s products in a two dimensional matrix: profit impact and supply risk (Kraljic, 1983). The model has been widely discussed both in the academic and the business world. Peter Kraljic first mentioned his model in the article “purchasing must become supply management” (Kraljic, 1983).

The purpose of the Kraljic matrix is for companies to analyze their purchasing portfolio. The model is a four stage approach, and the stages are: classification, market analysis, strategic positioning, and action plans. In the classification stage the company has to classify all its purchased items. This is done by looking at two different dimensions; importance of purchasing and complexity of supply market.

Kraljic Portfolio Matrix signifies the behavioral traits of the Construction Material Buyers based on the quadrant applicable to the good or service to be purchased (figure 2.11). The Kraljic matrix forms the basis of Construction Material buyers purchasing strategies, depending on the risk/complexity and the financial impact of the purchase:
• Strategic products: supplier alliances and development – long term.

• Leveraged products: buy at the best price (spot purchases) – short term.

• Non-critical products: improvement in administrative processes – automation.

• “Bottle necks”: search for substitutes or new supply sources.

![Figure 2.11: Procurement Portfolio Analysis (Source: Peter Kraljic, 1983)](image)

The importance of purchasing has criteria’s such as; percentage of raw material in total costs and value added by product line. The other dimension, which is complexity of supply market the company, considers entry barriers, logistic cost and/or complexity, and monopoly or oligopoly (Kraljic, 1983). The matrix is then divided into four different categories; materials management, supply management, Purchasing Management, and sourcing management (Kraljic, 1983).

Managing the firm’s supplier base is becoming an essential strategic issue for the companies. As an increasing part of companies’ products are purchased from external companies the need for efficient and suitable purchasing strategies becomes more important. Since Construction Material Buyer purchasing activities greatly differ depending on which type of business they operate in, there is a need for differentiated purchasing strategies.
To deal with the limitations that are related to the Kraljic matrix, both the academic and the business world have made efforts in trying to develop and improve the strategies related to internal purchasing strategies. Gadde, et al., (2001) suggest a network view on the purchasing activities rather than the traditional channel approach.

The idea of creating purchasing strategies only using a two dimension matrix has been widely criticized Dubois & Pedersen, (2002) and Håkansson & Persson, (2006). The supplier’s side of the relationship is disregarded in the traditional Kraljic matrix. Some authors such as Håkansson & Persson, (2006) have chosen to focus the purchasing strategies towards the interdependencies between the companies.

2.9 E-PROCUREMENT BEST PRACTICES

Allen (2003) clearly emphasises that e-procurement should be conceived as “a multi-dimensional, complex business change effort”, not a “software installation effort”. The formula for successful implementation is given as: “building on the foundation of people, then reengineering the business processes around best practices and finally applying the right technology”. In terms of people, executive sponsorship and cross-functional implementation teams are counted as vital.

The e-procurement benchmarking report by Aberdeen Group (2004) classifies the e-procurement users as “laggards”, “industry averages” and “best-in-class” applications based on their characteristics in terms of process, organisation, knowledge, technology and performance metrics. In their classification, the best-in-class companies are reported to have enterprise wide deployment, coverage of full source-to-pay process, detailed and near-real-time visibility into compliance, usage and spend management. Presence of metrics for costs, adoption and compliance reported regularly and linked to financial goals and incentives is mentioned. The following strategies and approaches are reported for enterprises reaping greatest value from their e-procurement investments:
- Elevation of e-procurement from a tactical transaction management activity to a strategic source-to-pay initiative.
- Secured senior executive support.
- Shifting the bulk of supplier enablement and catalogue management tasks to third parties.
- Clearly defined cost, process and performance metrics for measuring success.

U.N. E-Commerce and Development Report (2004) focuses on public sector implementations and clearly specifies the need for consultation with representatives from government and private sector, as well as applying a consistent approach across all the spheres of the government. The report emphasises the need to use a phased approach, with each phase requiring careful consideration. The phases suggested are as follows:

- Establishing goal and vision.
- Identification and analysis of the regulatory framework.
- Analysis of existing processes.
- Process reengineering & Choosing a solution and platform.
- Formulation and implementation of a plan.

U.N. E-Commerce and Development Report (2004) mention the following characteristics given in Table 2.3 to summarize best practices in terms of different e-procurement functions. In this table, it is emphasised that “best practice” column will generally require the implementation of a comprehensive e-procurement solution with an ideal level of resources, and the “alternative” column can be an option for cases with more limited resources.
Basing on Intel’s indirect procurement success story, Ghiya and Powers (2005) report similar ideas, the success beginning with business process analyses that leveraged the available technology. It is clearly mentioned that sufficient time spent in understanding the “as-is” process is vital to ensure a solid “to-be” process, with special focus on data. They clearly report that “technology only” approach would have limited success.
As best practice requirements, Rehan (2006) clearly mentions the need for the following:

- Improving the internal processes and activities of the organisation’s procurement system.
- Establishing common procurement data definitions across suppliers and commodity groups.
- Improving access to certified/approved suppliers, identifying the needs for new contracts quickly.
- Identifying sources of alternative supply quickly, streamlining procurement processes, providing enhanced supplier performance visibility.
- Developing and monitoring dynamic supplier performance metrics.

Angeles (2006) mentions the following business practices that support e-procurement:

- Involving preferred strategic suppliers in planning for e-procurement.
- Selecting e-procurement software and services following the development of a solid business case.
- Consolidating suppliers and contracts.
- Understanding preferred supplier technology plans and their ability to support e-procurement initiatives.
- Enforcing on-contract buying with preferred suppliers.
- Centralising control of contracts, product data, catalogue data, catalogs and price updates for indirect procurement.
- Implementing and maintaining computerised rules governing procurement.
- Reengineering all affected business applications effectively.
- Reducing the number of suppliers.
- Analysing purchasing behaviours of end users.
- Deploying a “balanced” catalogue selection strategy.
- Giving individual and unit spending a lot of visibility.
As can be seen easily from the above-mentioned best practice guidelines and principles, many themes are repeatedly and consistently emphasised, such as need for reengineering, user training and acceptance and need for metrics. In that regard, best practice guidelines in the literature appears mature and consistent. Best practices clearly reveal that e-procurement systems are not simple requisitioning and purchasing automation systems. To sum up, best practices materialise from awareness that e-procurement is not a uniform technology or design and that e-procurement is not a technical solution, but an end-to-end business solution, which is a strategic decision needing a good business design, commitment from every involved party and phased approach.

Applicability of e-procurement in various sectors and both tangible and intangible benefits of e-procurement applications are well-discussed in literature. With benefits often to the tune of millions of dollars Miller (2006), Tatsis et al. (2006), Davila et al. (2003), Rehan (2006) and Panayiotou et al. (2003) provide various classifications of benefits of e-procurement.

Applications from diverse sectors reveal consistent and similar results. Commonalities in the literature are evident, some of which are purchasing cycle time reductions, transactional benefits and streamlined operations. Afsharipour et al. (2006), Panayiotou et al. (2003), Rehan (2006), Turban et al. (2006) mentioned in the table definitely support these commonalities.

Tremendous cost savings and benefits of implementing e-procurement systems, as reported by application cases, suggest that savings and benefits are beyond transactional efficiencies, with all the business process reengineering and back-end integration efforts contributing to aligned supply chain integration. As such, these savings contribute significantly to global competitiveness of the partners in today’s demanding digital economy.

Davila et al. (2003), Afsharipour et al. (2006) and Tatsis et al (2006) provide quantified support in this regard. Besides all these managerial and organisational challenges, literature reveals that today’s e-procurement systems are still struggling
with various technological challenges and suffering from lack of standardisation in message exchange formats, data management and infrastructures.

2.10 GLOBAL PERSPECTIVE OF E-PROCUREMENT – BENEFITS & BARRIERS

According to Aberdeen Group report (2006), Main pressures driving e-procurement adoption are basically automated procurement processes, reduced maverick spend, centralised procurement processes, improved spend visibility, reduced transaction costs and improved compliance. From the outset, even the most rudimentary e-procurement applications have been reported to be able to deliver some level of process efficiency and cost benefits to a procurement organisation by replacing a brutally inefficient manual/paper-driven workflow and enabling a self-service requisition capability for the extended enterprise.

Today, automating the requisition-to-pay process remains the most significant objective of an enterprise’s e-procurement initiative (Aberdeen 2006). Since reductions in procurement costs fall directly to the bottom-line of an enterprise’s income statement, there is increasing awareness of the importance of making purchases against negotiated contracts and reducing any type of non-contract or maverick spend (Aberdeen Group 2006).

Afsharipour et al. (2006) emphasises the same fact by mentioning “to date more or less all studies on e-procurement report large efficiencies regarding process and procurement costs”. They report the impact of e-procurement on enterprise compliance and spend management initiatives, referring to Aberdeen Group 2004 findings as in the below Table 2.4:
Table 2.4
E-procurement Impact (Average Performance)
Source: Aberdeen Group (2006)

<table>
<thead>
<tr>
<th>Performance Area</th>
<th>Before e-procurement</th>
<th>After e-procurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of spending that is off-contract (maverick)</td>
<td>38%</td>
<td>14.2%</td>
</tr>
<tr>
<td>Price savings on maverick purchases brought into compliance</td>
<td>-</td>
<td>7.3%</td>
</tr>
<tr>
<td>Requisition-to-order cycles</td>
<td>20.4 days</td>
<td>3.8 days</td>
</tr>
<tr>
<td>Requisition-to-order costs</td>
<td>$56</td>
<td>$23</td>
</tr>
<tr>
<td>% of spend under management of the procurement group</td>
<td>56%</td>
<td>69%</td>
</tr>
</tbody>
</table>

Table 2.5 also summarises quantified benefits of e-procurement applications as quoted by various literature. Besides these striking and quantified cost savings, the literature contains various non-quantified classifications of benefits companies expect to see by automating the tactical processes and workflows associated with purchasing. These are summarized in the below Table 2.6 & 2.7.
Table 2.5
Quantified E-procurement Benefits from Literature

<table>
<thead>
<tr>
<th>Reference</th>
<th>Quantified Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tatsis et al. (2006) refer to a European study conducted in year 2000,</td>
<td>Reduction in transaction costs of up to 90%, Lead-time reductions of up to 60% and Purchase prices reductions of up to 10%.</td>
</tr>
<tr>
<td>Tatsis et al. (2006) report another study, conducted among 14 companies of different sizes Davila et al. (2003)</td>
<td>Process cost reductions of 60–80% Purchasing transaction cost reductions of 42 per cent in, associated with less paperwork, which translates into fewer mistakes and a more efficient purchasing process</td>
</tr>
<tr>
<td>Miller (2006)</td>
<td>Reaping benefits often to the tune of millions of dollars! Enjoying returns that may measure up to 300% of the initial investment in just 3 years.</td>
</tr>
<tr>
<td>Mitchell (2007)</td>
<td>Between 5% and 15% savings on indirect spending, with 8-month pay-back periods, hard savings coming primarily from volume discounts and reduced off-contract spending, as well as from implicit labour savings when the activity-based cost of a purchase is reduced from US$75-150 to US$10-25.</td>
</tr>
</tbody>
</table>

In the network world, enterprises have learnt a lot more about the shortcomings in their procurement processes and have seen the advantages in automating them. The success of B2B e-Commerce only helped the growth of e-procurement. Miller (2006) reports that the increasing number of success stories point to the growing recognition of e-procurement advantages, indicating an increased optimism towards automation in spite of the slowing down of global economy.
Table 2.6
Non-quantified E-procurement benefits from Literature

<table>
<thead>
<tr>
<th>Author</th>
<th>Non Quantified e-Procurement Benefits</th>
</tr>
</thead>
</table>
| Parida and Parida (2005), referring to ITRG InfoTech Research Group (2002) | • Increased process efficiencies leading to immense savings  
• Ability to link into existing systems, such as ERP  
• Reduced lead times within the procure-to-pay cycle, in some cases by 50%  
• Self-invoicing on behalf of clients  
• Streamlined business processes, common catalogue  
• More engagement with strategic product management on the buyer side, leading to better contract negotiation  
• Reduced maverick spending  
• Inventory reductions leading to huge savings |
| Turban et al. (2006) | • Increased productivity of purchasing agents  
• Lower purchase prices of different types of goods and services  
• Better streamlining of information flow, business processes and workflows involved in purchasing  
• Eliminating maverick buying (i.e., buying from unauthorized buyers)  
• Reduced order fulfilment and processing times  
• Reduced number of suppliers the firm is dealing with  
• Better invoice reconciliation and dispute resolution  
• Reduced administrative processing cost per purchase order  
• Better integration of budgetary controls into the procurement process  
• Minimized human errors  
• Better monitoring and regulating buying behaviour |
| Angeles (2006), based on survey covering 185 firms | • Reduced paper-based transactions across the enterprise  
• Automation of some parts of the procurement process  
• Reduced cost of generating purchase orders  
• Reduced cycle time  
• Freed up procurement team for value added work  
• Quicker finding of purchase items  
• Improved order accuracy  
• Aggregate spending to achieve economies of scale  
• Better analysis and monitoring of global corporate spending  
• Increased control over supplier base and supplier prices  
• Reduced maverick buying  
• Promoted collaborative design/development with suppliers  
• More favourable contracts negotiated  
• Simplified process of identifying new suppliers |
Table 2.7
Non-quantified E-procurement benefits from Literature

<table>
<thead>
<tr>
<th>Author</th>
<th>Non Quantified e-Procurement Benefits</th>
</tr>
</thead>
</table>
| Parida and Parida (2005), referring to Davila et al., (2002) and Presutti (2002) | • Cost savings  
• Process efficiency  
• Better information flow between buyers and suppliers  
• Reduced maverick spending  
• Streamlined processes  
• Better inventory levels |
| Panayiotou et al. (2003)                    | • Improved control of vendor relationships  
• Accurate fulfilment of the processes  
• Improved effectiveness of the purchasing process  
• Achievement of higher service levels  
• Reduced prices from the key suppliers  
• Reduced inventory carrying cost  
• Reduction of the order cycle |
| U.N. E-Commerce and Development Report (2004) | • Reduction of prices through competitive bidding and transparent negotiation with suppliers  
• Reduction of bureaucracy, including “overheads”- money spent on administration of services rather than their delivery |
| Ghiya and Powers (2005), referring to the Intel’s indirect purchasing | • Reduced system architecture  
• Centralized procurement system attached to the communication backbone  
• Improved and standardized data models  
• Proven data architecture in use globally  
• Reduced IT operations management overhead  
• Scalability of core system components  
• Extensibility to other modules and third party applications  
• Visibility of data |
| Rehan (2006)                                | • Savings from reduction in the cost of ordering non-production goods  
• Reduction in cycle times  
• Increased customer satisfaction  
• Ensured streamlining of the procurement process and eliminated administrative overheads  
• Cross-business entity analysis for better contracts and pricing |
| Afsharipour et al. (2006)                   | • Price reduction  
• Improved contract compliance  
• Shortened Procurement cycle times  
• Reduced administration costs  
• Enhanced inventory management,  
• Improved visibility of supply chain  
• Reduced operating & inventory costs  
• Increased accuracy of production capacity & Enhanced decision making Improved market intelligence |
Today, it is clear that initial wave of e-procurement applications are over with significant benefits are harvested. According to a newer study by the Aberdeen Group, “The 2006 E-Procurement Benchmark Report: E-Procurement 2.0”, enterprises are not only embracing the second wave of solutions, they are relying on them for significant process improvements, cost savings, and overall optimization of their procurement initiatives. The respondents of this year’s survey are reported to be handily outpaced the 1998, 2001, and 2004 e-procurement benchmarks previously delivered by Aberdeen. On average, the enterprises participating in the 2006 benchmark report are reported to obtain the following:

- Increased their spend under management by 38%
- Reduced their requisition-to-order cycles by 84%
- Reduced their requisition-to-order costs by 59%
- Reduced their maverick spend by 40%

Rightworks.com (2007) compares the first generation e-procurement applications with current applications and clearly emphasises the need for new generation of e-procurement applications to support management and controlling of global procurement spent for multi-site corporations with complex requirements. It is mentioned that automating the front end of the procurement process only does not deliver the full potential value for corporations interested in improving internal efficiencies and reducing costs. To provide maximum benefit to a company, an e-procurement system needs to:

- Deliver more than desktop requisitioning.
- Support for the entire purchasing lifecycle.
- Have a flexible and comprehensive content strategy.
- Have analytics enabling real-time visibility and support for accurate and integrated sourcing decisions worldwide.
The literature review revealed a collated set of benefits to e-procurement as identified in Table 2.8.

Table – 2.8
Benefits of e-procurement identified from Literature

<table>
<thead>
<tr>
<th>No</th>
<th>Drivers from Literature</th>
<th>Referenced in:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Service / Material / Product Cost Savings</td>
<td>Minahan and Degan (2001), Martin (2008)</td>
</tr>
<tr>
<td>5</td>
<td>Increasing Profit Margins</td>
<td>McIntosh and Sloan (2001), Wong and Sloan (2003), Ribeiro (2001)</td>
</tr>
<tr>
<td>9</td>
<td>Shortened Overall Procurement Cycle Times</td>
<td>Minahan and Degan (2001)</td>
</tr>
<tr>
<td>15</td>
<td>Reduction in time through increased visibility</td>
<td>Kalakota et al (2001)</td>
</tr>
<tr>
<td>16</td>
<td>Increased Quality through increased competition</td>
<td>Kalakota et al (2001)</td>
</tr>
<tr>
<td>17</td>
<td>Increased Quality through Benchmarking (Market Intelligence)</td>
<td>Hawking et al (2004)</td>
</tr>
<tr>
<td>18</td>
<td>Increased Quality through increased visibility in the supply chain</td>
<td>Minahan and Degan (2001) and Hawking et al -2004</td>
</tr>
<tr>
<td>19</td>
<td>Increased Quality through increased efficiency</td>
<td>McIntosh and Sloan (2001), Ribeiro (2001), Martin (2008)</td>
</tr>
<tr>
<td>20</td>
<td>Increased Quality through Improved Communication</td>
<td>Hawking et al (2004)</td>
</tr>
</tbody>
</table>
As a non-uniform, strategic end-to-end business solution which passes enterprise boundaries, clearly e-procurement implementations involve various barriers. Literature mentions various classifications of barriers (Table 2.9):

Rehan (2006) mentions two basic barriers:

- Defining and integrating various processes and harmonizing operations between the organisations, suppliers and distributors.
- Implementing a technology on top of existing enterprise systems that will work to bring the disparate systems and the new procurement software together to improve operations.

Chen and Rankin (2006) mention the following four basic sources of barriers basing on their study on AEC (architecture-engineering construction) sector:

- Technological
- Human
- Financial
- Environmental

In this classification, compatibility with other technologies, security, reliability, software or hardware solutions and frequency of upgrades are counted among the basic technical issues. Lack of affordable solutions and concerns about security are clearly mentioned. The human issues include a lack of knowledge about the new technology, mistrust or fear of the new technology and poor management. Difficulties of shifting the mindsets of people to develop confidence of using new technologies are clearly emphasised as the greatest obstacle. Under financial challenges, they mention long payback periods and lack of sufficient investment for new technologies.
Aberdeen Group report (2006) on barriers of e-procurement success mentions that supplier enablement, user adoption, and budgetary and policy support challenges delay or mute the benefits of e-procurement. Other challenges mentioned to be cited by the respondents include adopting processes and functionality to sufficiently support procurement and compliance management requirements for non-cataloguable items, such as contingent labour, printing, and travel.

Afsharipur et al. (2006) mention development cost, system integration, culture, development time and security as the 5 major impediments for e-procurement implementations and they give the following summary of barriers identified by referring to previous literature:

- Security of transactions.
- Lack of supplier e-procurement.
- High cost of technology.
- Lack of legal framework.
- Lack of technical expertise.
- Lack of e-procurement knowledge.
- No real business benefit identified.
- Data exchange standards lacking.
- Lack of business relationships.
Table – 2.9

Barriers to e-procurement identified from Literature

<table>
<thead>
<tr>
<th>No</th>
<th>Barriers from Literature</th>
<th>Referenced in:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Other Competing Initiatives</td>
<td>Kheng et al (2002)</td>
</tr>
<tr>
<td>3</td>
<td>Resistance to change</td>
<td>Davila et al (2003), Martin (2008)</td>
</tr>
<tr>
<td>6</td>
<td>Lack of a national IT policy relating to e-procurement issues</td>
<td>Carayannis et al (2005)</td>
</tr>
<tr>
<td>7</td>
<td>Lack of Flexibility</td>
<td>Carayannis et al (2005)</td>
</tr>
<tr>
<td>8</td>
<td>Bureaucratic dis-functionalities</td>
<td>Carayannis et al (2005)</td>
</tr>
<tr>
<td>9</td>
<td>Complicated procedures and extended relationships</td>
<td>Carayannis et al (2005)</td>
</tr>
<tr>
<td>11</td>
<td>Company access to the internet</td>
<td>Smith (2006)</td>
</tr>
<tr>
<td>12</td>
<td>Insufficient assessment of systems prior to installation</td>
<td>Forrest (1999)</td>
</tr>
<tr>
<td>16</td>
<td>Clarity of sender and tenderer information</td>
<td>Wright (1999), Dumortier et al (1999)</td>
</tr>
<tr>
<td>19</td>
<td>Internal Compatibility</td>
<td>Davila et al (2003), Boeing (1996)</td>
</tr>
</tbody>
</table>
2.11 E-PROCUREMENT ADOPTION DIMENSIONS FROM THE LITERATURE

The detailed literature review has helped to identify the following dimensions, which need to be investigated in the research:

- Commodity Dimensions.
  - Complexity
  - Strategic Importance
  - Repeat Purchase
  - Price
  - Cost Savings (Competitive Efficiency)
  - Processing Time

- Dimensions of Buyers’
  - Perceived e-Procurement benefits
    - Quality,
    - Time &
    - Cost
  - Perceived e-Procurement barriers
    - Internal,
    - External &
    - Technical

- Dimensions of Suppliers’
  - Perceived e-Procurement benefits
    - Opportunity,
    - Time &
    - Cost
  - Perceived e-Procurement barriers
    - Online Crime,
    - Relationship &
    - Internal Management
2.12 CONCEPTUAL E-PROCUREMENT MODEL

Based on previous studies and institutional theory the proposed e-Procurement model can be defined in terms of Commodity, Buyer and Supplier dimensions (Figure 2.12).

Figure 2.12: Conceptual e-Procurement Adoption Model for Construction Industry
2.13 RESEARCH GAPS IDENTIFIED

The literature reviewed and discussed above, which is primarily focused on the scope of Procurement in Construction Projects, scope of application of e-Procurement in various industrial sectors, identifies a number of potential factors that might affect the adoption of e-procurement within the Construction Industry.

However, it has become apparent from this review, that there are a number of significant gaps in the current literature in relation to the uptake and adoption of e-procurement. More specifically, the following important gaps have been identified:

- Current studies of e-procurement have tended to adopt rather narrow definitions and conceptualisations of e-procurement.
- There have been few, if any studies which explicitly focus on the Construction Industry, in general, nor the adoption of e-procurement by Construction Sector within GCC Countries and Kuwait Construction sector, in particular.
- There are a number of studies that identify factors that might affect the adoption of e-procurement, but they tend not to be empirically tested in relation to Construction Industry.
- Moreover, such studies do not provide complete and coherent taxonomies of the problems with traditional procurement, or the potential benefits of, and inhibitors / facilitators of e-Procurement adoption in Construction Industry of Kuwait.
- Where empirical studies of the adoption of e-procurement, have been conducted, they tend to be industrial sectors not related to Construction, focussing on a restricted set of adoption factors and a narrow conceptualisation of e-procurement.
- Until now, not much evident research has been conducted to pursue successful applications of e-Procurement to the construction supply chain in GCC Countries especially in Kuwait.
- Although independent studies as specified in the literature have been conducted on the Commodity Dimensions, Buyer benefits/barriers and Suppliers benefit/barriers towards adoption of e-Procurement independently at various industrial sectors, the above aspects have not been studied with context to Construction supply chain in a single market.

Against this backdrop, a study was initiated to investigate the factors affecting the uptake and adoption of e-procurement among the Construction Material buyers and Suppliers in Kuwait. Whilst this study explicitly builds upon the factors identified in prior studies, it was envisaged that it would provide a far deeper and richer data set, upon which to draw conclusions.