Sustainable Cotton Production Forum

Sudan's Report

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1. General features of cotton development

Introduction of cotton in the Sudan dates back to the first quarter of the nineteenth century driven by interests and initiatives by the then Turkish-Egyptian rule. Success of its cultivation in a seasonally flooded delta in Eastern Sudan (Tokar) in 1862 triggered profound concern about the crop, that later provided good basis for a pilot investment in cotton production early in the twentieth century under pump irrigation in the northern part of the country by an American investor. A British company took over after three years of unsuccessful venture and managed to bring cotton production to a success; a situation that drew attention to the vast flat arable "Gezira" lands between the Blue and White Niles as a potential area for cotton expansion to respond to the growing demand of the British textile industry. The early start there in 1907 by a British company was given continual momentum that led to the construction of a dam on the Blue Nile in 1925 to provide cotton with gravity irrigation, culminating after successive developments over the years to the establishment of the currently about one million-hectare "Gezira-Managil" Scheme. The Sudan "Gezira" Scheme served as a prototype for the development of many other irrigation schemes that grow cotton; yet it remained as the largest and most important cotton-producing farm in the Sudan.

Although irrigated farming forms the most important system for cotton production in the Sudan, cotton is also produced under rain-fed conditions that has nevertheless been characterized by highly instable areas. Rain-fed cotton has been introduced as early as the late nineteen-twenties in the "Nuba Mountains" in the southern parts of western Sudan with relatively reasonable rainfall amounts. Its cultivation was expanded during the nineteen-forties to the semi-mechanized areas of central Sudan in a crop combination including sorghum and sesame.

The Sudan has a long history of cultivating extra-long staple cottons, but the spectrum of its types has broadened to include long, medium and short staple cottons. Out of 203 thousand ha grown with cotton in season 2003/2004, 118 thousand (58%) were under the long-staple variety "Barakat", 77 thousand (38%) under the medium-staple "Acala", and 8 thousand ha (4%) under the short staple varieties "Nuba and Acarain".

Although over the past decade, the share of cotton in Sudan's foreign export earnings has relatively declined where other products like sesame and livestock have become strong competitors, cotton still maintains a major role in the economy. It forms an important source of livelihood for a large number (200,000) of its growers and their families, provides crop residues as feed for a large number of livestock from the pastoral sector, employs a considerable amount of hired seasonal labor in its picking and ginning

operations, and maintains important forward and backward linkages that engender economic activities in the factor and post-harvest markets.

2. Production modes and trends

Cotton is grown in the Sudan under both irrigated and rain-fed modes of production. Yet, irrigated cotton is the predominant mode. Although bound with some variability, irrigated cotton occupied an average of 93% of the area and produced 98% of the production over the past 10 years (1994/95-2003/2004).

Over recent years (1990/91-2003/2004) the Sudan grew an average of 163 thousand ha of cotton and produced an average of 223 thousand tons of seed cotton, with an average yield of 1375 kg/ha (Table 1). The bulk of the area was under irrigation while rain-fed cotton depicted very high variability in both its areas and productivity.

Table (1). Average (coefficient of variation) cotton areas, production and yields over the past five years in Sudan (1999/00 – 2003/04

Item	Irrigated	Rain-fed	Total
Average area (000 ha)	155 (7%)	8 (42%)	163 (7%)
Production (000 t)	220 (19%)	3 (47%)	223 (19%)
Average Yield (kg/ha)	1423 (22%)	443 (65%)	1375 (23%)

However, over the years, Sudan's cotton production assumed a declining trend, mainly due to declining areas in response to intermittent policy decisions induced by tendencies for shifting land resources to the production of food crops in some cases and by external market conditions in others. While production averaged 930 thousand bales (420 lb) of lint during the nineteen-seventies, it declined to an average of 432 thousand bales during the nineteen-nineties and dropped to only 275 thousand bales in season 1999/2000 (Table 2). In fact production in some seasons in the past reached some 1.2 million bales. Nevertheless, more momentum has been given to cotton production since the turn of the century when production reached 449 thousand bales in 2002/2003, although it decreased in the following season to 360 thousand bales.

Table (2). Development of lint production in Sudan over the past three decades and recent seasons

Decade/Season	Production (Thousand Bales of 420 lb)
1970s	930
1980s	831
1990s	432
1999/2000	275
2000/2001	394
2001/2002	336

Source: Abdeen[1]

1 Abdeen Mohamed Ali: Keynote Address (in Arabic), in: Workshop on the "Future of Cotton Cultivation in the Sudan, organized by the Sudan Cotton Company Ltd., March 2002, Friendship Hall, Khartoum

Most of Sudan's cotton is exported as lint. Major importers of Sudan's cotton are Egypt in Africa; Germany and Italy in Europe; and Thailand and Bangladesh in Asia. Compared with average export earnings of 270 million US dollars during the 1970s, proceeds from cotton exports slumped to only $42 million in 2001.

In relative terms, local utilization of lint, mostly in textile industry, varies between 10% during the 1980s and 7% to 17% in recent years. However, in absolute terms, domestic lint consumption consistently declined from an average of 86 thousand bales during the 1980s to only 16 thousand bales in 2001 due to reasons connected with mal-functioning of the local textile industry.

Earnest efforts are now being made to revive both cotton production and domestic textile industry. Much concern is about the low cotton physical productivity and the challenges for its improvement. Productivity comparisons for recent years reveal that Sudan's cotton physical yields form, on average, about 50% of those in Egypt, which grows extra-long and long staple cottons, 30% of Syria's medium staple, and from time to time lower than productivity in West African countries that mostly grow rain-fed cotton (Abdeen 2002 – see footnote 1).

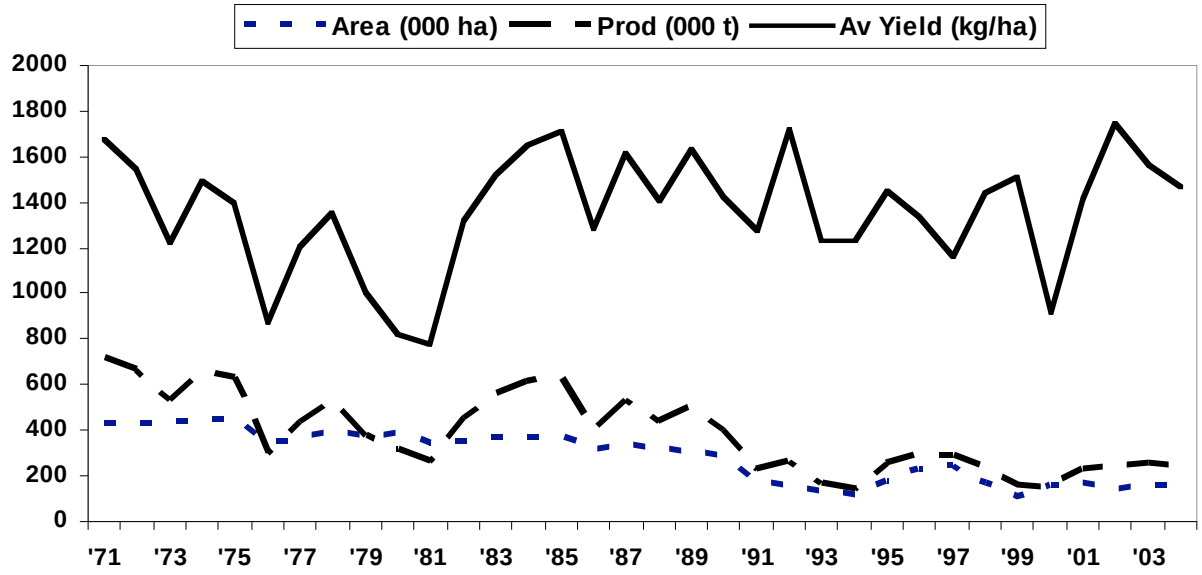
3. Variability indicators in Sudan's cotton

3.1 Areas, yields and production

Unstable total areas and production are of high concern at the national level on account of their effect on export earnings and government budget. Further to what has been mentioned above on the status of production variables in recent years, long-term time-series data depicted in Figure 1 reveals high variability in areas and production in the irrigated sector, which is supposed to provide a dependable level of sustainability. In addition to their variability, the long-term trend for both areas and production depict a falling pattern at trend values of 10295 ha for area and 13119 tons for production. Yield, on the other hand, that form a crucial sustainability concern to farmers, have been fluctuating between a minimum of 779 to a maximum of 1748 kg/ha with a coefficient of variation of 19%.

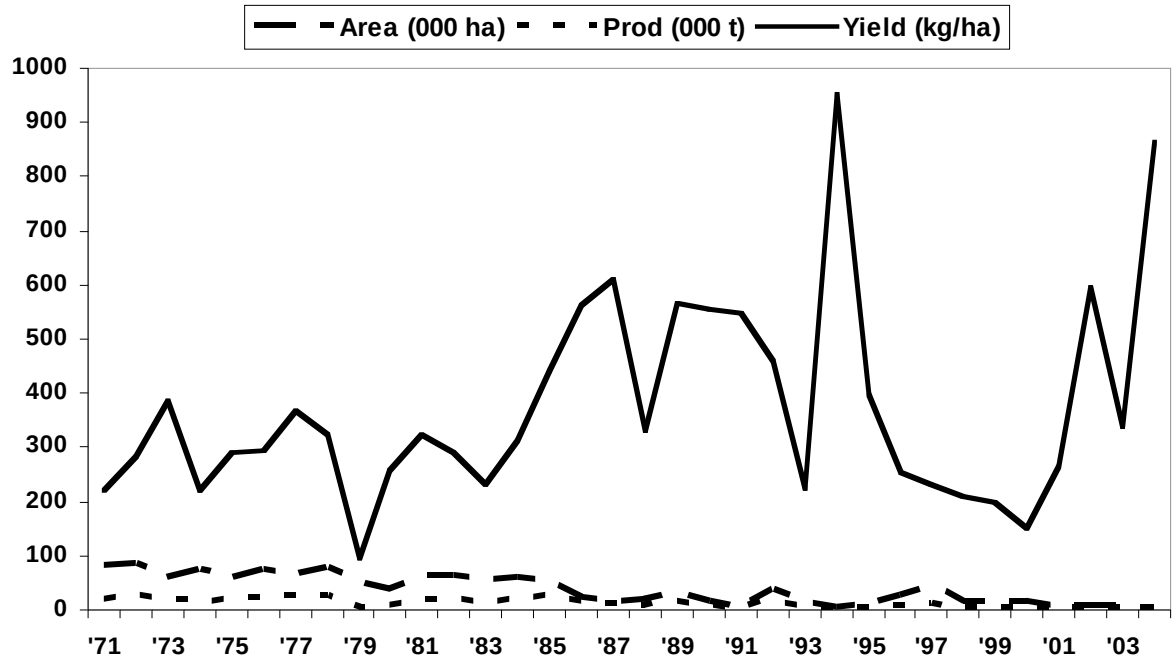
In the rain-fed sector (Fig. 2), areas and yield have been falling with a trend value of 2355 ha and 638 tons over the period under consideration. Yield variability was more dramatic, ranging between 94 and 952 kg/ha, with a coefficient of variation of 51%. This subjects farmers to high vulnerability in their livelihoods.

Figure (1): Total areas, production and average yields of irrigated cotton in Sudan, 1971/2-2003/2004



Source: Statistics of the Department of Agricultural Economics, Ministry of Agriculture and Forests, Khartoum, Sudan.

Figure (2): Total areas, production and average yields of rain-fed cotton in Sudan, 1971/2-2003/2004



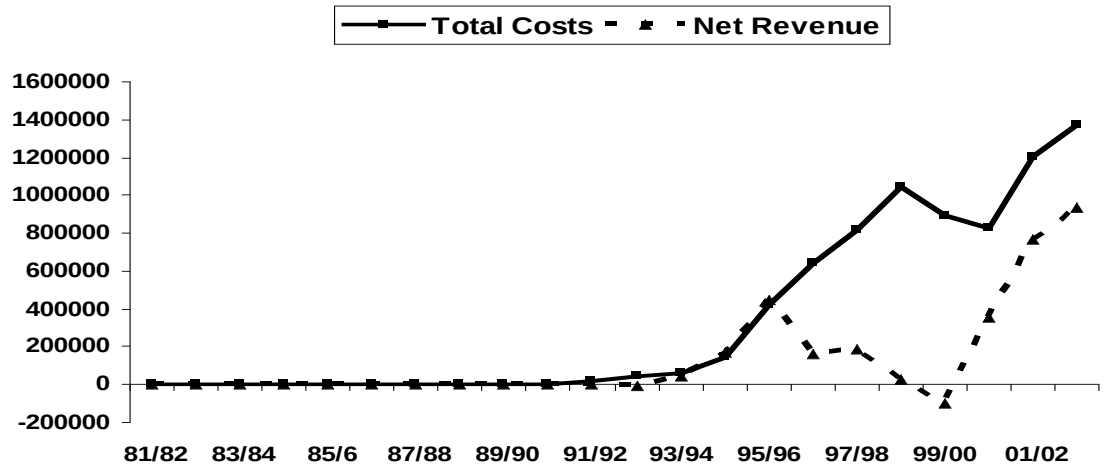
Source: Statistics of the Department of Agricultural Economics, Ministry of Agriculture and Forests, Khartoum, Sudan.

Cotton production instability takes also another dimension affecting producers. While yields in the above presentation were calculated according to the harvested area, actually cultivated areas were notably higher, indicating that yields must have been lower and most probably more variable on account of crop failures. Over the period 1990/91-2003/2004, the average harvested area formed 92% of the cultivated in the irrigated sector and 82% in the rain-fed sector. Crop failures resulted in ratios of harvested to cultivated areas of as low as 70% for irrigated cotton (season 1998/99) and 46% for rain-fed cotton (season 2003/04).

3.2 Production costs and net returns to farmers

Figure 3 illustrates the development of per ha cotton production costs and net returns in nominal terms to farmers in the irrigated Gezira Scheme in the period 1981/82-2001/2002. Although not clear from the figure in the period up to the early 1990s, costs had been rising by a trend of LS 239 per ha per year and net returns by LS 65 per ha per year. Afterwards the steady rise in costs and the variable rise in net returns are clearer. It is to be noted that the second period coincides with the country's fast adoption of economic reforms, including the depreciation of the Sudanese pound against the dollar and reduction of state interventions in price controls. In order to approximate the situation in real terms, costs and returns were adjusted by the exchange rate as a proxy indicator for the change in prices. The resulting development in production costs and net returns are depicted in Figure 4.

Figure (3): Average production costs and net returns to farmers of cotton in Gezira in nominal terms, 1981/82-2002/2003(LS/ha)



Variability in both cost and returns is apparent. The coefficients of variation of the two variables for the whole period were respectively 46% and 88% with respective decreasing trend values of $16.86 and $5.85 per ha per year that were nevertheless disturbed by the high variability (see Table 3). The effect of liberalization was positive at the start (1991/92 – 1995/96) with gradually increasing revenues to surpass costs, but as production inputs had become more liberalized, costs rose while net returns dropped. However, net returns started to pick up over the last three seasons. The steep drop in production costs and net returns in 1991/92 and afterwards is attributed to the substantial depreciation in the Sudanese currency. In all and subject to high variability as reflected in Table 3, sustainability of farmers' income is notably jeopardized.

Figure (4). Average production costs and net returns to farmers of cotton in Gezira in real terms 1981/82-2002/2003 ($/ha)

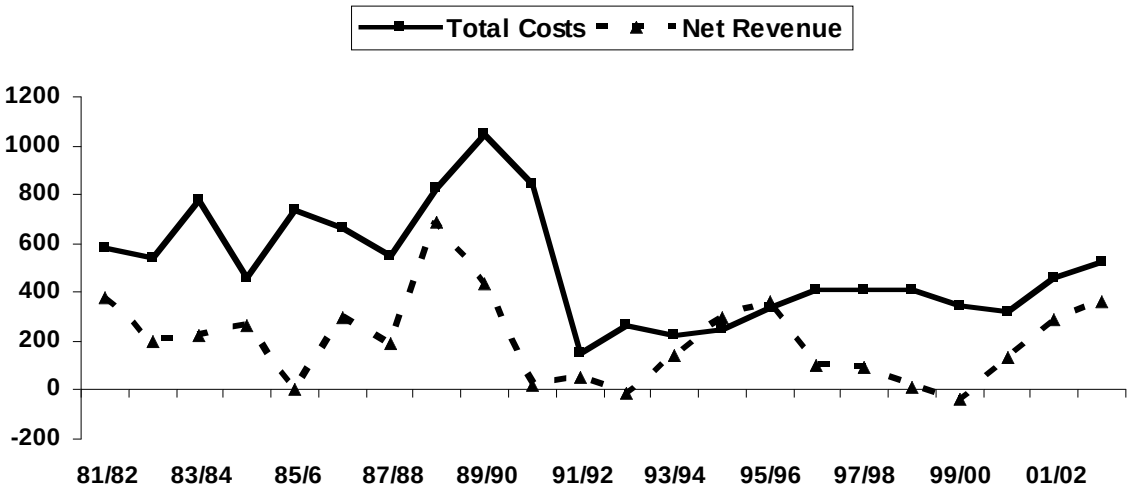
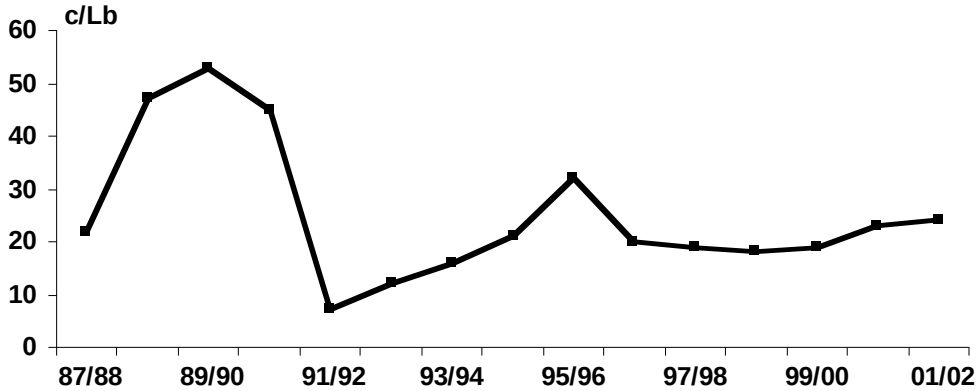


Table (3). Variability in cotton production costs and net returns to farmers in Gezira, 1981/82-2001/2002

Item	Average	CV (%)
Production costs ($/ha)	506	46%
Net returns ($/ha)	204	88%
Net returns as % of production costs	42%	82%
Price received by farmers (lint equiv in c/lb)	25	57%

One of the major factors affecting returns to farmers is the fluctuations in cotton prices received by farmers. Figure 5 shows the development of cotton prices received by farmers for their seed cotton modified by computing lint price equivalent. While price fluctuations are reflected by the high coefficient of variability in Table 3, Figure 5 reveals that as for 1991/92 and after the high price variation in the preceding period, variability has still been substantial with a coefficient of variation of 34%, yet prices have assumed a noticeable rising trend.

Figure 5. Equivalent of lint price of extra-long staple cotton (Barakat) received by farmers for seed cotton in Gezira, 1987/88-2001/2002 (c/lb)



4. Sources of cotton production variability

Various sources of variability influence physical cotton productivity and its financial benefits to producers. Yields are affected by natural factors, clearly more so under rain-fed modes of production, but also in irrigated farming. The most important of these are rainfall and pest and disease infestation. Obviously, rainfall conditions represent the predominant single yield-influencing factor for dry-land cotton on account of both drought and flooding effects. However, pests and disease infestation do not form a major threat there and rain-fed cotton enjoys high quality.

Under irrigated production the intermingling of rainfall and supplied irrigation water often than not create water availability problems. High rainfall entails high water demands at one time for large areas for the subsequent watering that could hardly be met by the irrigation network capacity. In addition, high rainfall incidence subjects the crop to water logging to which cotton is considerably sensitive. The irrigation network faces problems of silty and weedy irrigation canals that require annual cleaning for which budget allocations are often inadequate. Further, breaks of irrigation canals are a noticeable phenomenon, subjecting the crop to hazards of untimely water supply and at the same time causing crop damage to flooded areas.

Irrigation water concerns are also related to equity in water distribution. This is caused by uneven water distribution along the irrigation networks as well as along field canals supplying water to a group of farmers. Early studies on head/tail-end difference in water supply in the Gezira have shown that cotton yields along field irrigation canals decrease by a coefficient of 78 kg/ha with the location of fields away from the water outlet source[2]. On the other hand, farmers at tail end of the irrigation systems and fields canals were found to incur 50% yield reduction that those at head locations. Along with other crops grown, the effect on farm income was significant amounting to a reduction of 37%.

Pests and diseases infestations are notorious factors that reduce crop yields and inflate production costs. The costs of pest and weed control form a major cost component, reaching about one third and may be as high as 40% of pre-ginning production costs. They further vary with the season, inducing costs and returns variability. Besides yields, pests and diseases may affect cotton quality and necessitate strenuous measures to combat quality influencing factors.

Cotton picking labor forms another impediment to cotton production stability. Usually seasonal labor is recruited from traditional rain-fed areas for cotton picking. Labor supply, however, is influenced by the production situation in those areas; declining with seasons of favorable climate and high production there and increasing in poor production ones. Further to problems of uncertainty of adequate finance for cotton picking, variations in labor availability and its costs are ever-rising problems affecting cotton productivity in irrigation schemes.

[2] Hamid Faki (1981). Effect of irrigation-water management on farmers' income in the Gezira, Sudan. Quarterly Journal of International Agriculture, vol. 20, No. 4, Oct.-Dec. 1981, pp 345-359.

Rain-fed cotton, which boasts of high potential despite its high yield variability, has suffered from negligence for a long time in terms of production support as well as research development. While civil strife has been a reason behind the sharp declines in rain-fed cotton production, institutional changes have had a significant contribution to that decline. Dissolving of public production corporations in the early 1990s has negative impact on rain-fed cotton grown in the southern part of western Sudan (Nuba Mountains), which is one of the oldest and most important areas of producing low-cost and good quality rain-fed cotton. Declining and unstable cotton areas and production in this and other rain-fed parts of the country represent a loss of high potential for developing rural areas and contributing to the economy, especially if it is taken into account that opportunities exist for expanding rain-fed cotton to a little more than 200 thousand ha[3].

Although the Sudan has a well-established tradition in cotton research extending over about 100 years, diversification of varieties to meet the range of market demand for various qualities has lagged behind in the past period. Irrigated cotton production has for a long time relied on a limited number of cotton varieties that offered a limited quality range, while the medium cotton type (Shambat variety) that Sudan used to produce for some time has been lost. Within the past three seasons, however, more support has been given to cotton breeding activities with the results that a number of new varieties with a wider range of better qualities and higher yields are now released for commercial production while others are in the pipeline. Other research activities, including integrated pest management, have provided a wealth of information, although much of the released technologies have not been satisfactorily adopted and the crop management practices on the ground have remained suboptimal.

The early-mentioned price and cost fluctuations are highly influenced by policy decisions where cotton production and marketing are largely under state control, especially in the state-owned large irrigation schemes. Variability in international cotton prices, exchange rate manipulations and the levels of tariff on imported inputs such as fertilizers, herbicides and insecticide are factors influencing production costs and returns to farmers. Export tax on cotton had an added effect in the past but it has now been removed. Recently, tariff on agricultural input has been highly reduced, forming an encouraging element to production. Payments to farmers after cotton sales in international markets induce discouraging delays for farmers in receiving their cotton proceeds. However, as from this season, a mechanism has been devised and put in place whereby farmers get their proceeds directly upon seed cotton delivery. This is expected to form a major drive for farmers to put more efforts on cotton production. A crucial policy factor is the provision of timely finance, especially at the time of cotton weeding and picking operations.

The wave of privatization has induced considerable instability connected with sharp exchange rate movements whereby the local currency has depreciated by 375 times between 1990/91 and 2002/2003. Such changes have contributed to the presence of

[3] Mohamed O. Saeed, Ali I. Elkhalil and Mustafa M. Khalid (2002). Prospects for expansion of rain-fed cotton (in Arabic). In Workshop on the "Future of Cotton Cultivation in the Sudan, organized by the Sudan Cotton Company Ltd., March 2002, Friendship Hall, Khartoum

substantial uncertainty over cotton returns and costs of imported inputs. Besides, input tariffs changes, although depicting a decreasing trend, have caused an additional source of variability.

Institutional arrangements also have far-reaching implications on cotton production stability. For instance, the management of irrigation-water supply at the field level has undergone alternate shifts between the irrigation engineers (Ministry of Irrigation) and the administration of agricultural production. Such shifts have been associated with variations in the levels of canal maintenance and water provision to farmers.

Two institutional issues that are associated with economic reforms are the supply of finance and privatization of important services that used to be provided by the administration of irrigation schemes, the most important being cotton land preparation. Uncertainty in seasonal finance caused by changing forms of financing institutions as well as changes in terms of finance is an issue that is of continual concern to farmers. On the other hand, transfer of land preparation practices (on which cotton has high demand due to the nature of the heavy clay soils under cultivation) to the still not highly capable private sector is a source of uncertainty about the quality of operations as well as about the required finance to perform such operations.

A new institutional restructuring exercise is now under piloting in the Gezira, whereby water management responsibilities (and other production activities) are to be transferred of to farmers, along with a freedom in crop choice, which has historically been under state control. A new land reform has also been devised subject to which farmers have more claim on land property. Although these changes might carry promise for more efficiency in production, they are nevertheless bound with transitional changes that might impair sustainability of cotton production. The cotton initiative on the WTO agenda, within which developed countries are to remove their domestic subsidies, forms another encouraging element for promoting cotton production in developing countries.

5. Conclusion

Cotton production in the Sudan has been bound with high variability attributable to variation in natural conditions, policy instruments and institutional set-up. There is currently notable enthusiasm and earnest efforts to re-activate cotton production. This should be accompanied by relevant activities to prudently identify appropriate remedies to the various sources of instability so that cotton production enjoys the level of sustainability needed to improve its already significant role in the livelihood of farmers and the economy as a whole.