

# The Construction and Building Materials Industries in Sudan

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## Abstract

The role of construction in socio-economic development has been addressed by various writers and international bodies, many of whom have focused on developing countries (Turin, 1973; World Bank, 1984; Wells, 1986; Ofori, 1990; Palalani, 2000). Developing countries and specially Sudan face major problems related to extended urbanization, which are result of war, conflicts, socio-economic factors and environmental depletion. This growth is creating exceptional demands for space and services to be provided by the construction industry which provides facilities necessary for the economic development and well-being of people. Therefore, Construction is an important sector contributing to survival and the economical output of nations, its role is inevitable. This study will review the status of construction and building industries and their importance in Sudan as a developing country with special emphasis on building materials and components industry. Peace and the following stage of the economical development and the future of construction industry in Sudan require a higher level of sustainable production of building materials and adoption of appropriate technologies in terms of economical, technological, and environmental efficiency. Therefore, this paper concentrates on the building materials with a special focus on Southern Sudan and Darfur since that these two regions, because of the war and conflicts, are experiencing severe supply problems. The availability, supply, quality, and distribution of building materials are of the most serious problems facing the construction industry and housing Sector and hence peace in these regions and in Sudan as a whole. This situation motivated the authors to attempt to throw light on it. This paper is prepared as an introductory to a wide research on the construction and building materials industries in Sudan. It identifies the common challenges that face developing countries generally and Sudan specifically in the construction and building materials industries. Surveys and available literature were the main source of data beside the statistics provided by governmental authorities in Sudan and international organizations; United Nations, World Bank, etc. The paper identifies a set a challenges, which face the construction and building materials industries in Sudan, to be investigated. As a consequence of war and conflicts, the regions of Southern Sudan and Darfur need more developmental programs and further attention.

**Keywords:** construction industry, building materials, economy, Sudan, southern Sudan, Darfur

# **1. Construction & building materials industries and development**

## **1.1 Introduction**

The Construction Industry has been identified as one of the main engines of growth in any economy. It provides the infrastructure required for other sectors of the economy to flourish, provides housing as the basic human need. The role of construction in socio-economic development has been addressed by various writers and international bodies, many of whom have focused on developing countries (Turin, 1973; World Bank, 1984; Wells, 1986; Ofori, 1990; Palalani, 2000). The provision and maintenance of shelter, other permanent structures and infrastructure networks are fundamental to the national economy. In almost every sector of the economy - agriculture, health, industry and communications - there is some construction component (UNCHS, 1986). Construction activity is an integral part of a country's infrastructure and industrial development. It includes hospitals, schools, townships, offices, houses and other buildings; urban infrastructure (including water supply, sewerage, drainage); highways, roads, ports, railways, airports; power systems; irrigation and agriculture systems; telecommunications etc. Covering as it does such a wide spectrum, construction becomes the basic input for socio-economic development (Planning Commission (India), 2002). The construction sector has major linkages with the building materials industry since construction materials accounts for a sizeable share of the construction costs (Shaddad, 1979).

Sudan, as a developing country, has experienced great developments during the previous decades. These developments took place in many fields, of which the construction industry is an important one. A wide range of various construction materials is used in the construction of different types of buildings. The prefabricated units and high tech facades become common features in the today buildings in urban centers. Today, the construction companies draw a great attention to the management of the production resources and the environmental impact of its consumption. However, this development is concentrated in the capital and some of the big cities besides the areas of oil production. Areas of conflict- Southern Sudan and Darfur- suffer severely from the underdevelopment of the construction sector and experience challenges in the building materials industry on different levels (production, supply, use, waste treatment, ... etc). Despite the resolution of the war in Southern Sudan and the increase in the level of construction works, the building materials form a major obstacle in the development process in the region. The regions of Southern Sudan and Darfur lack capacity to produce building materials in order to satisfy their local demand. No doubt, the whole country lack capacity in production, however, the situation in Southern Sudan and Darfur is more acute.

## 1.2 The relation between construction & building materials and components industries

A wide range of materials is used in building industry for new buildings, maintenance and civil engineering. Some materials like cement and bricks are produced exclusively for construction purposes. Other materials, although construction may be the largest user of the industry's products, are nevertheless produced for a wide range of uses, e.g. iron, steel, and wood-based products (Elkhalifa & Shaddad, 2008). As many materials are actually made on site, especially at the early stages of economic development, a considerable overlap exists between the building materials and the construction industry. Production of such materials (e.g. concrete blocks) would count as part of the construction process. Many materials inputs (e.g. aggregate) are supplied in semi-produced or simply shaped state. Production of such materials is not always recognized as a manufacturing industry. Development plans and national statistics, when available in developing countries, cover only the key materials (i.e. cement steel, wood products). However, planning for inputs for construction must take account of the whole range of materials required; critical shortage of even small component would cause a serious delay to construction output (Shaddad, 1979).

Building materials constitute the single largest input to construction, accounting for 50 to 80 per cent of its total value (UNCHS, 1986). Generally speaking, the cost of building materials represents the highest share in comparison to other construction cost components for all categories of construction industry. Table (1) shows a breakdown of construction cost components for the main categories of construction industry, which is developed by Construction Industry Development Council Survey in India.

*Table 1: Share of Construction cost components (%) into different construction categories (Source: Planning Commission (Government of India) Tenth Five year Plan 2002)*

Category	Materials %	Equipments %	Labor %	Finance %	Enabling %	Admin. %	Surplus %
<i>Building</i>	58-60	4.5	11-13	7-8	5.5-6.5	3.5-4.5	5-6
<i>Roads</i>	42-45	21-23	10-12	7-8	5.5-6.5	3.5-4.5	5-6
<i>Bridges</i>	46-48	16-18	11-13	7-8	5.5-6.5	3.5-4.5	5-6
<i>Dams, etc</i>	42-46	21-23	10-12	7-8	5.5-6.5	3.5-4.5	5-6
<i>Power</i>	41-43	21-24	10-12	7-8	5.5-6.5	3.5-4.5	5-6
<i>Railway</i>	51-53	6-8	16-18	7-8	5.5-6.5	3.5-4.5	5-6
<i>Mineral Plant</i>	41-44	20-22	12-14	7-8	5.5-6.5	3.5-4.5	5-6
<i>Medium Industry</i>	50-52	7-9	16-18	7-8	5.5-6.5	3.5-4.5	5-6

Turin (1973) has devised a matrix for construction industry in developing countries based on the different levels of technology used. He categorized the construction industry into four different sectors; the international modern, the national modern, the national conventionally, and the

traditional. The four sectors of the construction industry make different demands on the building materials industry ranging from modern and sophisticated materials to local and simple materials. Similarly, the materials requirements differ between various building types and between building and civil engineering. Thus the composition of demand for materials is affected by the composition of construction output and by the construction technology employed. As Turin writes, “The different categories respond differently to changes in technological levels of demand. Resources released by one category cannot be used by another...”. However, as with other manufacturing industries, it is impossible for building materials producers to have some influence on the demand. This may arise through changes in construction technology due to availability of certain materials instead of others, or through an increase in total construction activity due, for example, to a significant drop in the price of cement. All these changes are subject to time lag before their effect is observed.

### **1.3 The socio-economical signature of construction and building materials and components industries**

The role of construction in socio-economic development has been addressed by various writers and international bodies, many of whom have focused on developing countries (Turin, 1973; World Bank, 1984; Wells, 1986; Ofori, 1990; Palalani, 2000). Turin and Wells, using cross-country comparisons, both found an association between construction investment and economic growth. (Lopes et al, 2000). The Construction Industry has been identified as one of the main engines of growth in any economy. It provides the infrastructure required for other sectors of the economy to flourish, provides housing as the basic human need, and is instrumental in providing national communications network (Palalani, 2000).

Many studies highlighted the positive relationship between per-capita income and the ratio of total construction investments to gross domestic product, indicating the economic significance of the construction industry to economic growth and development (Turin, 1969, 1973). Besides the direct impact of the construction industry on the economy through infrastructure provisions, further significant contributions are made directly/indirectly in terms of employment and income generation (Moavenzadeh, 1978; Ofori, 1988; Wells, 1985). The level of performance in the construction industry and economical output are cyclically co-related in a loop (Ebohon, 2000). This implies that increases in economic growth necessarily invites increased construction investments, resulting in high elastic demand for construction products and manifesting in rapid build-up of physical overhead, which affords significant employment and income generating opportunities. However, studies have shown that construction output grows particularly fast, often exceeding the rate of growth of the economy as a whole, as countries put their basic infrastructure in place during the early stages of development (ILO, 2001: 8).

The socio-economic signature of the construction industry can be gauged from a number of global indicators. Turin (1973) carried out the most comprehensive study on the role of construction in development through studying the economics of several countries. For the purpose of international comparisons, the most significant of these and those which are more readily available are;

- The Contribution of construction to GDP; About 2-3% in developing countries, 5-7% in industrialized countries
- Value added by construction; 3-5% in developing countries, 5-9% in industrialized countries
- Capital formation in construction; Represents 6-9% of GDP in developing countries, 10-15% for industrial countries, with an international average of about 55% of all capital formation
- The Contribution of new construction assets to GDFCF; 45-60% in all countries
- Intermediate inputs from other sectors in the economy;
- 50-60% of construction's inputs comes from other sectors in the economy
- Level of imports of intermediate inputs for construction accounts for 5-8% of all imports of intermediate inputs in developing countries, about 5% of all imports.
- Employment share of construction sector; 6-10% of total employment in a majority of industrialized countries, and 2-3% in the less developed countries. When employment in the delivery of materials inputs is included, the share of construction employment can account for as much as 15% and 10% in industrialized and the less developed ones respectively (Hassan, 2006).

The significance of the construction industry in development, in terms of growth, is much higher in developing countries than developed countries. For instance, the percentage shares of the value added (VA) by construction for most developed countries in Western Europe appear to be relatively consistent over the 20-year period considered. Meanwhile, Eastern/Central European countries were also notable as their increasing needs for infrastructural developments generated more construction spending (Pheng et al., 2008).

Expenditure on building materials can be calculated at some 4-6% of the GDP (Shaddad, 1979). In Africa, Asia, and Latin America the value of imported building materials ranged from 5-8% of the total value of imports (UNCHS, 1986). Since expenditure on building materials is 3-5% of the gross domestic product (GDP) in developing countries, it is clear that building materials, as compared with inputs for other industries, use up a disproportionate share of foreign exchange. In less developed countries, and Sudan is one of them, however of building materials and components may contribute 20-30% of the output value (Shaddad, 1979). The role of building materials industry in socio-economical development in Sudan needs to be investigated and researched thoroughly.

## **2. Construction and building materials industries in Sudan**

### **2.1 Sudanese economy overviews**

Sudan is the largest country in Africa and the tenth country in the world, with a territory covering about 2,505,813 square kilometers of northeast and central Africa. The country's primary resources are agricultural, but oil production and exports are taking on greater importance since October 2000. The country's transportation facilities consist of 4,800 km single-track railroad with a feeder line, supplemented by limited river steamers, Sudan airways, and about 1,900 km of paved and gravel road—primarily in greater Khartoum, Port Sudan, and the north. Some north-south roads that serve the oil fields of central/south Sudan have been built. Extensive petroleum exploration began in the mid-1970s and might produce all of Sudan's needs. Significant finds were made in the Upper Nile region and commercial quantities of oil began to be exported in October 2000, reducing Sudan's outflow of foreign exchange for imported petroleum products. There are indications of significant potential reserves of oil and natural gas in southern Sudan, the Kordofan region and the Red Sea province.

Instability is the main characteristic that dominates the performance of the Sudanese Economy. Since independence and till now, a number of plans were put under application, most of these plans weren't carried out properly and hadn't follow the time schedule set for the plans. The political instability was the main reason behind the failure in the application of different economical plans. The economical instability resulted clearly on higher inflation rates, instable and fluctuations in exchange rates, and low level of investments. Similar to many developing countries, corruption has been a major characteristic of the Sudanese economic scene.

### **2.2 Sudan civil wars**

Sudan has been in near constant conflict since it became independent in 1956. The two most extensive conflicts have been those between the North and South, with the first civil war lasting from 1956 to 1972, and the second civil war from 1983 to 2005. The war in Southern Sudan was the most critical to the Sudanese society socially, economically and politically.

Sudan's Comprehensive Peace Agreement (CPA) was signed on 9 January 2005, finally bringing peace between the North, represented by the government, and Southern Sudan, represented by the SPLM/A<sup>1</sup>, for the first time in 20 years. A final resolution of Sudan's civil war could greatly help the country's economy, lead to the lifting of various sanctions against the country, and encourage investment by foreign companies including oil companies.

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<sup>1</sup> Sudanese People Liberation Movement/ Army

Reopening the wounds of war, a conflict broke out in Darfur in 2003 and continues to date. Coming at a particularly inopportune time, during the peace negotiations between the government and SPLM/A, two rebel groups in Darfur, the SLM/A<sup>2</sup> and the JEM<sup>3</sup>, began organizing themselves in the course of 2001 and 2002 in opposition to the Khartoum Government. While only loosely connected, the two rebel groups cited similar reasons for the rebellion, including socio-economic and political marginalization of Darfur and its people. The rebel movements began their first military activities in late 2002 and in the beginning of 2003 (UN, 2005). The conflict in Darfur has complicated attempts at ending the country's larger civil war. The International community is looking forward to resuming the conflict in Western Sudan sooner. Great efforts have been carried out by the Sudanese government and neighbor countries to end the new civil war in Sudan to avoid any of the results of the war in Southern Sudan. Optimistic points of view consider the situation as less critical than the previous war.

## 2.3 War impacts

Sudan in general and the southern region in specific have been negatively affected by war for all but 10 years of the independence period, resulting in serious neglect, lack of infrastructure development, and major destruction and displacement. More than 2 million people have died, and more than 4.5 million are internally displaced or become refugees as a result of the civil war and war-related impacts (UN, 2005).

War and economy are interdependent (Gueli, 2007), most of the nation's resources were devoted to the war rather than development projects. The war in the South affected construction activities since developmental projects were suspended every now and then and some projects have started a long time ago without been finished yet. Construction projects suffer from the war as many other developmental projects (i.e. Jonglei canal)<sup>4</sup>. Moreover, a great portion of the economy output was devoted towards the military work and the war shifted most of the funds assigned for developmental and constructional projects to the war. The shifting of funds towards war has its observable impacts on all markets in Sudan. Construction and housing as growing markets suffered from the war severely. The equilibrium between demand and supply was not subject to market forces; instead it was at the mercy of the war and the resources available after covering the war costs. The market was reluctant to respond to the gap between demand and supply.

The migration was inevitable due to the war; migration wasn't organized by the government. As a normal result for unorganized migration, demand and supply were unpredictable making it difficult to create a well organized and planned market for real estate and its submarkets. As a result, investing in

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<sup>2</sup> Sudan Liberation Movement/Army

<sup>3</sup> Justice and Equality Movement

<sup>4</sup> It is estimated that water worth over \$1 million to agricultural production is lost annually, through spreading, evaporation, and seepage, in Africa's Sudd swamp. In 1974, Egypt and the Sudan agreed upon the construction of a canal - the Jonglei Canal - that would partially drain the Sudd, minimize the water losses, and provide Egypt with water needed during the arid season. This project will study the impact the Jonglei Canal might have on the inhabitants of the region. The work in this project has stopped since 1983.

construction and real estate was characterized as risky investment. Therefore, the role of the private sector in the construction and real estate markets was unrealizable.

In Darfur, which became the latest chapter in Sudan's civil wars, 10,000-30,000 people have been killed and nearly a million have been displaced (UN, 2005). No doubt, if this war continues, it will cost the Sudanese economy as similar as the war in the South did. Sudan is in need of any resources including human resources in order to recover its economy.

## 2.4 Economy performance and implications on construction and building industries

During the last 15 years the Sudanese economy experienced a relatively high level of stability; 7.9% as an average rate of growth in GDP. The inflation rates dropped to economical acceptable levels; from 121.9% in 1991 to 8.1% in 2008 (CBOS). The value of the Sudanese Pound against the American Dollar increased on regular bases by year 2005. Low inflation rates, stability of exchange rates and oil production attracts foreign capital to invest in Sudan. The growth in the invested capital result in a higher demand for space which is reflected on higher construction activities. The share of the construction industry increased during the five years following oil production. The relative stability in the Sudanese economy performance and oil production attracts foreign capital to participate in business.

In many developing countries nowadays, as it is the case in Sudan, development efforts often focus on the modern construction sector so as to deal with growing investment programs and to meet pressing needs for urban shelter. Most of the construction work activities take place in the City of Khartoum and some other big cities. Figure (1) shows how big the difference is in the level of construction activities and needs of space in Khartoum, the South, and North Darfur.



A hut in the South



A house in N. Darfur



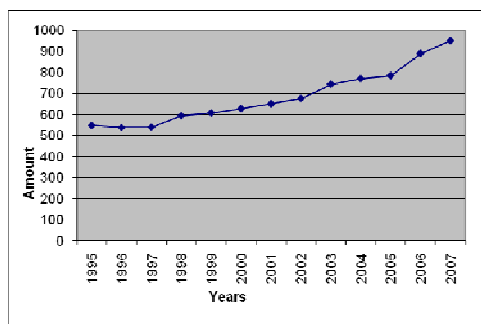
Alfatih Tower in Khartoum

Figure 1: Differences in construction work in Khartoum, South, and Darfur

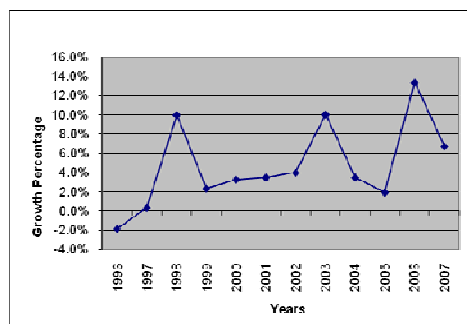
The real growth that the construction sector experienced in Sudan was negative till the mid 1990s, it became positive in 1997. The shift from negative to positive growth was a result of the national development projects those were going on that time such as national roads, bridges housing projects

and redeveloping of some projects and infrastructure. Moreover government start to built oil infrastructure in 1998, when it was finished the construction share decreased from 10% in 1998 to 2.4% in 1999 because of finishing the oil infrastructure. After 2000 the amount spent on construction continues to increase because of the entry of foreign companies and investors. The share of the construction and building sector to GDP is shown in (fig 2). The future of this demand is expected to increase for many reasons;

- The resolution of the Civil war in Southern Sudan.
- Devoting the war budget for developmental projects
- Developmental projects and infrastructure are expected to take place in the South.
- Expected entry of foreign capital



Construction Sector Shares in Amount (Thousands SDG) in GDP



Productivity Growth of the Construction Sector (%)

Figure 2: Productivity and productivity gross of Construction sector in the Sudanese Economy 1995-2007 *Source: CBOS*

The construction industry is considered a tool for enhancing peace in the immediate aftermath of major conflict and even avoiding conflicts in the first place (Gueli, 2007). Motivated by the cease of the civil war in the south, construction activities increased significantly including infrastructure projects, governmental facilities, health care facilities, educational buildings, social facilities, ... etc. Following the activation of the CPA, many national and international organizations participated in the development programs. The movement of development on the political and economical levels results on higher demand for space and infrastructure. The boom in construction industry led to a higher demand for construction products and materials production. Most of building materials are imported from the foreign market. The government of Southern Sudan is the major client beside the international organizations that are concerned with the development of southern Sudan. The case of Darfur is not yet settled, thus, no development programs are taking place.

The equilibrium between demand and supply of space and infrastructure is subject to the rate of response of the construction sector to the demand and political policies and decisions. As a matter of fact, suppliers of building materials depend on the international market as a source of building

materials. Cement, sand, gravel, and simple building materials are brought from the local market. However, not a single cement factory is located in Southern, Western (Kordofan & Darfur), or Eastern Sudan. All finishing materials, decorative items, high quality materials, mechanical & electrical items are imported from abroad. Fluctuations in prices are normal result of the instability and unsteadiness of materials supply. Encouraging the local investors to produce building materials and products locally might have a great effect on the price of construction and the balance in the market.

In the case of Darfur, the status of construction activities is quite different since the area is still lacking the secure environment required for developmental projects. Most of the ongoing projects, if any, provide the basic services required for the refugee camps. These projects are far beyond the region's needs and are developed to temporarily satisfy the needs of the region inhabitants and the IDPs. No doubt, the end of the conflict in Darfur will call for huge developmental construction activities. Generally, the following stage of the economical developments requires a higher level of production for the whole country and marginalized regions on specific.

### **3. Challenges facing construction and building materials industries in Sudan**

#### **3.1 The common scene**

The construction industry everywhere, given its special problems and requirements, faces problems and challenges. However, in the developing countries, these difficulties and challenges are present alongside a general situation of socio-economic stress, chronic resource shortages, institutional weaknesses and a general inability to deal with the key issues. There is also evidence that the problems have become greater in extent and severity in recent years (Ofori, 2000). The situation in Sudan is similar to the general situation in developing countries. The difficulties that face construction industries in developing countries and the proposed solutions have been extensively investigated by the international organizations such the United Nations (1981, 1984), International Labour Office (1987), the World Bank (1984), also by Turin (1973), Wells(1986), Ofori (1990) and (Sultan & Kajewski, 2003 & 2004). The problems and challenges that face the construction and building materials industries in developing countries are common (Sultan & Kajewski, 2003), Sudan isn't an exception. These challenges include;

- Lack of capacity of the construction sector (Du Plessis, 2002);
- Inefficiency and/or absence of regulatory instruments and professional institutions (UNCHS, 1996);
- Absence or inefficiency of quality assurance system, national standards and quality specifications; meaning that the quality of products and services (i.e building materials and

labor force) in the construction industry are questionable (Palalani, 2000), and (Okema, 2000);

- Poor organization of the construction industry with a large number of very small and inefficient firms (Wells, 1986);
- An unfavorable operating environment for construction enterprises, which is further aggravated by complex procedures and regulation, delays in payments, and unsuitable contract documents;
- Contractors capabilities; lack of technical and managerial expertise, lack of adequate finance, difficulty in obtaining essential resources materials, equipment and skilled personnel, and inadequate supervisory capabilities(UNCHS, 1996);
- Lack of planning at all the levels of the construction process(Wells,1986);
- Low and fluctuating overall levels of construction activity;
- Lack of capacity and “economic rationality” in design, construction, and the production of building materials (Wells,1986);
- Lack of Finance (UNCHS,1996);
- Information scarcity and lack of accurate data (Du Plessis, 2002; Palalani, 2000);
- Under development of the national systems of innovation (Milford, 2000);
- Inadequate and integrated research and development (R&D) facilities and programs beside the poor linkage between research and practice (Du Plessis, 2002; Ofori, 1994);
- High rates of risks and uncertainty (Du Plessis, 2002; Okema, 2000) including; Macro-economic risks and uncertainties, insurance industry risks and uncertainties, site production risks and uncertainties, natural calamities risks and uncertainties, bureaucracy and corruption risks and uncertainties, contract and contractual performance risks and uncertainties, project risk and uncertainty due to public demand, political and insecurity risks and uncertainties, and donor associated uncertainties;
- Corruption: it costs construction industry in the world a huge amount of money<sup>5</sup> (TI, 2005). Construction industries are particularly susceptible to corruption in licensing, taxation and obtaining government contracts, including bribery, fraud, embezzlement, and kickbacks

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<sup>5</sup> The American Society of Civil Engineers claim that corruption accounts for an estimated \$340 billion of worldwide construction costs each year.

(Sohail & Cailli, 2008). Beside the characteristics of the construction sector, the fragility of economies and ineffectiveness of the legal systems make developing countries prone to corruption (Fewings & Henjewe, 2008);

- Shortage of skilled labor due to absence of the training programs or failure to provide adequate rewards (Wells, 1986; Ofori, 1994); and
- Problems specific to the building materials industry:
  - Inadequate capacity and inefficiency in the building materials industry, (Wells, 1986);
  - Building Materials; expensive, high transportation costs, high production costs and energy costs (UNCHS, 1996);
  - Availability and price of building materials, (Wells, 1986);
  - Problems in availability of locally produced materials, (Wells, 1986);
  - Unhealthy reliance on imported materials in face of foreign exchange problems, (Wells, 1986); and
  - Frequent shortage of construction materials resulting from the preference of users for conventional materials, most of which are imports.

Imports of building materials are considerable; in many developing countries, a large proportion of building materials are imported. For instance, it is estimated that building materials alone annually account for 5 to 8 per cent of the total value of imports in Africa (UNCHS, 1986). The potential for developing the domestic building materials industry, therefore, would seem large. However, in many developing countries, these potential developments are difficult to realize because of the relatively small size and large fluctuation of present demand, not only at the local level, but also in the national context. Scale economies apply to the production of building materials since large-scale manufacturing results in production feasibility (Elkhalifa & Shaddad, 2008). Not only large demands are therefore required, but these demands should also be concentrated, considering the often low value/weight ratio, which prohibits transport to very long distances, certainly in an African setting, where transport in general is poor. Next to the small size of local demand, scarcity of finance and lack of know-how and skills prevent a rapid development of the building materials industry in most developing countries. These problems often result in high price levels of locally produced building materials. It is not, therefore, surprising that imports of building materials are considerable with a value of as much as 5-8% of the total value of imports.

Beside the underlying problems facing the construction industry in the developing countries and SSA countries on specific, apparently, the development of the construction sectors seems to be a challenge itself. It has been indicated that unless urgent steps are taken to develop appropriate institutions necessary to facilitate the development of modern and sophisticated construction industry, sub-Saharan Africa will remain a net importer of construction materials and services (Ebohon, 2000).

### 3.2 Problems of building materials industry specific to southern Sudan and Darfur

The regions of Southern Sudan and Darfur, beside the vulnerability of the socio-economical environment, face acute situation in their built environment. War, conflicts, and security situations have had devastating effects and contribute significantly to the current situation in both regions. Many of the internally displaced people (IDPs) who were forced to flee their homes have ended up living in make-shift camps around the major cities. Upon their return back to their original villages, returnees are going to face numerous difficulties, the most significant of which will be the mass destruction of local infrastructure and homes. Lack of infrastructure and basic services, lack of adequate and appropriate affordable housing alternatives, shelter poverty and high prices of building materials become common characteristics of the two regions. There is a shortage of building materials due to drought and the huge need for shelter. The most common rural house design is the *Gutiya* made out of straw or millet stalks covering a wooden skeleton (fig 3). The environment has been exhausted and deteriorated with wood also being used in vast quantities for cooking.



Figure 3: Examples of houses in North Darfur

The common problems of the building materials industry in southern Sudan and Darfur, which need to be addressed and researched thoroughly include;

#### **Lack of Security**

Due to war and ethnical conflicts, the general environment is classified to be unsecure. Obviously, in such a situation, local production of needed building materials is impossible. Skilled labors abandon their villages and flee to other regions in the country in search for security, work, and better living conditions. Security situation restricts the flow and transportation of building materials from other parts of the country. Even in the South, where the war is over, clashes and conflicts continue to exist.

**Lack of capacity**

The two regions face critical shortage in capacity for the production of building materials, including; lack of required infrastructure, lack of finance, lack of production facilities, lack of skilled labor, lack of education and training program. Besides, no investors or producers show interest in the making business in the two regions.

**Lack of Finance& Management Capabilities**

The establishment of building materials factories and production facilities calls for efficient management and technical experience beside the required finance. The lack of these capabilities affects the performance of the building materials industry and hinders its development.

**Lack of skilled labors**

The immigration, due to conflicts and socio-economical situation, leaves the two regions without the capable human resources for the production of building materials on local level. The work forces that carry the day-to-day work in construction either not trained or haven't developed their capabilities.

**Lack of materials and High prices**

The two regions face severe shortage in the supply of building materials and raw materials for production. In the south, for instance, cement, brick, sand and gravel have to be imported from different parts of the country. The lack of key materials on the local level, results in high price due to high transportation cost and fees of intermediate providers. For example, the price of one cubic meter of gravel in the city of Malakal is 18 fold its price in Khartoum.

**Inefficiency of transportation Systems**

Limited means of transportation systems impose more constraints to the development of the building materials industry in the two regions. Paved roads are limited to the intra-city level, for the inter-city level gravel roads and natural routes are more common. During the rainy seasons, most of the inter-city routes become out of service. The river-streams in the south are inactive as a result of war and lack of maintenance and upgrading. No railway routes exist in the south and the region of Darfur except for some big cities. If proper and efficient transportation systems are available, prices of building materials will fall respectively. The inefficacy of the transportation system results in higher construction costs, project delays, and overheads. For example, in some places in the south, gravel, sand, and brick are packed in bags to be transported through unpaved roads.

**Taxes and Governmental Fees**

The country in general suffers from the high level of taxes and fees on the production, transportation, and sales of building materials. Taxation, custom duties, zakaat, fringes, highway taxes, and provincial fees beside other types of fees contribute to the high prices of building materials.

**The General Environment**

The country in general is characterized by the unfavorable environment with corruption, favoritism, bias, and high risks and uncertainties due to the political instability.

## 4. Conclusions

Construction activity is an integral part of a country's infrastructure and industrial development. Covering as it does such a wide spectrum, construction becomes the basic input for socio-economic development. Besides, the construction industry generates substantial employment and provides a growth impetus to other sectors through backward and forward linkages. The construction sector has major linkages with the building material industry since construction material accounts for sizeable share of the construction costs. The cost of building materials represents the highest share in comparison to other construction cost components for all categories of construction industry.

Sudan as a developing country experienced great economical development during the previous decades as a result of oil production and the end of war in the south. This development took place in many fields, of which the construction industry is an important one.

Overcoming the challenges that face the Sudanese construction and building materials industries to meet the requirements of peace and development is progressively demanding. The industry is already under severe pressure which casts a shadow of doubts as to whether its capacity, efficiency, strength, and resources to cope with the existing and expected situation. The authors identified a set of challenges that face the construction and building materials industries in the country. The status of the building materials is more acute in the regions of Southern Sudan and Darfur as a result of wars and conflicts. Further attentions should be drawn to these regions in order to sustain peace.

A general international, national, and multidisciplinary study to assess raw materials for the building materials industries (i.e., cement, brick, and timber, aggregate, sand, and steel) is urgently needed. The survey should cover the evaluation of the properties, quantities and means of economic exploitation of such raw materials. There is also a need for human power survey to assess the needs of the prospective building materials industries. International specialized organizations such as the United Nations Industrial Development Organization (UNIDO) and the International Labour Office (ILO) might be approached to carry out the proposed survey in cooperation with Sudanese professionals and staff.

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