

# INFORMATION AND COMMUNICATION TECHNOLOGY [ICT] SUPPORTED SUPPLY CHAIN MANAGEMENT – BENEFITS FOR CONSTRUCTION BUSINESS IN LANDLOCKED DEVELOPING NATIONS

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The Construction business scenario in Zambia is such that the local industrial base cannot fully support construction; hence contractors import most of the materials. However inaccessibility to the sea and highly bureaucratic border control systems cause extraordinary transport costs, acute delays on projects and severe logistical challenges to construction in general. The general characteristics of construction industries – *such as fragmentation and rudimentary operations* –, regional political squabbles and general global business trends create unpredictable and hard to control effects on projects that exacerbate competitive disadvantages for companies with poor capital base. This research looks at how contractors in landlocked underdeveloped nations can apply the principles of supply chain management (SCM), locally and regionally, with the support of basic information and communication technology (ICT) systems to improve their logistical operations, and invigorate business competitiveness. The research proposes a schematic model that contracting businesses can use so as to stay afloat.

Keywords: AEC/FM Zambia, Competitiveness Advantage, ICT, Supply Chain Management

## INTRODUCTION

The architecture, engineering, construction and facilities management (AEC/FM) industry in Zambia faces an aggressive regional and international competition brought about by the government's investment policy (Sinkolongo, 1998). The whole market has been liberalised while public entities were privatised. This adversely affected the local industrial base as a result (Times Reporter, 2000). Additionally, inaccessibility to the sea increases transportation costs, and delays due to slow border control systems. Regional political squabbles and global trends create further complications to construction business. These factors affect the competitiveness of construction firms. Instead of searching for tangible solution to wade off competition, contractors tend to seek protection from government; which is the opposite of the very economic policy of liberalisation. This research aims to apply the principles of supply chain management (SCM), - *with the help of basic ICT tools* – as a technique to bridge the gap between the ever-competitive international firms and the sluggish local firms. The key objective of the research is to identify and analyse a typical supply chain for a local contractor with a view to improving its efficiency, and create a positive impact on the competitiveness in construction business.

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## **AEC/FM SECTOR IN ZAMBIA – THE OVERVIEW**

The construction industry in Zambia is a relatively large industry that befits an underdeveloped nation, contributing over 6.2% of annual Gross Domestic Product (GDP) in year 2000 (Central Statistics Office, 2000). The industry procures materials and components from a variety of worldwide suppliers, some of who are in different continents (Kärkkäinen, Holmström, Främling, and Artto, 2003). The general incapacity by local industries to meet the demand for construction inputs is so severe that 70 – 80% of the inputs are imported (Times Reporter, 2000). Compounding the problem is Zambia's location, which averages over 2000 kilometres to sea, and is surrounded by nine (9No) countries. As a result the industry has difficulties in co-ordinating operations due to the high complexity of global supply chains; and that any imported material or equipment undergoes a minimum of two (2) border checkpoints.

This phenomenon has been plaguing many other industries. However it has been exacerbated by the economic policies of the early 1990s which – *inter alia* – promoted market liberalisation and industrial privatisation, and led to the dismantling of parastatal firms, which hitherto controlled well over 80% of the Zambian economy and, were a major clientele for the industry (Mashamba 2000). As a result, cost variations, delays, and generic poor operational system are rampant in today's construction business (Ohmae, 1980).

## **SUPPLY CHAIN MANAGEMENT: A BRIEF OVERVIEW.**

A Supply chain (SC) is the process of activities, which transform raw materials to finished goods and services for use by the end-consumer, irrespective of corporate boundaries (Cox and Thompson, 1998). Realistic SCs have multiple end products with shared components, facilities and capabilities (Harrison and Ganeshan, 2001). Therefore supply chain management [SCM] is the management of these interlocking networks of organisations – and in particular, the relationships between them (Peck, et al, 1999). The foundation for successful implementation of SCM is largely dependent on:

- Jointly developed goals and plans;
- Avoiding niche collisions;
- Structuring the team;
- Clear communication links;
- Understanding cultures;
- A Structural learning process;
- Other factors (Harrison and Ganeshan, 2001).

In these 'virtual networks' organisations ought to create businesses, which facilitate joint decision-making, complete transparency on costs, and the sharing of risks (Peck, et al, 1999).

### **Supply Chains in Construction Business**

Construction supply chains differ from manufacturing and service industries in that (Cooper and Ellran, 1993):

- Supplies are purchased for use on a site, usually distant from the office where orders are placed;
- Supplies are highly bulky relative to their value, with high transportation cost;
- The client can supply specialised products;
- Subcontracting is part of the construction contracts;
- Some supplies involve intra-company purchasing;
- Other factors.

Supplies to the construction industry do not only consist of materials but also professional and specialist services, plant, labour and finance. Therefore, the platform upon which SCM is applied in construction differs from other industries. In construction, for example, it may be more difficult to develop long-term supplier relationships that are transparent and permissible to apply principles of SCM because of such factors as client specifications that do not accommodate certain suppliers that the contractor may have long-term relationships with.

Another factor may be that, because construction does not take place in a stationary factory, proximity of the site to the supplier, which may make transportation costs high if the site is far, work against using the same suppliers, and encourage materials/services to be procured near to where the site may be (Cox and Thompson, 1998).

To the contrary, the following factors negate the usage of SCM in construction:

- Too many procurement paths;
- The nature of demand, which is project specific, Ad hoc, one-off, technical, uncertain and the high value that accompany such demand (Peck, *et al*, 1999);
- The nature of supply, which is fragmented, with low barriers of entry, hyper competition, low profit margins, adversarial culture, many insolvency and lack of training (Lysons, 1996).

#### **4.0 Application of SCM in Construction Businesses of a Landlocked Developing Nation**

The basis for competitive advantage comes through focusing upon that part of the value chain where the firm has either a distinct cost or value advantage (Porter, 1985). SCM therefore entails that organizations look at their chain's distribution network, its uniqueness and pockets of strength. Companies' form 'virtual integration' which seeks to gain the benefits that accrue to companies who focus on core competencies whilst providing the advantage of co-ordination and integration that can flow from vertical integration (Griffiths, 1992). When an organisation is able to establish higher levels of total effectiveness and efficiency in operation than its rivals are, it has, in fact, developed a competitive advantage. As a result developing networks of collaborating and allied organisations can provide a powerful competitive leverage (Piercy, 1997). The implementer of SCM benefits in (i) elimination of waste (ii) greater efficiency (iii) shared resources and capabilities (iv) synergy (v) cost-base reduction (vi) customer focus, and (vii) greater competitiveness (Cox and Thompson, 1998; Laufer, 1999; Franks, 1995).

However applying SCM largely depends on the ability to manage the demerits associated with it, some of which are:

- Exploitation by certain members for selfish interests;
- Too dependant on mutual agreement;
- Unstable trust in a non binding relationship and;
- Takes a long time to establish relationships (Cox and Thompson, 1998; Franks, 1995; Wang and Jay, 2000).

In landlocked developing countries, various factors exacerbate the above demerits. For a company to manage their internal business environment, the various laws governing import and export business, and the very nature of sluggish border controls would demand a high level of reliance on existing ICT systems on the part of the supply chain manager.

### **ICT SUPPORTED SUPPLY CHAIN MANAGEMENT IN THE AEC/FM ZAMBIA**

There are four (4) main factors of production on the supply side of the construction industry in Zambia: (i) construction materials (ii) labour (iii) equipment and (iv) capital and finances (Mashamba, 1997). Construction materials are the largest single input for most construction works in sub-Saharan Africa, accounting for over 50% of the total construction cost (Central Statistics Office, 2000). Since materials are sourced locally, regionally as well as internationally, a careful deployment of ICT systems such as the e-business, the web, electronic mails are essential to SCM in the AEC/FM Zambia. Figure 1 abstracts the basic flow process of procurement of construction input generic to a construction process, as an illustration. The figure depicts a search for a useful equipment such as a 'rock' moving machine for construction in a mining operation. The firm would start the search, and decide whether to hire one and/or own one, based on various factors obtaining at any particular time. When a firm engage in the supply chain, it has to rely on 'total supply chain management' for it to succeed in the procurement of the equipment. Therefore, the whole process is tedious, iterative and taxing more so if there is no deployment of existing ICT tools to facilitate the process.

Based on this illustration, the research was designed to identify the critical relationships in construction business, and analysing the impact they can have on ones competitiveness. Deployment of ICT was central to the overall research theme.

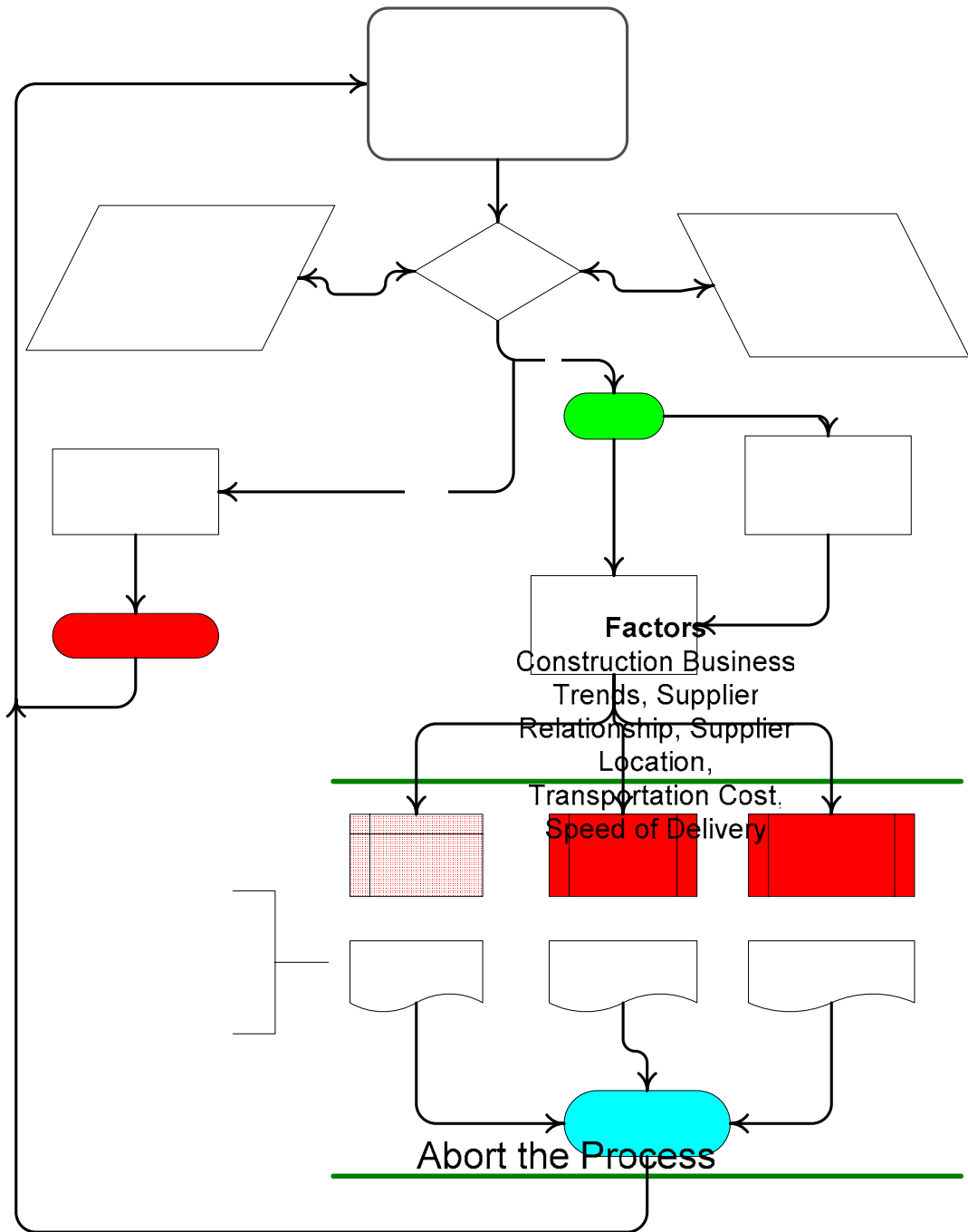


Figure 1: Abstraction of the basic flow chart of the procurement of a product for construction consumption in Zambia [Source: Authors, 2005]

Loss of Business

## RESEARCH DESIGN AND DATA ANALYSIS

Using a questionnaire, interviews were conducted from a sample of 55 construction business dealers in four main categories as shown in Table 1.

Sample Classification	Sample	Response
Clients	5	3
Cost Consultants	10	9
Contractors – Local	15	12
Contractors – International	15	12
Suppliers and Manufacturers	10	8
<b>TOTAL</b>	<b>55</b>	<b>44 (80%)</b>

**Table 1:** Research Sample and Rate of Response [Source: Authors, 2005]

The key areas of discussion from the research are based on the identification of key contractor supply chain relations, and the analysis of how the relations affect various aspects of the business that can in turn impact ones competitiveness. Because of lack of space, the paper does not cover details of the research design. It just raises issues identified by respondents that are crucial for a meaningful research discussion, which are as follows:

### ***(i) The Impact of Supplier Relations on Project Costs***

The research results indicated that contractors with short-term inconsistent supply chain relations submit high tender sums while those in long-term relations tended to consistently submit lower bids. A direct relationship between supplier relations and the cost of construction was thus established.

### ***(ii) The Impact of Supplier Relations on the Efficiency of Overall Project Delivery***

Results indicated that contractors in long term business relationships delivered projects in a much more efficient way than those on short-term one-off business relationship. The key reason is that contractors with a seemingly stable source of jobs could secure credit facilities, finance as well as enjoying good will from vital business entities within the region.

### ***(iii) The Effect of Supplier Relations on the Quality of Constructed Facility***

Contractors on long-term contractual arrangements tended to rely – *inter alia* – on quality of past products. Therefore, product reliability – *especially in construction projects related to copper mining in general* – is crucial for continued business. To the contrary, firms with poor construction record on quality tended to have erratic project supplies.

### ***(iv) The Effect of Supplier Relations on the Firm's Competitiveness***

The longer the business relationship, the more competitive the firm tended to be. International construction business firms tended to make alliances amongst themselves because of the past working relationship. Results showed that local firms are losing out on business because of the virtual supply chain barrier within which international firms operate. Therefore short-term business relationships have a negative effect on the competitiveness of the contractor.

### ***(v) The Effect of Financial Base/Backing on the Firm's Competitiveness***

Research results indicated that there was a direct relationship between a contractor's financial base and his competitiveness. International contractors use this factor to edge local firms.

***(vi) The Impact of ICT tools on a Company's Competitiveness***

Like other factors, ICT is vital to logistical operations of construction business. It was found that company's with low level ICT tools performed poorly on a variety of projects not only in bidding processes but also in the optimisation of resources within their businesses. International firms tended to use ICT as a key factor in the management of the procurement processes as well as the suppliers with whom they worked with.

***(vii) The Impact of Suppliers on the Clientele and Consultants***

Generally, the clientele experienced common problems such as poor quality products, delayed material supply, political interference, and time overruns. Key factors causing these problems are: lack of commitment, high employee turn-over, and poor financial base. As a result, long-term, established and transparent relationships between contractors and suppliers, clients and consultants, were only envisaged with the support of contractual arrangements as opposed to mutual agreements. As a result, the degree to which the construction team can be integrated into the SCM process is largely determined by the tendering/procurement arrangements of the industry. Because the sequential procurement system predominates, integrating the contractor into the supply chain is hampered by the psychological barrier that separates design from construction, and operation. This promotes fragmented work culture, breeding into a perfect atmosphere for the fragmented supply chain. Build-ability, delay and disruption ensue (Griffiths, 1992).

***(viii) The General Effect of the Origin of the Contractor (International or Local) on Competitiveness***

Research indicated that the selection criteria for contractors were mainly based on three factors: (a) Experience, (b) The bid sum, (c) the reputation, and (d) technological capacity. International firms have better financial base and technological ability than local contractors. The origin of a contractor therefore plays a vital role in securing financial capital and alliances that could be used to out-bid competitors.

***(viii) The General Effect of Local Manufacturers and Suppliers on Contractor Competitiveness***

Local manufacturers and suppliers experienced similar logistical and technological problems to contractors because of over-reliance on importing inputs. Once they experience a delay for instance they usually incur costs; which are passed down the chain, and are reflected in his tender prices. Suppliers' logistics of imported material affect the contractor's efficiency, cost, quality and timely delivery of products. The research shows that local contractors arrange random supplier-buyer relationships each time they win a tender. With such haphazard relationships, local contractors tend to be negatively affected in their competitiveness, especially with the endemic erratic supply of projects.

Results also showed that seventy five percent (75%) of the international contractors surveyed had established suppliers from their headquarters that they use for bid submissions in Zambia. This scenario disadvantages local suppliers too. For instance, before a local supplier gets a supply contract most international firms require proof that the supplier: (i) can handle materials to the required specification and quality, (ii) Agrees to inspection of materials prior to procurement, (iii) Is internationally Certified by an international certification body, (iv) is highly experienced, (v) can employ a system of tracking the position of materials and/or plant and equipment especially at

national border points, using assorted ICT tools, and (vi) Maintains good relationship with other members of the supply chain.

### **6.0 ICT Support in Construction Supply Chain Management: A Discussion**

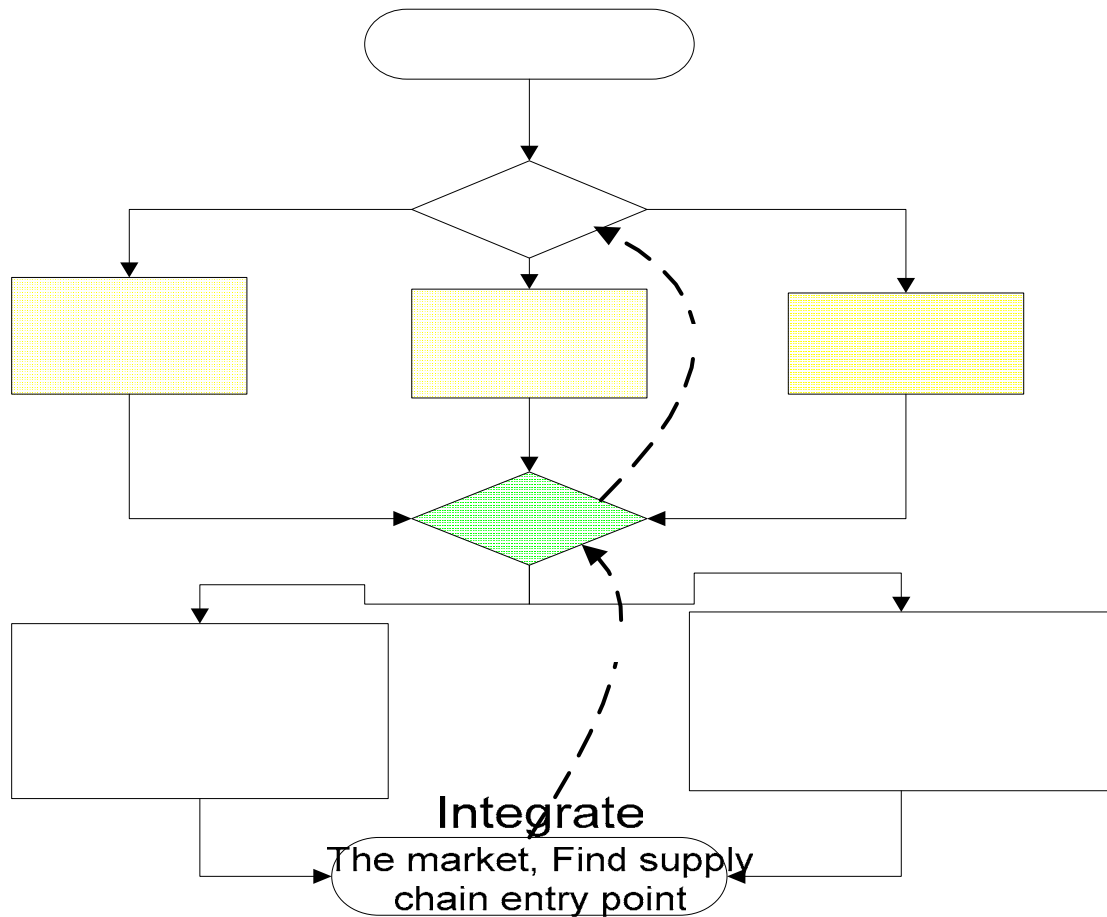
While supply chain management is not a panacea to competitive disadvantage faced by local contractors, the system could alleviate the problem if used correctly. Within the realm of supply chain management, results indicated that in general contractors had poor electronic links to organisations whose operations impinge on the general logistics of input procurement for construction. This is mainly because of a poor uptake of Information and Communication Technologies (ICT) in the overall management of supply chains. For instance, failure to use advance electronic clearance systems set by various governments in the region would cause severe delays in the actual clearance of inputs. This problem typifies regional construction businesses. It is therefore worth applying the following suggestions:

- Utilisation of basic ICT tools, such as emails and the Internet in the management the supply chain because of the vastness of the region;
- Consider alliances, and or joint ventures so as strengthen their competitive edge;
- **Seek financial backing;**
- **Promote intra-company trading;**
- **Consider attitude change by focusing on the customer, integrated processes and teams;**
- **Improving total quality for package by exceeding customer expectations;**
- **Promoting a resounding commitment to people in general, the environment, and customers;**

**Figure 2:** Supply Chain Management Implementation Model [Partly adopted: *Wang &Yang 2000, Porter 1985*]

Figure 2 abstracts the process with which a firm could deploy supply chain management as a management strategy, and augment it with an update of essential ICT systems so as to manage the up-stream and down stream business relations within the region, and on the international market. Some of the suggested strategies include integration, diversification and concentrating on their niche. The way forward therefore demands a combination of various strategies, plus an uptake of ICT.





## CONCLUSION

The Zambian contractor's supply chain is characterized, to a large scale, by random, short-term supplier relationships governed by such reasons as a desire for the cheapest prices, favourable stock, proximity to site and a desire to gain from competing suppliers. The relationship characteristics depicted are typical of the traditional form of contracting whereby each party of the chain operates separately with highly divided organizational functions and borders. Consultants operate independent of the contractor, rarely involving him in decision-making and contractors relate similarly to their suppliers of various goods and services. There is no deliberate effort to manage the relationships between them and their suppliers, let alone employ effective utilisation of cheap ICT tools to enhance their SCM systems. For construction business to increase their competitive edge, they need to take up total supply chain management systems as well as a high level of basic ICT systems that can facilitate the procurement, transportation, and deployment of key supplies in making products that are of high quality.

## Managerial Strategy

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**Alliances**

**Mergers**

**Commitment**

**Change of attitude**

**Better Supply C  
Leading to C**

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