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Analysis of Basic Education Extension in Khartoum State using GIS

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Abstract: From a human rights perspective, equity means that all children have an opportunity to survive, develop and reach their full potential, without discrimination and exclusion. Khartoum is one of the eighteen states of Sudan. Its populations more than seven million. So it is the most populated city in the country. In recent years, Khartoum state received many migrations and displaced people from rural areas and some large cities. Looking for better education is one reason of this emigration.

This study work carried out to analyze the development and coverage of basic education services and its distribution it in Khartoum state up to 2016 using ARC GIS. Last 26 years were the core of the analysis. Khartoum city was taken as a sample of the three cities forming the state. GIS package used to create maps and link descriptive with spatial collected data. Analysis of data and building of queries was also carried out with aid of the package.

Results showed that boy and girls now have an equal chance to join basic education. Where, deaf and other slice of pupils have a limited chance. Also, basic education grow up during the period of 1996 to 2005 then, it went declining. Moreover, during the all periods of study, basic education services development did not met the population growth.

Keywords: GIS, GPS, Mahdist, Out-of-school.

I. INTRODUCTION

In the 1850s the Turks, who were ruling Sudan through the Khedive of Egypt, decided to open five schools in different towns in northern Sudan. These taught Islamic studies, arithmetic, and the Arabic and Turkish languages. All these schools were destroyed during the Mahdist (1885-1899). The earliest educational system of Sudan was established by the British during the first half of the 20th century. Its primary function was to provide a limited number of qualified professionals for the colonial administration. In addition, independent Christian missionaries established schools across the south.

With the independence of 1956, only few reforms were launched in the educational sector. Since 1962, schools in the civil war ridden southern provinces have been operated by local authorities. There is no common program for education here, and resources were limited. Through the 1970's reforms to make education effectively compulsory were launched, and with improved focus on technical and vocational education. Until then, education had focused training for an eventual university degree, but only a small part of all pupils got that far. Still, through the 1980's the school system failed to produce enough qualified candidates at both lower and higher levels. Technical studies continued to have a low status among pupils, usually considered a second best option.

A persistent problem to the Sudanese educational system was the loss of qualified teachers, who often chose other forms of work or took work in foreign countries. Special programs to promote education among girls have been carried out, but often facing the opposition from traditional ideas. Sudan has its own women's university, which has been quite successful.

Education in Sudan is free and compulsory for children aged 6 to 13 years. Primary education consists of eight years, followed by three years of secondary education. The former educational ladder 6 + 3 + 3 was changed in 1990. The

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primary language at all levels is Arabic. Schools are concentrated in urban areas; many in the South and West have been damaged or destroyed by years of civil war.

The concept of out-of-school children implies that there is a group of children that should be in school but are not. Sudan has both the largest number and the highest out-of-school children rate in the Middle East and North Africa (MENA) region. The 2010 Education management Information System (EMIS) data indicates that a total of 3 million children between the ages 5 to 13 are out of school in Sudan [1]. This comprises 490,673 children of pre-primary age (5 years), 1,965,068 children of primary school age (6-11 years) and 641,587 children of lowersecondary school age (12-13 years). The proportion of out-of-school girls is higher than boys.

II. DATA COLLECTION

Educational data of basic schools in Khartoum acquired from the ministry of education of Khartoum state government. These data covered school names and date of establishment.

Because there was no map showing school location and distribution, a hand-held GPS receiver used to collect locational data of basic schools in form of points (X, Y). Table 1 below demonstrates the collected data of basic schools for boys in Khartoum, their locations and date of establishment of each.

Table 1. Basic schools for boys in Khartoum.

ID	School Name	Location		Date
		X(m)	Y(m)	
1	Ebad haj alamen	452582	1725482	1911
2	Alshahid Ahmed Yosif	446595	1727454	1917
3	Aldeem sharg	450433	1722060	1923
4	ALgrayf garb (2)	455132	1720781	1937
5	Alhelaaljadeda shamal	448742	1722495	1944
6	Abd Elmoem (2)	449177	1723345	1949
7	Bory Allamab	454945	1725100	1950
8	Algoz 3	447902	1721162	1950
9	Aletehad	449956	1723072	1952
10	Alsjana Aljadedah	450605	1720844	1952
11	Altayeb Rrezgalla	449636	1722555	1953
12	Altaib Alshaikh Edris	453441	1725056	1953
13	Alrimila 1	447389	1721237	1955
14	Selah almodraat	446833	1717813	1956
15	Soba gareb	463470	1714188	1956
16	Algoz 2 Alqurania	447904	1721521	1959
17	Alhela Aljadedah	448767	1721383	1960
18	Abdalmonem (1)	449861	1723721	1960
19	Alnor khederalnor	449533	1721644	1962
20	Alshahid Fathi Khalil	452850	1724004	1962
21	Arbab Alagaid	446813	1727291	1962
22	Osman Ebnafaan	453979	1725050	1963
23	Alrashdn	448707	1722423	1963
24	Osman Hassan arbab	445838	1717964	1963
25	Alozozab	444898	1715394	1963
26	Ali Ebn abytaalb	450947	1719927	1965
27	Gays alansary	450722	1719271	1965
28	Shikan	446377	1719798	1965
29	Kaab Ebn omayr	451041	1718894	1967
30	Alhmadab	445992	1717937	1968
31	Nor aleslam	452259	1718034	1969
32	Alshahed salah khedr	454608	1721064	1970
33	Arkawet shamal	452999	1720063	1971
34	Talha Ebn alzobar	450336	1718658	1971
35	Omer alfarog	449357	1717892	1971
36	Naser (2)	453466	1724521	1972

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37	Algadsya	450105	1718244	1972
38	Amar bnyaser	451190	1718342	1972
39	Aldabasen	444937	1714927	1972
40	Abdalla Ebn msod	453401	1723433	1973
41	Abdallatef abdalrahman	454064	1719056	1974
42	Alshahed mokhtar suliman	451794	1717809	1974
43	ALamarat (2)	451284	1721544	1974
44	Abdalazez Hassan khalel	445645	1718013	1974
45	ALgrayf garb (1)	455266	1720722	1975
46	Abdalla sayed fahal	450200	1718553	1976
47	Ahmed Hassan derar	445684	1720280	1976
48	Alshahed hesan osman	449048	1717217	1976
49	Bilal EbnRbah	459107	1713886	1978
50	Almostafa	452877	1718476	1979
51	Salah adam	456470	1719117	1982
52	Sohayb Ebnsenan	450102	1717053	1982
53	Abdalla Ebn omer	452036	1718530	1982
54	Arkawet sharg (50)	453608	1720273	1983
55	Moatasim hesan brakat	454002	1723663	1984
56	Adel ahmed edrees	449640	1717413	1984
57	Abo Horyra	448984	1717663	1984
58	AboBakr alsedeg	448191	1717047	1984
59	Alrimila 2	447316	1721578	1984
60	Hyrmanjamayz	453363	1717709	B1990
61	Maaz Ebnjabal	452612	1718439	B 1990
62	Alhara Alola Alkoranic	454704	1722212	B 1990
63	Albrof Abdalla altayb	449493	1720935	B 1990
64	Albraka typical	452600	1725619	B 1990
65	Bashir Alhasan Alhesayn	451172	1719449	B 1990
66	Alzebayr Mohamed saleh	449103	1718640	B 1990
67	Alabas Ebnabd almotalab	450528	1717884	B 1990
68	Alshahed Altaher	450959	1717673	B 1990
69	Od ageeb	445224	1715874	B 1990
70	Al lamab Bahar Abyad	446450	1719791	B 1990
71	Algrayf garb (3)	455705	1719732	B 1990
72	Alamarat (1)	451440	1721565	B 1990
73	Elzbir Ebn Elaoam	450160	1717501	B 1990
74	Alryad	453448	1722991	1991
75	Alabhas Albitria	461485	1712741	1992
76	Alribat	464498	1711550	1992
77	Nor Aleiman	460336	1712924	1993
78	Khalid Ebn alwaled	454231	1718681	1994
79	Alsaliheen	461150	1714173	1994
80	Alshahed D.khalid ali	454914	1719530	1996
81	Alrayan/jabrah (15)	448222	1715670	1996
82	Zayd Ebnthabet alqoranya	446044	1718825	1996
83	Alshahid Loa Abbas	450858	1724856	1996
84	Alferdos	455460	1718498	1997
85	Alamal institute for deaf	449318	1722842	1997
86	Hassan ali alshekh	445687	1715072	1998
87	Alzakhera Alqoranya	445645	1717058	1998
88	Hozyfa Ebnalyaman	449131	1715695	2004
89	Abdon talent & Excellence	450721	1721232	2005
90	ALmogran	448447	1724673	2012

Date: Date of Establishment, **B:** Before

From the above table, it can be seen that the first boy's basic school in Khartoum was established in 1911 during the canalization government. Throughout that time, increase in education was so slow. During the total period of canalization that extended for about 57 years (since 1899 up to 1956) only 13 schools was established. While, during the same period of independence, national governments success to establish 77 school. Since 2012 up to date (2017) no new schools was established. Khartoum has only one school for deaf that established in 1997 and one school for talent and excellence. Now, there are 90 basic boys exist in Khartoum [2-6].

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On the other hand, data of basic schools for girls was also acquired from the ministry of education of Khartoum state. Again it was necessary to collect their locations and distribution using GPS receiver. The collected data arranged in Table 2 below [7].

Table 2. Basic schools for girls in Khartoum.

ID	School Name	Location		Date
		X(m)	Y(m)	
1	Bory Almahas	452959	1725401	1937
2	Somia bnt Alkhiat	449549	1722669	1937
3	Abd Almonem mohamed	449277	1722917	1948
4	Alhomyra	453152	1724999	1949
5	Aleslah	448176	1722387	1949
6	Alkhansa	448246	1722207	1950
7	Algrayf garb (1)	455200	1720812	1951
8	Aletehad	449847	1723669	1956
9	Almaygoma dual	449367	1721711	1956
10	ALhela aljadedah dual	448756	1721629	1956
11	Almogran	447206	1724893	1958
12	Alhamadab dual	445979	1717900	1960
13	ALshaikh gafar	450655	1721194	1961
14	Nosiba	454950	1725028	1963
15	ALgoaz dual	447895	1721067	1963
16	Mona abdalla draag	445606	1718076	1963
17	ALmaaly	451129	1719453	1964
18	Sharifa salim	450414	1721996	1964
19	OM almomenen	446238	1719909	1964
20	Alozozab (a)	444896	1715351	1964
21	ALozozab (b)	444879	1715318	1964
22	Mohamed Almardy	450117	1723102	1965
23	ALnagah	450575	1719766	1965
24	Soba garb	463451	1714197	1967
25	Marya	450985	1718876	1967
26	Alentesar	450692	1719267	1968
27	Alshima	450334	1718703	1968
28	Halyma Alsadya	449925	1717765	1968
29	Alshahid Antra	450653	1721223	1969
30	Elkhansa	450045	1718257	1969
31	Zat Alnetagayn	448767	1721332	1970
32	Somya bntelkhyat	449424	1717886	1971
33	Alamarat(2)	451333	1722165	1972
34	Alremyla	447307	1721246	1972
35	Rabaa Aladwya	452266	1717980	1972
36	Nosiba bntkab	453282	1717696	1973
37	Khadyga bntkhowayld	445603	1718010	1973
38	Arkaoyet garb	452601	1718509	1974
39	ALhomyra	452949	1720054	1974
40	Thowayba	453771	1725097	1974
41	Mohamed Ebrahim dyab	449640	1719000	1974
42	Rabha Alkenanya	451791	1717860	1974
43	Aldabasy	444933	1714868	1974
44	Alzhraa	453947	1719695	1974
45	Emtedad naser (a)	453953	1723895	1974
46	Safya Abdalazez	452947	1724305	1974
47	Khola bnt Alazoar	453424	1724963	1975
48	Khadyga bnt khowayld	450754	1717323	1975
49	Hafsa bnt omer	451170	1717224	1975
50	Mehyra bnt abod	452005	1717358	1975
51	Kamal hamzaAlhasan	447271	1726823	1977
52	Maryam alazraa	459080	1713916	1978
53	Fatima alzhraa	449113	1717186	1979
54	Nosiba bnt kaab	449109	1717232	1979

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ID	School Name	Location		Date
		X(m)	Y(m)	
55	OM atyaAlansarya	453835	1719406	1980
56	ALRyad	453732	1723207	1980
57	Alshahid Alkhir sror	451063	1724731	1980
58	Abdalahim maky	446496	1719536	1981
59	Arkawyt janob (63)	454167	1718669	1982
60	Abdalkarem maky	445711	1720339	1983
61	Aldyom aljadedah	449549	1720943	1984
62	Selah almodraat	446722	1718078	1984
63	Haj Ali Abdalahim	455393	1721756	1985
64	ZatAlnetagayn	451423	1718288	1985
65	Nafisa hassan	451292	1721376	1986
66	Alglaa Aljadedah	455393	1721786	B1990
67	AlharaAlsadsa	456454	1719156	B1990
68	Aldaym sharg(5)	449939	1722340	B1990
69	Rogaya Abdelwahab	450474	1722001	B1990
70	ELhomyra	449535	1717170	B1990
71	Alshahed altahir	451395	1717891	B1990
72	Alsya hager	452041	1718485	B1990
73	OM habya	460906	1713822	B1990
74	ALgrayf garb (2)	455186	1720700	B1990
75	Algrayf garb (3)	455553	1720001	B1990
76	Mostafa khalid	447224	1726986	B1990
77	Rofyda	454005	1723930	1990
78	Asmaa bnt abybakr	448353	1717048	1990
79	OM Algora	453098	1719344	1991
80	Altayf	454290	1720967	1991
81	OM aymen	460368	1712916	1993
82	Jabra aljadedah (15)	448275	1715693	1994
83	Emtedad naser (3)	453817	1724508	1994
84	Zayd Ebn Thabt Algoranya	446176	1718844	1995
85	Hyrman jamaynar	453365	1717697	1995
86	AlzkhiraAlqurania	446163	1718363	1997
87	Alamal institute for deaf	449318	1722842	1997
88	Alfrdos Janob	455477	1718460	2002
89	Alfrdos shamal	454918	1719499	2003
90	Jabra (18)	449091	1715695	2003
91	Abdon talent & Excellence	450721	1721232	2005
92	Asmaa almalk	461529	1712698	2006

Date: Date of Establishment, **B:** Before

Table 2 shows that, girl's education was started 26 years after boys. The first girl's school was established in 1937 then, began to increase in rapid manner as it can be noted from the table.

Table 3. Population growth of Khartoum.

Year	Population
1990	328,753
1995	415,099
2000	501,444
2003	553,252
2005	587,790
2010	680,906
2016	777,381

After collection of education data, population data of Khartoum city was also acquired. Central statistical organization provided population data for the period from 1990 up to 2016 as shown in Table 3 below.

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III. RESULTS AND ANALYSIS

Both, special and attribute collected educational data were applied in GIS program. A map showing the distribution of governmental educational services created. Fig. 1 below shows the distribution of boys schools where, Fig. 2 shows girls schools.

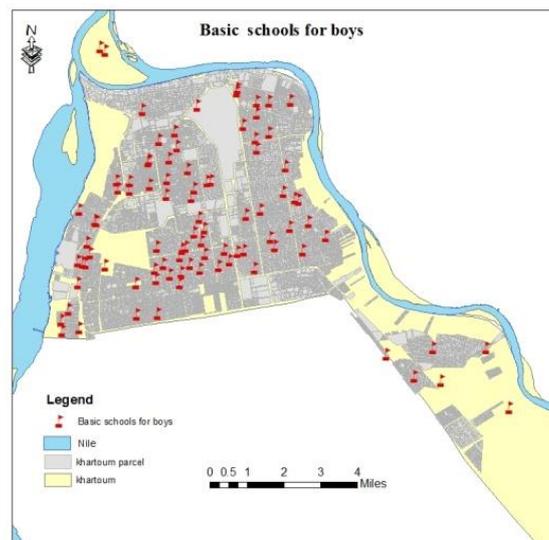


Fig. 1. Boys schools distribution.

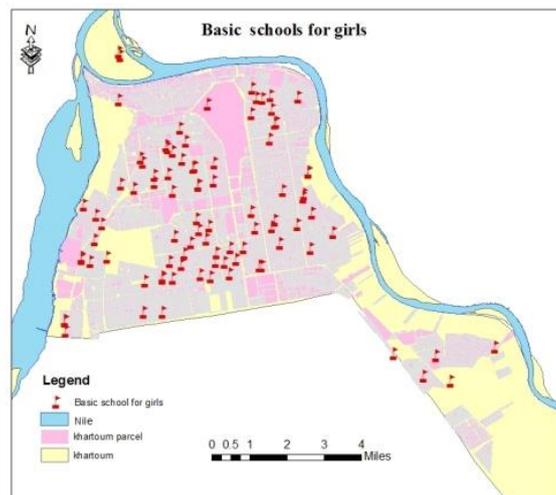


Fig. 2. Girls schools distribution.

From the above data it can be clearly noticed that Khartoum has 90 basic schools for boys and 92 for girls. One deaf school for both boys and girls. Development in basic schools during 1990 up to 2016 was analyzed as shown in Table 4 below.

From the below Table 4 it can be seen that since 1990, only 31 basic school were established. 17 for boys and 14 for girls. 10 schools of which was established during the period of 1996-2000.

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The maximum rate of development occurred during 1996 - 2000 for boys and 2001- 2005 for girls. No boys' schools established during 2006 -2016 and since 2010 no girls school established. The minimum rate of the development of basic schools recorded in the last 10 years.

Table 4. Percentage of basic schools development.

Year	Number of Schools		Development%	
	Boys	Girls	Boys	Girls
Before 1990	73	78	-	-
1991 - 1995	79	85	8.2	9
1996 - 2000	87	87	10.1	2.4
2001 - 2005	89	91	2.3	4.6
2006 - 2010	89	92	0	1.1
2011 - 2016	90	92	1.1	0

The ratio of the number of schools to population (schools to population ratio) was derived. This coverage ratio calculated for each five years as demonstrated in Table 5 hereunder.

Table 5. Basic schools to population ratio.

Year	Coverage Ratio		
	Boys	Girls	Average
1990	1/4503	1/4215	1/4359
1995	1/5254	1/4884	1/5,069
2000	1/5764	1/5764	1/5,764
2005	1/6604	1/6459	1/6,532
2010	1/7651	1/7401	1/7,526
2016	1/8638	1/8450	1/8,544

Analyzing the above table it can be predicted that basic schools going in crowding manner. It started with average of one school for every 4,359 in 1990 to be one school for 8,544 in 2016 i.e. double capacity.

Fig. 3 below demonstrates basic schools to population ratio during years 1990 to 2016. It can clearly be seen that how it is going declining.

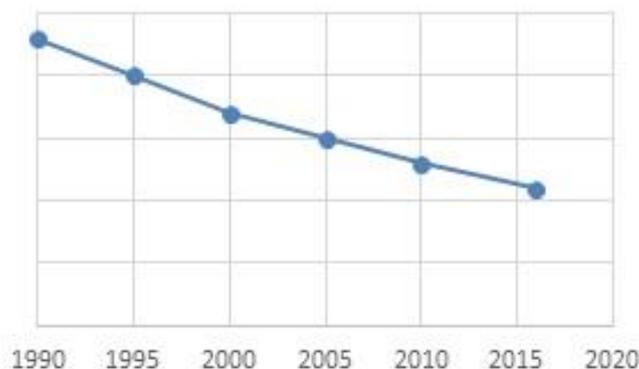


Fig. 3. Basic schools coverage ratio.

Basic school development can also be compared with population growth as calculated in Table 6.

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Table 6. Percentage population growth versus schools development.

Year	School Percentage Development			Population Growth	Ratio
	Boys	Girls	Average		
1991 - 1995	8.2	9	8.6	26.3	1:3
1996 - 2000	10.1	2.4	6.25	20.8	1:3
2001 - 2005	2.3	4.6	3.45	17.2	1:5
2006 - 2010	0	1.1	0.55	15.8	1:28
2011 - 2016	1.1	0	0.55	14.2	1:26

The ratio of the basic school development to population growth, reflects that school development is going slowly compared with population growth.

Finally distribution of basic schools coverage rang in 2016 was also examined as shown in Fig. 4.

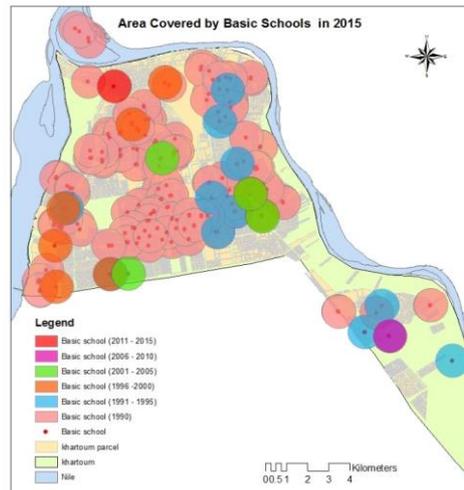


Fig. 4. Distribution of basic schools.

From the figure it can be seen that, to some extent, basic education is well distributed throughout the city. Although, some gaps can be noted especially in the southern areas.

IV. CONCLUSION

From the collected data and analysis carried out for the development and coverage of basic education extension and its distribution in Khartoum, this research work can be concluded with the following [8-11]:

- Girl's education was started 26 years after boys then, it begun to increase in rapid manner.
- Now, Khartoum has 90 basic schools for boys and 92 for girls. This means that approximately an equal chance of basic education is exists.
- Khartoum has only one school for deaf and one school for talent and excellence.
- Since 1990, only 31 basic school were established.
- Basic education grow up during the period of 1996 to 2005 then, it went declining.
- During the last 26 years, basic schools were going in crowd manner.
- During the all periods of study, education services development is less that population growth especially in the latest ten years.
- Basic education is well distributed throughout the city although, additional schools are needed to cover southern areas.



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