



*International Conference on
" Women and Youth in Arab Development"
(Cairo, Egypt, 22-24 March 2010)*

**Gender Disparities in Human
Development in Sudan, 1990-2005**

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I Introduction:

Human development is the process of enlarging people's choices. These choices are created by expanding human capabilities to the fullest and putting these capabilities to their best possible use in all spheres – economic, social, cultural and political, among others. These capabilities are to lead along and healthy life, to be knowledgeable and to have access to resources required for a decent standard of living. Human development is also defined as the development of the people for the people by the people (UNDP, 1993).

The human development index (HDI) is based on three sub indicators: longevity, as measured by life expectancy at birth; educational attainment, as measured by a combination of adult literacy (two-thirds weight) and the combined first-, second-and third level gross enrollment ratio (one-third weight); and standard of living, as measured by real GDP per capita in dollar adjusted according to purchasing power parity (UNDP, 1998).

The Human Development Reports, which launched in 1990, have helped to refocus attention on people as the centre of development – noting that the real purpose of development is to create the enabling environment for people to enjoy long, healthy and creative lives (UNDP, 1999).

In spite of the efforts exerted by the successive governments in Sudan to make economic reforms and rebuild the infrastructure, the social aspects of reconstruction received insufficient attention in all development strategies. In particular, the most conventional diagnosis of the nature and manifestations of Sudan's economic crises, based on the examination of officially recorded macroeconomic aggregates, have failed to give adequate consideration to the human development components in general and in a gender sensitive manner in particular. Thus, like many other African and Arab countries, human development indicators in Sudan are still below ambitions in spite of the upward trends. Up to the year 2000, Sudan was among the low human development category. It is only in the year 2001 that Sudan has moved to the medium human development category, with (HDI = 0.503). However, until 2004, Sudan was the worst performer in terms of human development among the group of Arab countries. Furthermore, Sudan with (HDI = 0.516) in 2004 was among the least six medium human development countries in the world for which the index was calculated.

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Having noted the above, many questions could be raised in accordance with regard to this study, which include the following: What are the certain contributions of health, education, and income to human development of males and females in Sudan? Can Sudan eliminate gender gap in human development by the year 2015? Are there significant differences between the levels of human development of males and females in Sudan?

The ultimate goal of any society striving for development is to empower its citizens both men and women without discrimination, and place them at the centre of the development process by providing them with access to information, knowledge, health care, and decent standard of living. UNDP (2005) argues that human development if not engendered, it is endangered. Human beings are the key element of any development program and efforts throughout the world, they are the final target of all development programs. In addition to that, the development programs must be carried out by them. One of the major challenges facing Sudan and many other Arab countries in the new millennium pertains to achieving equitable and sustainable human development. Thus, it is of paramount importance to shed the light on this issue. Furthermore, the importance of the study stems from the importance of human development in realizing economic development and welfare for the society. Human development also leads to the realization of the Millennium Development Goals (MDGs).

The ultimate objective of this paper is to investigate from an empirical point of view, gender disparities in human development indicators in Sudan over the period (1990-2005), and to show whether Sudan can eliminate gender gap in human development by the year 2015 or not. The secondary data employed in the study are collected from official sources namely, the Human Development Reports of the UNDP and the Central Bureau of Statistics, Khartoum.

The empirical results assure the existence of gender gap against females in all human development indicators except for health, in which females are better. The compound growth rates of the HDIM and HDIF in Sudan are estimated at (1.8%) and (3%) per annum, respectively. With these growth rates, gender gap in human development can only be eliminated by the year 2023, where both sexes are expected to realize a level of human development equals (0.78).

The remainder of the paper is organized as follows: section (2) reviews the literature on human development indicators in Sudan, while section (3) illustrates the methodology and data used in the study. Section (4) discusses the empirical results and policy implications of the findings. Finally, some concluding remarks are reported in section (5).



II. Features of Human Development in Sudan :

2.1. Education in Sudan:

The education system in Sudan has expanded rapidly over the last four decades. In spite of this, the policy of universalization of basic education faces many challenging problems represented in the unavailability of schools in some underdeveloped areas of Sudan and inaccessibility for the poor children because of the high school user fees.

According to the Federal Ministry of Education (2001), the education system in Sudan is facing a host of problems. These include, high illiteracy rate among the active population and an uneven distribution and settlement between rural and urban areas, and the migration of skilled youth from rural to urban areas and abroad. The above-mentioned problems have created a scarcity in qualified manpower to be employed to implement educational change on one hand and a high more demand for education for young children and youth on the other hand. The weak infrastructure due to civil war and natural resources disasters, have hindered developmental efforts. The declining foreign aid coupled with an imposed economic embargo have further aggravated the situation. The result has been a reduction in education budget to 2.8% of GNP and hence a deterioration in the quality of education. The suggested mechanism to address these problems is:

- To speed up the process of spreading the database network to cover all the states.
- To raise the percentage of the education budget in the public budget so as to meet the needs in the textbook provision, training, improvement of school environment and coverage of education services to reach the unreached.
- To intensify contact between the centre and the states at all levels and by different means.
- To pay more attention to specialized training as well as continuous teacher training in order to have enough trained personnel to shoulder the federal system of governance and to adapt to the innovations in curricula.
- To promote external relations in the field of education so as to attract more funds and technical assistance for education.

As for the elimination of gender disparity in primary education, which is one of the Millennium Development Goals (MDG), the educational statistics of the Federal Ministry of Education, Khartoum, reveal that the ratio of girls to boys in basic education decreased from 0.84 in 1999/2000 to 0.82 in 2004/2005.

Along the same lines, Fadul (2007) examined empirically the possibility of achieving the Millennium Development Goal (MDG) on primary education in Sudan by 2015. He used quantitative secondary data obtained from the Federal Ministry of Education and the Central Bureau of Statistics (CBS). The technique of Box-Jenkins in time series analysis was applied to produce the future forecasts. The most important results



showed that the total enrolment rates as well as those for boys and girls indicate that Sudan will not achieve MDG-2 by 2015 as these rates will be only 71.18% for boys, 81.48% for girls and 76.21% for the total. In other words, these results suggest that Sudan is far from achieving universal primary education by the target date, considering the current trends. Thus, achieving the goal of universal primary education in Sudan will remain a focal challenge that should be taken into account in formulating policies related to the education.

With regard to the secondary level of education, the declared policy of the Ministry of Education is to guarantee equal opportunity and access to all those who have successfully completed basic education (Ali, 1998). However, based on the educational statistics of the Federal Ministry of Education, Khartoum, the enrollment rate in secondary education in the school years 1995/96 and 2003/2004 decreased from 27.3% to 25.9% for girls, respectively, while that of boys decreased from 28.6% to 25.8%, respectively.

More recently, the Ministry of Education adopted a 25-year Strategy for Education (2003-2027) which included in its overall framework an introduction among which contained the successes achieved in the history of education, both the internal and external challenges, philosophy and general objectives, public policies, output (the same time and the specifications of the future generation), and calendar. The first medium term plan of the strategy (2003-2007) focused on issues related to access to education and equal opportunity for education. In relation to basic education, the strategy aims at increasing the intake rates of six-year old children to 90% during the first quarter of the strategy. Emphasis is also placed on the achievement ratio in remote rural areas and war-affected areas, and among groups with special circumstances (e.g. the disabled, nomads and displaced persons), as well as among girls in some areas. In addition, the strategy aims at increasing the overall enrolment rate for children at the age of basic education (6-13 years old) to the rate of 80.9% to reduce the differences between States. Furthermore, the plan aims to raise the enrolment rate in basic education to 75% in states with current enrolment rates of 50-60%. For relatively more advanced states (with 65% and above enrollment rates), the plan aims at achieving the target of 100% enrollment in basic education. Similarly, in increasing literacy and reducing the rate of illiteracy, the objective is to absorb 80% of children in primary school age who did not have access to education and dropped out before acquiring basic education skills; raising the levels of literacy among adults (15-45 years) to 75% by the end of five years; utilizing Khalwas and sources of non-formal education to increase the literacy rate. The plan operate through all available means (the curriculum, the preparation and training of teachers and improving the learning environment) for upgrading the quality of formal and informal education, and ensuring excellence in learning through measuring the output in various skills to ensure that the products meet the educational standards set by the general framework of the strategy.

At the tertiary level, a number of new universities and higher institutes were opened in most of the states of the Sudan since 1990. As a result of this new policy, which aimed at offering greater opportunity and access to higher education, there is a marked increase in the students' intake from 60981 in 1990/91 to 200538 in 1998/99



(Ministry of Higher Education and Scientific Research, Khartoum, 2000). The percentage of the students in the faculties of humanities and social sciences is twice as large as those in the fields of science and technology, with percentages estimated at 66.23 and 33.77, respectively.

Based on data collected from the Ministry of Higher Education and Scientific Research, the students in the faculties of medicine, dentistry, pharmacy, engineering and computer, and other faculties, were estimated at 3.79%, 0.40%, 1.10%, 11.58%, and 83.13%, respectively, from the total number of intake, which was estimated at 58906 students for the year 2004/2005. In view of the higher unemployment rate amongst the university graduates, there appear to be no or little coordination between the Ministers of Higher Education and Scientific Research and Science and Technology on one hand and the sources of employment including the government on the other hand. The newly opened universities as well as the old ones suffer a very acute staff and human resource shortages because most of the skilled manpower and university professors had emigrated to the Gulf and European countries in search of better jobs. For the few professors who did not emigrate, it is practically difficult to meet all the educational demands in the various universities. Another problem is represented in the shortage of facilities and resources: the references, the technical workshops and the science laboratories and computers and research facilities. The poor quality of the higher education is clearly indicated by the rise in the student/staff ratio in universities.

2.2. The Health Sector in Sudan:

According to Federal Ministry of Health (FMOH, 2004), between the years 1989 and 2000 there was a steady increase in the number of health centres at an average of 3.5 % annually and 3.8% for hospitals. Hospital beds have increased in number by 20 percent (a rate of 1.7 percent per annum). On a national basis, the number of beds equivalent to about one bed per 1,000 of the population, compared with a ratio of half a bed per 1000 people in Egypt and around 10 in middle-income European countries. The most important part of the story, however, is the distribution of these health care facilities. The decrease in the number of primary health care units has been almost exclusively in rural areas.

The health services suffer from inherited problems, which can be summarized as follows: absence of referral systems, lack of means of patients' transport and ambulances, lack of quality work standards, service is not based on the concept of client satisfaction, weak infrastructure and distribution, many health facilities are not constructed according to the recommended standards for its location, buildings...etc, low quality of tertiary services leading to patients seeking treatment abroad, weakness of integration between curative and preventive services leading them to work in isolation, and lack of clear vision, mission and plans (FMOH, 2004).

Table (1) shows the development of health manpower in Sudan over the period (2000-2004).



Table (1) : Health Manpower in Sudan per 100000 Population (2000-2004)

Specialization	2000	2001	2002	2003	2004
General Doctors	16.0	17.0	17.6	18.4	20.0
Medical Specialists/Consultants	2.6	3.0	3.0	3.1	3.3
Dentists	0.7	1.0	0.6	0.7	0.8
Pharmacists	1.0	2.0	2.0	3.1	2.0
Medical Assistants	22.6	22.0	21.0	20.0	20.0
Technicians	9.2	9.3	9.4	9.5	11.3
Nurses	56.0	52.0	50.4	51.0	49.0
Public Health Officers	1.4	1.0	1.1	1.1	1.3

Source: Federal Ministry of Health-Information Centre.

Recently, increased government revenues (largely due to oil revenues) have allowed an increase in public expenditure on the health sector. Federal and State spending on the government health system doubled between 1999 and 2002. However, it is also shown that as a proportion of total government spending, public health expenditure remained relatively constant at between 2 and 3%. Similarly, government spending on health has remained at less than 1% of GDP. Government health spending in Sudan ranks among the lowest in the world. The amount of government contribution to finance the health system could be underestimated. The annual federal government per-capita health spending has been estimated on average at 265 S.D. (approximately US\$1 for 2000-2003). Table (2) illustrates the health finance and some health indicators according to UNDP statistics.

Table (2) :Commitment to Health in Sudan: Resources, Access and Services

Indicator	Percentage (%)
Public health expenditure (% of GDP), 2003	1.0
Private health expenditure (% of GDP), 2003	2.4
One- year- olds fully immunized against tuberculosis, 2004	51
One- year- olds fully immunized against measles, 2004	59
Births attended by skilled health personnel, 1996-2004	87
Contraceptive prevalence rate, 1996-2004	10

Source: The UNDP Human Development Reports (2005, 2006).

2.3. Standard of Living in Sudan:

Using data covering the period (1980-1999), Ahmed (2003) examined the trends in per capita income and consumption in Sudan before and after liberalization policies. Dividing the period (1980- 1999) into two sub-periods, namely the period before liberalization (1980-1989) and the period after liberalization (1990-1999), the results he obtained indicate that the growth rates of real GDP and real per capita income have improved significantly after the adoption of liberalization policies. While the growth rate of real GDP increased from 2.99 % before liberalization to 6.05 % after



liberalization, that of real per capita GDP has more than tripled increasing from 1.20 % to 3.96 %. On the other hand, real private consumption has declined at a rate of 1.22 % before liberalization and at a rate of 6.84 % after liberalization, while real per capita private consumption declined at a rate of 3.01 % before liberalization and even more pronounced rate of 8.93 % after liberalization. Thus, while economic liberalization policies may have lead to significant gains in terms of economic growth, these gains are more than outweighed by the significant losses in consumption growth. He attributed the reasons behind these results to the removal of consumer subsidies coupled with the high consumption taxes (as reflected in the high inflation rates) that accompanied the liberalization policies.

Ali (2003) investigated the feasibility of achievng the Millennium Development Goal (MDG) of reducing poverty by half by the year 2015 for Sudan on the basis of a relevant analytical framework. He argued that poverty, in the context of the MDGs, is meant the spread of poverty as measured by the head count ratio. The major results are (a) to achieve the MDG on poverty Sudan's GDP needs to grow by an annual rate of 7.2 per cent, requiring an investment rate ranging from 35% to 42% of GDP, (b) given Sudan's past growth performance, and assuming that Sudan will be able to sustain a GDP per capita growth rate of 2.2 percent (equivalent to a GDP growth rate of 5 percent) a reasonable horizon for reducing poverty by half would be 28 years starting from 2001, almost double the horizon implied by the MDGs.

In 2004, GDP per capita in Sudan was (US \$ 594). GDP per capita annual growth rate over the period (1975-2004) is estimated at 1.6%, while GDP per capita annual growth rate and average annual change in CPI over the period (1990-2004) are estimated at 3.4% and 46.1%, respectively. The change in CPI in 2003/2004 is estimated at 8.5% (Human Development Report, 2006). The table below illustrates some human and income poverty indicators in Sudan.

Table (3) :Human and Income Poverty Indicators in Sudan

Indicator	(%)
Probability at birth of not surviving to age 40 (% of cohort), 2000-2005	27
Population without sustainable access to improved water source, 2004	30
Children underweight for age (under age 5), 1996-2004	17
Human poverty index, 2004	31.3

Source: The UNDP Human Development Report (2006).

With a total area of 1690 million hectares, the Sudan has a relatively huge economic resource potential measured in terms of its endowments of natural resources, including arable and grazing land, water, mineral resources, and a diversified and pervasive climatic zones. Despite this, the majority of the population lives in absolute poverty. The available poverty indices suggest that poverty remains one of the most serious problems in Sudan and has become the major concern of the general public, the government, as well as national, regional, and international organizations. More than 90% of the population in Sudan are classified as poor, both in rural and in urban areas. Furthermore, key human development indicators such as literacy rates, life expectancy, and child mortality, are still far below the levels in many middle-income



countries. Under the present circumstances, the prospects for the Sudan to achieve the MDG of halving the number of the poor between 1990 and 2015 seem to be bleak (Mahran, 2007).

III. Methodology and Data :

According to UNDP (2005), if the Gender Related Development Index (GDI) of a country is less than its HDI in a certain year, then there is gender bias against women in terms of human development. Instead of comparing HDI with GDI for the purpose of examining the gender gap in human development in Sudan, we firstly calculate the HDI for males (HDIM) and females (HDIF) separately using the standard formula of UNDP for calculating the HDI. In this case, comparisons between males and females will also be carried out with regard to health, education, and standard of living.

The standard UNDP benchmarks for the calculation of HDI can be summarized as follows: For each capability, and each country, region or state, a normalized indicator, I_{ij} is obtained as shown below, where X is the value of the indicator of capability and X_{max} and X_{min} are respectively the maximum and minimum values of these indicators:

$$I_{ij} = [X_{ij} - X_{min}] / [X_{max} - X_{min}]$$

For the income dimension, it is the logarithm of income that is used in the computation of the index. According to UNDP (2003) "income serves as a surrogate for all dimensions of human development not reflected in a long life and in knowledge. Income is adjusted because achieving a respectable level of human development does not require unlimited income". The HDI for country j is obtained as the simple average of the normalized capability indicators as follows:

$$HDI_j = 1/3 (\sum_i I_{ij})$$

According to UNDP (2005), the goalposts for calculating HDI are as follows:

- Life expectancy at birth (years): max = 85; min = 25;
- Adult literacy rate (%): max = 100; min = 0;
- Combined gross enrolment ratio (%): max = 100; min = 0;
- GDP per capita (PPP US\$): max = 40000; min = 100.

The above mentioned formula will be used for the calculation of HDIM and HDIF in Sudan for the study period. It is worth noting that data on the average incomes of males and females are reported in the UNDP Human Development Reports for some years under study. For the remaining years, only the earned income shares of males and females are reported. Thus, the average incomes of males and females are calculated based on the values of GDP in Sudan (PPP), numbers of males and females, and the income shares of both sexes. Data on the population size by sex, are obtained from the Central Bureau of Statistics, Khartoum, while data on other study variables are obtained from the UNDP Human Development Reports.



To accomplish the research objectives, firstly, the contributions of longevity (health), educational attainment, and income (standard of living) to HDIM and HDIF in Sudan will be calculated. We also calculate the coefficient of variation (as a measure of variability in relation to the mean) for each indicator. Furthermore, the least squares growth rate, g , will be estimated by fitting a least – squares linear regression trend line to the logarithmic annual values of the variable in the relevant period.

To see whether the gender gap in human development is constant, increasing, or decreasing over time, we then calculate the growth rate of the ratio of males – females human development index. In addition to that, preliminary analysis could also be conducted using the standard Student's t -statistic to test for the difference between the means of HDIM and HDIF as well as for their sub indicators.

In the next section we report the empirical results of the study.

IV. The Empirical Results :

Using the standard formula of UNDP (1999) for calculating the HDI, as reported in section (3), we calculated the index for males and females separately over the period (1990-2005). In this case, comparisons can be made between males and females in all human development indicators. The choice of the period under consideration is dictated by data availability. For example, while data on the health and education indicators are available for both sexes for some years before 1990, neither the income shares nor the average income by sex are found to be available. So, the period under study could also be used as a base period. The (HDIM) and (HDIF) are reported in tables (4) and (5), respectively, while figure (1) shows a graphical fitting.

Table (4): Longevity Index, Educational Attainment Index, and Standard of Living Index for Males in Sudan (1990-2005)

Year	Longevity Index	Educational Attainment Index	Standard of Living Index	HDIM
1990	0.430	0.477	0.422	0.443
1991	0.443	0.482	0.428	0.451
1992	0.447	0.487	0.431	0.455
1993	0.448	0.492	0.423	0.454
1994	0.410	0.497	0.470	0.459
1995	0.430	0.495	0.474	0.466
1996	0.460	0.524	0.429	0.471
1997	0.477	0.559	0.529	0.521
1998	0.483	0.577	0.512	0.524
1999	0.487	0.583	0.387	0.486
2000	0.493	0.586	0.553	0.544
2001	0.483	0.587	0.568	0.546
2002	0.483	0.600	0.555	0.546
2003	0.498	0.597	0.563	0.553
2004	0.500	0.597	0.575	0.557
2005	0.517	0.598	0.586	0.567

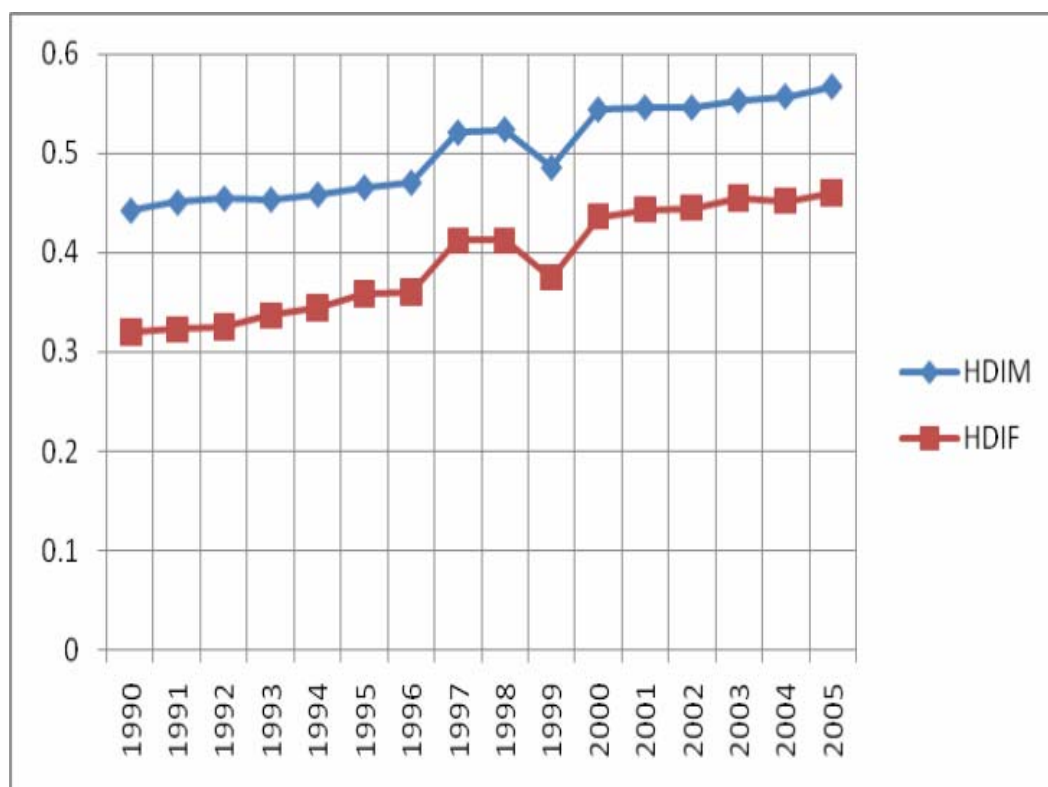
Source: Own Calculations based on Data Collected from the UNDP Human Development Reports, and the Central Bureau of Statistics, Khartoum.

Table (5): Longevity Index, Educational Attainment Index, and Standard of Living Index for Females in Sudan (1990-2005)

Year	Longevity Index	Educational Attainment Index	Standard of Living Index	HDIF
1990	0.490	0.290	0.180	0.320
1991	0.490	0.295	0.185	0.323
1992	0.490	0.299	0.189	0.326
1993	0.492	0.299	0.221	0.337
1994	0.457	0.307	0.270	0.345
1995	0.477	0.327	0.272	0.359
1996	0.500	0.352	0.227	0.360
1997	0.523	0.379	0.335	0.412
1998	0.530	0.393	0.312	0.412
1999	0.533	0.403	0.190	0.375
2000	0.540	0.411	0.358	0.436
2001	0.530	0.424	0.375	0.443
2002	0.533	0.438	0.362	0.445
2003	0.548	0.443	0.370	0.454
2004	0.550	0.462	0.343	0.452
2005	0.563	0.463	0.354	0.460

Source: Own Calculations based on Data Collected from the UNDP Human Development Reports, and the Central Bureau of Statistics, Khartoum.

Figure (1): Human Development of Males and Females in Sudan (1990-2005)





The arithmetic means and the contributions of factors to HDIM and HDIF, respectively, are calculated as shown in tables (6) and (7), where the figures inside the parentheses are the standard deviations of means and those inside the square brackets are the coefficients of variation (C.V). The average HDIM over the period (1990-2005) is estimated at (0.50) with a coefficient of variation equals (0.125), while the average HDIF is estimated at (0.39) with a coefficient of variation of (0.136). Thus, while males in Sudan are on average in the category of medium human development, females are characterized by low human development. Furthermore, the contributions of health, education and income to HDIM over the period (1990-2005) are estimated at (31%), (36%), and (33%), respectively. With regard to the HDIF, the contributions of health, education and income are estimated at (44%), (32%), and (24%), respectively. Educational attainment recorded the highest share as a contributor to HDIM, while health alone was responsible for 44% of the HDIF.

Table (6): Means and Contributions of Factors to HDIM in Sudan (1990-2005)

	Longevity	Educational Attainment	Standard of Living	HDIM
Mean	0.468 (0.030) [0.064]	0.546 (0.050) [0.092]	0.494 (0.068) [0.138]	0.503 (0.063) [0.125]
Shares (%)	31	36	33	100.0

Source: Own Calculations based on Data of Table (4).

Table (7) : Means and Contributions of Factors to HDIF in Sudan (1990-2005)

	Longevity	Educational Attainment	Standard of Living	HDIF
Mean	0.52 (0.031) [0.060]	0.37 (0.064) [0.173]	(0.28) (0.075) [0.268]	0.39 (0.053) [0.136]
Shares (%)	44	32	24	100.0

Source: Own Calculations based on Data of Table (5).

Once the means of HDIM and HDIF as well as their sub indicators are calculated, the Student's t-test is conducted on the standard formula. The results of the t-test for the difference between two means are reported in table (8) below, where the figures inside the brackets are the standard deviations of the variables and the t-ratios are reported in absolute terms.



Table (8) : Student's t-test for the Difference between Means

Indicator	Group Means		t-ratio	Significance Level
	Males	Females		
Longevity	0.468 (0.030)	0.52 (0.031)	4.82	0.000
Educational Attainment	0.546 (0.050)	0.37 (0.064)	8.67	0.000
Standard of Living	0.494 (0.068)	0.28 (0.075)	8.46	0.000
HDI	0.503 (0.046)	0.39 (0.053)	6.44	0.000

Source: Own Calculations.

From these results, we observe that the means of educational attainment, standard of living, and the level of human development for males are greater than that of females, while the mean of longevity for females is greater than that of males. Furthermore, the t-statistic for the difference between means is statistically significant at the 1% level in all comparisons. These results suggest the existence of gender gap in all human development indicators against females, except for the health indicator in which females are better. This may be due to the efforts exerted in the Safe Motherhood Program to improve health conditions in terms of vaccination and maternal health.

It is worth noting that, besides negatively affecting numerous development factors, gender inequity is a major contributor to poverty. Women's empowerment is central to human development. Human development, as a process of enlarging people's choices, cannot occur when the choices of half of humanity are restricted. Males and females are affected by policies in different ways and hence experience development differently. But all have the right to share in the benefits of development. If sustainable development is to be achieved, an engendered approach to development policy and practice is essential. The UNDP (1997) argues that "If development is not engendered, it is endangered".

By applying the Ordinary Least Squares (OLS) technique, we estimated the trend equations for the HDIM and HDIF in Sudan over the period (1990-2005). The estimation results are shown in tables (4) and (5), where the figures inside the parentheses are the t-ratios of the estimated trend coefficients and those inside the square brackets are the significance levels.

**Table (9) : Estimated Exponential Functions for the HDIM in Sudan
(1990-2005)**

Variable	Constant a	Coefficient b	F-Ratio	R ²	D.W.
Longevity	3.74 (216.30) [0.000]	0.0121 (6.76) [0.000]	45.67 [0.000]	0.77	1.16
Education	3.85 (118.92) [0.000]	0.0173 (5.38) [0.000]	28.91 [0.000]	0.69	1.01
Income	3.69 (81.21) [0.000]	0.0233 (4.97) [0.000]	24.65 [0.000]	0.64	2.54
HDIM	3.76 (240.61) [0.000]	0.0181 (11.22) [0.000]	125.80 [0.000]	0.90	2.14

Source: Own Calculations.

**Table (10): Estimated Exponential Functions for the HDIF in Sudan
(1990-2005)**

Variable	Constant a	Coefficient b	F-Ratio	R ²	D.W.
Longevity	3.85 (239.63) [0.000]	0.011 (6.59) [0.000]	43.36 [0.000]	0.76	0.95
Education	3.33 (89.03) [0.000]	0.033 (9.47) [0.000]	95.40 [0.000]	0.87	0.89
Income	2.90 (32.98) [0.000]	0.049 (5.35) [0.000]	28.63 [0.000]	0.67	2.25
HDIF	3.42 (164.97) [0.000]	0.028 (12.88) [0.000]	165.90 [0.000]	0.92	2.09

Source: Own Calculations.

The estimation results of tables (9) and (10) reveal that the HDIM and HDIF as well as their sub-indicators exhibited positive trends. Furthermore, all trend coefficients are found to be statistically significant at the 1% level as indicated by the t-ratios. Based on the F-ratios, it is clear that all regression equations are significant at the 1% level. After solving the autocorrelation problem for the educational attainment for males and females, the Durbin – Watson statistic (D.W) indicates that the test for a serial correlation problem is either inconclusive or that there is no problem at the 1% level in all estimated equations.

The compound growth rates of longevity, educational attainment, and standard of living for males are estimated at (1.2%), (1.7%), and (2.4%), respectively, while that of females are estimated at (1.1%), (3.4%), and (5%), respectively. Furthermore, the



compound growth rates of the HDIM and HDIF in Sudan over the period (1990-2005) are estimated at (1.8%) and (3%) per annum, respectively. Thus, while females in Sudan are characterized by low human development, the growth in the HDIF is greater than that of males. With these growth rates, both sexes are expected to realize a level of human development equals (0.78) by the year 2023. These results indicate that the growth rate of females human development index has improved significantly during the period (1990-2005). The estimated compound growth rate of females human development index is almost (1.7) of that of the growth in males human development index. This may be due to the expansion in females' education and improved health conditions in terms of vaccination and maternal health. Increased female labour force participation in recent years has also contributed to the improvement of female incomes.

Thus, reducing the costs of schooling, addressing parental concerns about female modesty or safety, and increasing returns to families from investing in female schooling through improvements in school quality can overcome social and economic barriers to girls' education. Some effective strategies to increase the enrollment and retention rates of girls include among others: providing stipends for rural girls to cover the educational costs of school attendance, employing more female teachers, and supporting village education committees to provide parents with a visible role in promoting quality education. In this regard, the elimination of school fees particularly at the basic education level, provision of nursery centers attached to schools, abolition of school uniforms and the provision of free textbooks, are highly recommended not only for females' education but also for males' education as well.

Finally, with an statistically significant estimated trend coefficient of (-0.012) for the ratio of males-females human development, the growth rate in this ratio is estimated at (-1.2%). This indicates that the gender gap in human development is declining at an annual rate of (1.2%) due to the increase in HDIF with greater amount (3%) than the increase in the HDIM (1.8%).

Elimination of gender disparities in human development is one of the effective development actions Sudan should take. When a country educates both its girls and boys, cares for their health, and improves their standards of living, economic productivity tends to rise, maternal and infant mortality usually fall, and the health and educational prospects of the next generation are improved.

V. Concluding Remarks :

This paper examined, from point of view, the gender disparities in human development indicators in Sudan over the period (1990-2005). The standard formula of UNDP (1999) was used to calculate the HDI for males (HDIM) and females (HDIF) separately. The average HDIM is estimated at (0.50), while the average HDIF is estimated at (0.39), indicating that males in Sudan are on average in the category of medium human development, while females are characterized by low human development. The contributions of health, education and income to HDIM are



*International Conference on
"Women and Youth in Arab Development"*

(Cairo, Egypt, 22-24 March 2010)

estimated at (31%), (36%), (33%), respectively. With regard to the HDIF, the contributions of health, education and income are estimated at (44%), (32%), (24%), respectively. The t- test for the difference between two means assures the existence of gender gap against females in all human development indicators except for health, in which females are better. The compound growth rates of the HDIM and HDIF in Sudan are estimated at (1.8%) and (3%) per annum, respectively. With these growth rates, both sexes are expected to realize a level of human development equals (0.78) by the year 2023. Improving capacity for both sexes without discrimination is one of the effective development actions Sudan should take into consideration.



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