TOWARDS A SUSTAINABLE CONSTRUCTION PROCUREMENT:
TIMBER SUPPLY CHAIN APPROACH IN TANZANIA

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ABSTRACT

Sustainability occupies center stage in the worldwide debate about the future of the world. Consequently, mainstream concepts of sustainability as widely adopted by the construction industry are not always applicable for understanding procurement needs in the developing world. Although, the construction procurement has much to contribute to the debate on sustainable development and yet there has been a lack of critical analysis within the industry. There is a broad consensus on basic objectives of sustainable development. However, there is a need to further develop an understanding about what sustainability means to the developing countries, particularly in the area of construction procurement. The purpose of this paper is to explain how broad sweeping economic, social and environmental changes associated with sustainable development are impacting the timber supply chain in Tanzania. Such changes are important from an economic and environmental perspective within the construction industry, especially its supply industries, as well as for wider issues of economic prosperity. This paper contributes to the sustainable development debate in construction procurement, focusing on the role of supply-based timber firms in the rural areas, with the aim of improving processes, creating opportunity for continuous flow of employment and most important availability of the product at affordable price/rate.

INTRODUCTION

Sub-Saharan Africa is experiencing rapidly expanding towns and cities (Wells, 1995). This growth generates high demand for timber for construction purposes, which is met through a timber commodity chain, which stretches from users’ end of demand back to resourced area of the supply. There is a great concern that the changing demand and commercialization are putting new pressure on timber supply chain (SC), this is evident in research work by Wells et al., (2000). They identified that the timber commodity chains involving indigenous hardwood/softwood are particularly complex. They involve the use of local indigenous knowledge resources in identifying various species, felling of trees, selection and transportation, which are governed by various informal and formal regulatory procedure. While there is a broad consensus on the complexities in the SC, there is also a lack of critical analysis within the industry in sub-Saharan on how to procure sustainable timber.

To overcome these problems, industry practitioners and researchers in developed world have started to investigate how sustainable approach can be used effectively to improve the performance and productivity of construction SC procurement (Barrett et al., 1999). Taking into account the need for improved relations and effective collaboration, quality and effective use of sustainable materials (resources). Consequently, there is a growing interest in the application of sustainable principles to timber SC procurement, as a result of growing demand from users. The importance of developing and maintaining goods relations with resource users and suppliers in timber SC is a critical factor affecting procurement success performance. The combination of poor relations between customers and suppliers, the absence of quality focus, and the lack of carefully developed strategy for the complex and dynamic nature of the material SC (Udeaja and Tah, 2001), has meant that time and cost overruns has become endemic features of the timber procurement. However, the aim of this paper is to explain how broad sweeping economic, social and environmental changes associated with sustainable development are impacting the timber supply chain in Tanzania. Such changes are
important from an economic and environmental perspective within the construction industry, especially its supply industries, as well as for wider issues of economic prosperity. The paper discusses the general notion of supply chain that focuses on timber systems in sub-Saharan. The subsequent section analyses the issue of sustainable procurement discussing the economic, social, environment and biophysical issues. The debate that has gone in this field is also reviewed and this set the agenda for the development of the framework. The penultimate section introduces and describes the framework for sustainable timber procurement in Tanzania, using case study approach to analyse and discuss the system. Finally, the paper concludes by making recommendation and considering issues for further works.

SUPPLY CHAIN CONCEPT

The concept of supply chain has evolved enormously in the past few years (Handfield and Nichols, 1999). New (1997) argued that the idea of the supply chain owes much to the emergence from 1950s onwards of system theory, and the associated notion of holism. This may be summarized by the observation that the behaviour of a complex system cannot be understood completely by the segregated analysis of its constituent parts. The use of this idea in this regard is neither consistent nor straightforward. In spite of these different aspects of supply chain concepts that have been considered in the literature to date, there is a common ground on the principle tenets of supply chain. In the following section, the research explores the development of the supply chain theme and explains why definitional problems reflect a deeper dilemma.

Supply chain definition

Supply Chain has received attention ever since, yet conceptually the supply chain is not particularly well understood. In providing a topology of the supply chain concept, this research support Harland (1996) contention that within the supply chain literature there is a confusing profusion of overlapping terminology and meanings. As a consequence, in the literature many labels can be found referring to supply chain as Value chain (Cox and Thompson, 1998), Supply Network (Harland, 1996), Supply Pipeline (Farmer and Ploos Von Amstel, 1991), Demand Chain (Blackwell and Blackwell, 1999), Logistics (Christopher, 1998) and more recently design chains (Austin et al., 2001) etc. However how this literature has conceptualised these terms, they are simply another metaphor for supply chain.

In an increasingly complex and dynamic world, organizations are changing their ways of exchanging goods; they cooperate with other organizations rather than internalize and control their activities and resources through vertical integration, or buy and sell remotely through arm length procurement (Steven, 1991). Therefore, some organizations have started to look at the flow of goods from raw material to the end customer as an integrated process rather than a large number of independent transactions. To capture these full complexities of the flow of goods and to obtain a more holistic view of the process, therefore, organizations are increasingly starting to consider the big picture of supply chain. Grounded in the illustration above, this research defines supply chain as (Harland, 1996):

“A number of entities, interconnected for the primary purpose of supply of goods and services required by end customer.”

This definition implies that the entities are somehow interconnected; consequently, a supply chain is not merely a group or a cluster of entities. What characterizes a supply chain is that the entities are connected through transactions of goods and services.

Structure of the construction supply chain

The traditional supply chain structure has shifted, transformed and extended itself into dynamic and ever-changing processes. The transformation transcends the physical boundaries of the whole enterprise and reaches into the global and rapidly evolving series of network (Harland, 1996). Apart from broadening the perspective from single supply chains to networks, which results in a more holistic and strategic view of the process of supply. The use of the term ‘supply chain’ can also be linked to the growing complexity of the process. There are a number of ways of structuring the supply chain; one of the most useful is node and link model, with plots usually representing
movement over distance and nodes representing places/organization where goods are stored or processed (DETR, 1998). This chain also provides an understanding that there must be a complex interplay of business to business relationships within the process that links raw material manufacturers with the end products and services that are created to energize business relationships.

Timber supply chain structure in Tanzania is very large with large number of possible routes and channels, through which timber flows from the source to the purchaser in the city. The procurement of the timber from the producers to the final consumers (construction industry) involves interlinked exchange through which timber passes from extraction. Figure 1 below shows a supply chain structure for the production and distribution of timber mostly consumed by urban construction industry in Tanzania. Seven main functions are presented. These are: felling and sawing of logs in the forest; transport of wood from the forest to the roadside or village; the coordination of production activities; local trading in timber; transport to the city; retailing of timber in the city and the use of timber. A particular channel describes the number of times the semi-processed product is sold before its final sale to the customer. It also shows the number of enterprise involved in processing the product.

Figure 1. Production and distribution channels for timber from natural forest

SUSTAINABILITY DEVELOPMENT (SD)

Having discussed, albeit briefly, the evolution and use of supply chain, the purpose of this section is to discuss the concept of sustainable development as it relates to the construction timber procurement and to advance understanding of the sustainable construction procurement. However, since the beginning of the 21st century, the theme of the sustainable development has become an essential subject (Videia and Martinez, 2001). Sustainable development implies the use of natural and physical resources that enables people and communities to provide for their immediate social, economic and cultural well-being without compromising the ability of the future generations to meet their needs (Lacasse, 1999). Thus, from a construction perspective the evolution of the concept of sustainable development is used as a basis for advancing understanding of sustainable construction.

1 Note that city is used to denote the place of final consumption in the case Dar es Salaam, Mwanza, Arusha and Zanzibar
Hill and Bowen (1997) identified that sustainable construction is a word that has become common currency in recent years. In order to address sustainability in construction, the various professions of the construction industry need to embed the principles in their day-to-day operations. In the light of existing processes, it is understood that a change in culture and other issues are required. The construction industry inevitably must address certain consequential issues in the process of achieving sustainable development, because it consumes a considerable amount of natural and physical resources and as such has a significant impact on the environment (Barrett et al., 1999). Thus, current procurement methods need to be altered to accommodate requirements for sustainable construction. This procurement approach should ensure a better quality of life, not just now but for the future generations as well (Bourdeau, 1999). It should combine protection of the environment, sensible use of natural resources, economic growth and social progress. These issues are well documented in sustainable development literature, but are discussed briefly in the next section, to help illustrate how sustainability can be achieved in construction procurement.

**Issues of sustainable construction**

Having introduced the concept of sustainable development in relation to construction SC, the following section of the paper develops and discusses issues for the attainment of sustainable procurement. Consequently, this section outlines a number of issues whose application would make the construction timber SC more sustainable. The key issues related to sustainable development, such as social, economic, ecological, technological, technical and biophysical issues, has been discussed in (Hill and Bowen, 1997; Plessis, 1999; Barret et al., 1999; Edwards and Hyett, 2001). Most of these issues are also applicable in construction timber procurement. In this field, with regard to the specific timber procurement features, which affect the sustainable construction, it is necessary to examine the relationship between human activities, the environment and the Earth’s ecological processes, both now and the future; and the development of individual well-being through the sustainable growth of economic and social systems. Thus the issues that are required to make timber procurement in sub-Saharan sustainable are: social, economic and environmental issues. These concepts are well covered in research work by (Hill and Bowen, 1997; Plessis, 1999; Barret et al., 1999; Edwards and Hyett, 2001) and will not be discussed here again. However, these issues of SD are summarized and discussed briefly in Figure 2.

**Social Issues**
1. Seek equitable distribution of the social costs and benefits of timber extraction processes
2. Improve skill and training and capacity enhancement for the local indigenous
3. Provide a social system that allow timber arising from disbursement
4. Protect and promote human health through a healthy and safe working environment

**Economic Issues**
1. Re-invest the proceeds from timber extraction within the locality
2. Promote employment creation by ensuring that opportunities create the capacity of the communities
3. Ensure financial affordability for local indigenous
4. Promote environmentally responsible extractors

**Technical Issues**
1. Encourage and develop administrative system that is self-sustaining and flexible, that can accommodate unforeseen circumstances
2. Encourage some form of mechanisms such as reliable labelling schemes
3. Encourage compliance of relevant legislation and regulations

**Biophysical Issues**
1. Encourage extraction that respect the obligation to maintain the ecological carrying capacity
2. Put in place administrative system that is self-sustaining and flexible that can accommodate unforeseen circumstances
3. Encourage some form of mechanisms such as reliable labelling schemes
4. Encourage compliance of relevant legislation and regulations

**Figure 2. Transition of Sustainability in Construction SC Procurement**

On a finally note, it should be noted that optimization of all the listed principles is not always possible, and that trade-offs and compromises may be necessary. Indeed, some of the issues...
cannot be considered immediate priorities, but this does not mean that they should be ignored. The choice of which issues to apply to a particular procurement stage, and the decision on the extent to which each chosen principles should be applied, reflects value judgments, therefore whether to apply weak, strong, very strong sustainability. Thus, the emphasis, therefore, should be on implementing a timber procurement which seeks to achieve consensus among interested parties on which issues are more and which are less important (Hill and Bowen, 1997). The Tanzania construction SC aims to contribute to SD by adopting new policies and practices, which have a more positive impact on economic, social and environment systems. Improvements are sought in all stages of the construction procurement process, such as the land use, replenish of tree, social interaction and economic benefits for the society. Finally, the research aims to contribute to the durability, adaptability and energy conservation of timber procurement.

Sustainable development debate

The discussion on different perspective and priorities of the sustainable construction has so far been presented in sustainable development and environmental conservation agenda. The whole affair started with the 1972 Stockholm Conference, then the publication of the Brundtland Commission Report (WCED, 1987), the Rio Conference on Environment and Development (UNCED, 1992), Kyoto Protocol of 2001, and the recently World Development Summit in South Africa 2002. These events have popularised the above aspect of resource utilisation and conservation, and made them into an important part of the development debate. However, the problem of allowing concepts such as sustainable development to be used as normative magic phrases is that it could be used to justify measure undertaken in the name of environmental, economic, social sustainability etc., however misguided. For instance, in the current preoccupation with environmental issues a few people noted that, the success of industrial capitalist has enabled people in the countries of the north to push for quality life consideration as political priorities, however, in the poor countries struggles over the environment are still about basic needs, cultural identity and strategies of survival. Consequently, there is a great danger that the North is using its influence to impose its priorities in the name of saving humanity without caring for the survival priorities of the poor countries of the South (Okigbo, 2001).

Initially, natural scientists and economists, has always neglected the human dimension of sustainability. This emerged as an important notation for the sustainable development debate, where concern was raised about the need to sustain the world’s essential ecological processes and to preserve its genetic variation (IUCN, 1980). This concept gained international boost with the publication of the Bruntland Commission Report (WCED, 1987). However, there definition has been mistaken because it was an effort to strike a negotiation in order to satisfy the different contributors to the Bruntland Commission. This explanation leaves a room for manoeuvre, as it does not specify whose model of development should be followed, or who will determine the economic, social or biological needs of the present or of the future generation. Nevertheless, the Bruntland Commission has been congratulated for relating the discussion of sustainable development to human needs especially construction, in contrast to earlier discussion that focused only on the trade-offs between economic and biological system, and have been criticised for their bias towards managerialism, natural science and efficient resource use aspects of conservation (Lane, 1993; Tobisson and Rudqvist, 1992 and Redcliff, 1992).

In construction, the concept of environmental sustainability is becoming a dominant issue as the relationship between the construction industry on one hand and the use of resources on the other is becoming a source of discourse. The construction industry has the potential to enhance environmental sustainability by its structure, conduct and performance. An economic efficient construction industry enhances environmental sustainability by ensuring least cost methods of construction and optimum allocation of resources. While technically efficient production processes should guarantee competitive prices, further environmental sustainability can be achieved within construction when associated social and environmental costs are internalised and reflected in the final product price. In fact the scope for enhancing environmental sustainability is huge especially with regards to resource consumption and in particular depletable and non-renewable natural resources. This can be achieved by substituting recycled materials for new ones. For example the friends of the Earth and Wuppertal Institute for climate and energy (WGSE, 2001) have envisaged the huge differences that sustainable construction procurement could make to environment. A way
of reducing natural resource consumption by European construction particularly in energy intensive materials is being debated, but how this will impact the poor countries is yet to be established or is yet to make it in the agenda.

Evidently, construction activities have huge impact on the physical and biotic environment. However, the real challenge is to find ways of achieving dramatic shifts in attitudes in the different areas of the construction processes as many players in the SC have different roles that influence various stages of the industry. These stages include: material provision, design, construction, maintenance, building use and demolition. The players include, builders, resource providers, local and national governments, the provider of many kind of services associated with the use and maintenance of buildings etc. Unless these players quickly embrace the rapidly unfolding realities where changes to the local and national and even global physical and biotic environment are becoming irreversible, the problem would not only persist but the consequences will be uncontrollable.

A CASE STUDY OF THE EXTRACTION OF HARDWOOD TIMBER IN TANZANIA

Construction timber market is currently characterised by very few number of timber species. Although, many tree species are available that could be used for construction purposes, furniture making, export etc., but only a few species such as “mninga” and “mvule” are commonly preferred. These species compared to others lesser-known species are resistance to bores and termites attack. Sawn timbers from these species are relative light and timber tissues have pattern that makes it easy to work on (Streets, 1962). The research conducted by Wells et al., (2000) on timber usage shows these characteristics have made these species popular among timber users. This has led to the over-exploitation of these species and cutting of immature tree with small diameter. If this trend is left uncontrolled the ongoing extraction will result into the extinction of these tree species and this could have an impact on the ecosystem.

Extraction of timber from natural forest in Tanzania is complex and it involves many actors. Some of these actors are operating on their own, others in groups, and in collaboration with forest officials. Collaboration of extractors and timber traders with forest officials is undermining sustainable extraction practices by allowing traders to harvest trees species without supervision. Traditionally, extraction of hardwood timber and other forest resources has been argued to be sustainable under the control of local communities who extracted these resources for their own use. But it is becoming unsustainable as the demand from urban construction sector exceeds the capacity of the forestry replenishing. Research undertaking shows that timber agents who co-ordinate extraction and operate timber trade with an intention to supply urban construction sector are outsiders to areas they source timber. Their accountability over the areas they harvest hardwood timber is non-existence. These extractors are prepared to maximize their profit at any cost, even if it needs bribing their way out.

Big timber agents procure sawn timber by hiring pit sawyers or sub-contract procurement operation to contractors based at the resource production areas. The contractors organizes group of pit sawyers to carry out felling and sawing of timber by financing their operation. They also buy sawn timber from independent pit sawyers who have been identified to be widespread, not registered and their timber extraction activities are hard to be control and monitored. Research carried out by one of the author shows that extraction, sawing and hauling of sawn timber takes place during the night as most of these timbers is not accounted for. The research also shows that the timber businessmen sometime pay the fees and royalties, but extraction has always exceeded permitted volumes and harvesting for other species.

Conventionally, laws and regulations on sustainable extraction of resources have to be practiced to ensure sustainable extraction of resources such as timber. The research carried out has observed that existing methods of exploitation and extraction of indigenous hardwood timber from Tanzania

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2 Scientific (botanical) Pterocarpus angolensis, English name Bloodwood, Swahili name mninga
3 Scientific (botanical) name for mvule is Chlorophora excelse, English name Iroko, Swahili name Mvule
natural forest is unsustainable. The reasons are many such as cumbersome procedures for extractors to get access to resourced areas. This makes costs of compliances astronomical. A licensee from urban area will have to make 5 to 10 trips to the forest. He will have to locate both the regional, district and divisional forest officers. This may involve numerous attempts, small payment to get them in the forest and so forth. In reality most extractors avoid this kind of bureaucracy by carrying out illegal extraction. Because extractors are operating illegally, they end up practicing poor logging operation that result into a huge waste from felled trees as only section of the tree is being utilized as they fear to be apprehended by the authority. These reasons and many others that cannot be listed in this paper make unsustainable extracting of hardwood timber in Tanzania and elsewhere to be a source of concern and threat to the forest biodiversity.

In summary, this case study description given in this section is not an exhaustive discussion of timber procurement processes and constraints in Tanzania. However, the discussion has shown that there is an element of unsustainable practices that need to be discouraged in order to achieve a sustainable status of the supply of products such as hardwood timber for current use and for future demand.

**PROPOSED FRAMEWORK FOR SUSTAINABLE TIMBER EXTRACTION**

Hardwood timber extraction processes outlined above is nothing more than a system that cannot meet the needs of the future timber demand under the growing construction sector. To overcome these challenges and ensuring that extraction of timber is sustainable, this paper proposes a framework that aim to put in place an effective and efficient resource use and allocation. This framework is not an answer to all the problems associated with unsustainable practices on resource utilization. Each unsustainable human commission has a unique impact and thus need a different framework to make it sustainable. Figure 3 below presents options for achieving sustainable hardwood timber procurement.

![Proposed Framework for Sustainable Timber Extraction](image)

The current forest products extraction processes in Tanzania are complex and time consuming, making the extractors indulge in illegal extraction. In attempt to make the processes legal, the extractors forge some documents such as licenses and transit passes. This problem can be combated by pre-printing months, years or quarters on license and other associated documents involved in dealing with extraction of timber. Current licenses are not cancelled, and this was found to multiple uses, sharing and other means of tax evasion. Making this document transferable will help to determine on weather the wood is sustainable sourced. Currently in Tanzania, once the wood is extracted from the forest and supplied to urban centres is difficult to trace it back to its origin.
Apart from unsustainable practices by extractors, there is a lack of direct relationship between the construction industry and the wood-supplying sector. The construction sector is not promoting the use of lesser-known tree species, a common practice for the players in the construction industry remain and rely on limited species found in the market. Re-use of formal wood material is beginning to be practiced in small construction units but finding an alternative formwork is more important as will reduce extraction of wood materials such as bush poles. To this level, the control therefore lies within the construction registrar board that has mandate to put standards and regulations related to construction activities and sourcing of materials such as timber products.

Performance over sustainable resource allocation would undoubtedly improve if timber extractors and agents were made accountable over their extraction activities. At present the institutional structure is fragmented and most sawn timber found in the urban market is not inspected. Confiscating illegal sourced timber and transferring proceeds to sourced areas will ensure that allowed extracted volumes are consistent with the sustainable management plans.

In another proposed strategy in the framework, sustainable timber extraction process can be achieved by leasing of the natural forest management. The leaseholder would be provided with an allowable area and he would be responsible for conservation of sections set aside for future growth. However, such contract needs to be monitored and regulated by the government efficiently. Previous paper written by some of the authors, argue that standards has to be designed by construction board and the supply side of the building materials. But, there is great sceptism on weather anything can be achieved over the current situation whereby rules are undermined and standards are not pursued.

Some interesting twists can also be incorporated into a timber transport system in Tanzania. Reform of the natural forest product extraction should focus away from production; instead target other points along the supply chains. The hardwood timber market chain in Tanzania is akin to a *funnel*. The chain narrows at either the transport, processing or wholesale level, but then widens against as timber product are sold to retailer outlets.

Finally, to ensure sustainable extraction of timber resource, the framework proposes a complete decentralisation of the allocation and control of resourced areas. This will enable all revenue accrued from extracting timber to remain in the extracted areas. This will reduce the administration burden of compliance since all licences and payment and sustainable plans would be decided at this level.

**CONCLUSION**

The importance of material procurement in project performance or any other sphere has been known for several decades. Only recently, has the industry found it necessary to promote the sustainability of the material processes, and the resulting set of disciplines is now known as sustainable construction. This paper presented an approach to sustainable construction procurement using timber supply chain as a case study. It has centered on the main concepts and issues associated with sustainability as it relates to timber SC. It has drawn together a very wide range of material, and has hopefully provided an insight into how sustainable construction can be practiced among the timber SC participants in sub-Saharan region. However, the subject matter of this paper is important because it is increasingly felt both within research and industry that sustainable construction is a key strategic issue as construction becomes global, complex and competitive. However, in the early part of the paper, the general concept of SC was presented and the structure of the SC was determined with particular relevance to the Tanzania timber SC. A comparative description of sustainable development (SD) was presented and the issues effecting the deployment investigated and discussed. This charted a course for development of a framework for timber sustainable procurement. Consequently, the following conclusion can be drawn from the work presented in this paper:
• There is a need for improvements in the way the construction industry procure materials, so as to achieve client’s satisfaction and overall improvements in a sustainable and profitable manner.

• On the issue of sustainability, SD agenda cannot ignore the construction industry because it directly affects the problems of the environment in many ways, such as the use of natural resources, consumption of energy, generation of waste, contribution to pollution and contamination of microenvironments.

• The SD thinking has come a long way, the earlier concern of SD concentrated in the biophysical aspects that include natural resources and the environment. It has since broadened to include socio-economic issues in recognition of the fact that no meaningful SD can be achieved in the midst of social economic problems especially in developing countries.

• When one looks at SD in this light, it is clear that the construction industry is only addressing the tip of the iceberg. SD will require not only the use of resource efficiently and less polluting practices, it will fundamentally change the way the industry work, make decision, do business and be profitable.

In summary, the main argument is that the prevalent practice of construction procurement in Tanzania is deficient and implicit, which also is a major barrier for sustainable development in the construction industry. Whilst preliminary evidence in favour of this argument is presented, a more definite empirical validation is a task for the future continuous research.

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