GIS and Cultural Mapping for Better TV Programming and Modelling of Coverage Area of Sudan National Television Service (SNTV)

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Abstract: Better TV programming, this paper assumes, won't be possible without careful integration of the broadcasted material (i.e. programmes) to viewer's geographical and cultural elements on either of the national, regional or local levels.

The objective of this paper is to explain how GIS and spatial modelling methods and procedures are applied in cultural mapping and database building. The explanation is made within the framework of the geography of television and related terms such as broadcasting, narrowcasting, station profile, viewing levels, Furthermore; common TV programming concepts are coupled to GIS spatial procedures and models. Samples from SNTV programmes scheduled and broadcasted in the period 2005-2012 were used as data to analyze, using GIS, the ability of such programmes to represent and to reflect the cultural geography of the nation. In addition, digital cultural maps and spatial database building for the country are considered as necessary for better TV programming and broadcasting policies.

The results which include spatial mapping, buffers, spatial statistics and models show that; SNTV needs to consider GIS and cultural mapping in order to improve the understanding of its coverage/geography i.e. the homeland. In addition, the benefit from other programmes is rather minimized by many unconsidered factors such as; language type and level, optimum times in relation to viewers' economic activities, size of viewers and the availability of viewing facilities particularly in rural areas.

A GIS spatially-based model for programme designing, scheduling and broadcasting considering the "what", "when" and "where" elements of TV programming is suggested. Finally, as a recommendation, research and monitoring of viewers opinion and expectations through projects and regular surveys are needed for better feedback and programme updates.

Keywords: Geographical Information Systems (GIS), spatial modelling, cultural mapping, national integration, cultural diversity, TV programmes and programming, broadcasting, narrowcasting, coverage area, station profile, viewing levels and viewer's expectation.

1- Introduction:

In large developing courtiers with diverse cultures and many problems like Sudan, the national television services and programmes need to be carefully planned and harmonized with the spatial and thematic variations of the nation's culture. This would not be possible without careful classification and analysis of the broadcasted material on national, regional and local levels. Geographical Information Systems as a spatial information science can play a substantial role in planning these services in a way that makes cultural integration of the country viable.

This article suggests that TV services (i.e. programmes and programming) in post independence developing Sudan need to be reviewed and understood in harmony with changes in the nation's building and its natural and cultural resources and elements of representations.

2-Television studies and geography:

Television is variously taught about in universities within the fields of screen studies, textual studies, media studies, communications, and cultural studies. "Two dominant strands or paradigms of research into television can be detected. The first is the "critical theory or political

economy". Within this paradigm, television is seen as a site for the reproduction of ideology that (programmed to) suture the socio-economic relations and framework for a sizeable audiences. The second major paradigm explores the relationship between media texts and their audiences, and derives its methods from literary, screen, textual and cultural studies" (Flew, 1994). This textual-formal (semiotic) and socio-political (cultural) approach to television is borrowed variously from linguistics, anthropology, literary theory and criticism, sociology, political theory and journalism, as well as certain metadiscourses like structuralism, (Chomsky,1988). However, no relevant literature was found dealing specifically with this research problem i.e., using GIS in studying and analyzing the spatial components and relations of television programmes, programming and coverage. It must however be admitted that the analysis of television programmes in developing countries in particular, is too complex due to the fact that television production and programming involve the different scales of constructions of ethnicity and national cultural differences and viewer expectations (Fig 1). Such differences need to be treated and commonly denominated in programming text, The GIS system can be applied to make spatial-temporal analysis of the components of television services

context and scheduling (Carter, 1999, Sennitt , 1990, Spigel, 1992, Rust, and Eechambadi, 1989, Gerald, 1990) and Herbert, 1997).

Fig (1) Viewer's opinion and expectations from TV programmes

Television geography, involves the need to understand the viewer's spatial characteristics in different temporal conditions. The viewer domain represents a unique physical, environmental and cultural dynamic landscape. Programming policies and programmed forms and broadcasting schedule must observe these facts. These characteristics can be put into spatial indices i.e. thematic maps. Using GIS queries and models maps can be manipulated to produce programming scenarios to be used as programming decision support elements. Geographical Information Systems (GISs) (Burrough, 1986 , Maguire, 1993, Osman, 1996 and Dangermond, 2004) are information systems capable of input, manipulation and analysis of geographical/spatial data.

within a particular coverage area. Broadcasting a programme requires a service station, service policy, time,

content-context, programme target level and the target viewer/viewing unit in a particular space or coverage area.

The flow of television broadcasting via cable, fiber-optic, and satellites has affected the geographic features of the televisual and its environment in a variety of ways. It has brought traditional broadcast television into close relations with the paths and flows of telecommunications and telematics, though these convergences have been fraught with commercial and political conflicts over territory. The current co-dependence of television with telecommunication and telematics suggests that what has been known so far as "the televisual" was comprised of spatial formations and forms of spatial modeling whose effectivity belonged to a vanishing set of environmental conditions (Hay, 2004 and O'Regan, 1990).

Though many television and media terminology (Table, 1) reflect the presence of viewers' geography and other spatial characteristics, programming and production usually oversee or lump these elements in many a television services. Generally, television programmes and programming in developing countries may not be able to perceive the value of spatial variability factor and its meaning to nation building and national integration and development.

Table (1): TV terms and description

TV terms	Description
Area of Dominant Influence (ADI)	A geographical market definition whereby each locality/county is assigned exclusively to one television market.
Census Agglomeration (CA)	Geographical area, defined by Statistics Canada, with a population of 10,000 to 99,999. contains whole municipalities (or census subdivisions).
TV Coverage Area	Percentage of homes or individuals in a specific area that receive a broadcast and/or cable signal
Local Programme	Non-network programme airing on a station
UHF & VHF	Ultra High Frequency (cover a much smaller area) and Very High Frequency (have the greatest range of coverage)TV channels..
Narrowcasting	Programming designed to reach specific vertical targets. Often developed to appeal to special interest or age groups
Pre-emption	Cancellation/postponement of a regularly scheduled programme due to special programming
Repeat	The re-broadcast of an original programme, also called a rerun
Satellite TV	TV station signals from anywhere in the world which are intentionally beamed to a satellite from a station (received through satellite dishes).
Sets-In-Use (SIU)	Total number of sets viewed at a specific time
TV Penetration	The number of households owning TV sets.
Simulcast	Two broadcast stations carrying the same programme at the same time
Specialty Channel	Television channel that programmes to a vertical interest group
Audience Profile or audience composition	Describes the characteristics of a station's audience, programme or schedule, broken out by age, sex, education, occupation, etc. .
Demographics	A term used to describe audience classification by characteristics, such as age, sex, education, etc.
People Using	The number of people viewing television at a particular time or time- period for a

Television	specified area.
Station Profile	The characteristics of a station's audience, programme or schedule according to age, sex, education, occupation, etc.
Viewing Levels	The number of people viewing television at a particular time or time period for a specified area. It is expressed numerically, or as a percentage of the area's population.
Psychographic	A term that describes audience members based on some psychological trait, characteristic, or behaviour, i.e. values, attitudes, or lifestyles.
Average Hours Viewed	The average number of hours a viewer spends with a station or a television, usually over a one-week period.
Day parts (Segments of the TV broadcast day)	These include Early Morning: 5:00a.m.-9:00 a.m. Daytime: 9:00 a.m.-4:00p.m. Early Fringe: 4:00 p.m.-8:00 p.m. Primetime: 8:00 p.m.-10:00 p.m. Late Evening: 10:00 p.m.-1:00 a.m. Late Night: 1:00a.m.-5:00a.m.
Rating	Within a defined geographic area, Rate = average target audience tunes to a particular programme at a specific time period /target population x 100
Share	Average programme audience/average people viewing or listening during a specific time period x 100.
Share Of Hours	Percentage of the total hours of television station viewing at a given time in a geographically defined area.
Frequency	The average number of times a household or a person viewed a given television programme, station or commercial during a specific time period.

*Terminologies are from "Media Terminology", "TV terms and trade" and "Media Profile Glossary of TV Terms" web sites

3-The Sudan Television Service:

The government's Sudan television broadcasting service has begun in 1962 as one of the firsts in sub Saharan Africa (Fig 2). Since its inception, the service was bound to Khartoum region and its culture for long time. As for the rest of the country, technical and infrastructural problems hindered the TV services. In mid 1970s, the service started to reach many large towns in the country via ground receiving stations (satellite and microwave). With the advent of mid 1990s, the breakthrough in satellite and IT enabled the service to reach more areas in the country and abroad. In early year 2,000 there were an estimated 2000,000 television sets in the country. Located in Omdurman, the Sudan television operates local stations in almost all regional capital cities. The service uses Arabic, English, and several languages spoken in southern Sudan for broadcasting. In the early 1990s, Sudan television telecast about 60 hours per week of programming (now 18 hours a day). In 1997, there were 86 television sets for every 1,000 inhabitants; a figure that totals by present population estimates more than 3,268,000 sets in the country (Metz, 1991 and Encarta , 2002).

Fig (2) SNT: Fifty years of service

Source: sudantv.net

Typical programmes offered deal with news-politics, culture-entertainment and foreign film and opera shows (Arabic and some western). Obviously, the programmes and the programming policy repeatedly fail to represent the cultural and geographical diversity in the nation. This may be due to government interference and restrictions, as well as changing of policies, political attitudes, and programming goals.

Today, and though the service has made a breakthrough in technical and coverage fields, many problems are still seen in management, planning and programming matters. Other problems are typical to lack of well-trained and educated staff, unclear goals, philosophy, initiative, type, and quality of programmes. Moreover, the TV service is still less transparent too ideologue to many experts and gifted citizens who wish to contribute optimally to the role of the service in the nation's culture and cultural development.

4- The SNTS programming policies:

The term "programming" refers both to television content and to strategies of content selection and presentation. Another definition of television programming might turn on the formal aspects of content appearing on the tube. But in fact, many elements of television programming have never been limited exclusively to television. These simple definitions

will be accompanied to have a look at the SNTS programming policies and or system.

In an earlier interview, the director of Sudan TV summarizes service present and future programming policies of his satellite TV (Sudan TV, 2003). The director sees TV programming as a combination of science, art and luck. He admits that programming must be in harmony with attitudes and choices of the viewers and that must regard the production, time prioritization, the nation's social system and characteristics. Furthermore, he mentions four areas that the TV programming may consider. These areas include entertainment, philosophy, culture and social. A TV programme according to the director follows some stages that include execution, control, assessment of viewers' reactions and responses through specialized committees. The Sudan TV -he further says conducts research to gauge the viewers and public opinion on its programmes.

A question has been raised in the same interview about how these visions and guides are reflected in the service programmes and programming. The answer by the director was the use of research and questionnaire as conducted for example in Khartoum State months before. Moreover, he admits that the methodology of such research and polling is incomprehensive and non-representative of many viewers'

opinion in other parts of the country. Another question about the necessity of linking the programmes to development issues was raised. The director answered by raising a question about the goal of programming is it educational, learning, entertainment or the encouraging role of the citizen in development.

Responding to a female viewer's commented via telephone that the Sudan TV programmes are boring, talkative and less entertaining. Picking this comment, the interviewer wondered about the institutional and professional aspects in the service programming system. The answer by the director reflects that cultural and entertaining issues should have equal emphasis. More comments via phone came to reflect some viewer's content about the programmes and programming with some request for more face lifting. Interestingly, a university geographer hinted that the many and diverse cultures of the Sudan are poorly covered by the national TV. Hinting about programming essence and the appearance, the comment was it is always difficult to please all viewers in such a common channel despite the trial represent all the cultures in Sudan.

In conclusion, the Sudan TV director pointed out that several issues are of concern to the service. These include political dialogue, intellectual dialogue, the dialogue between civilizations, the Middle East conflict and other world events, civil war in the Sudan, development, women and children issues, news-info, literature, art, cinema, books, and drama. Finally, the director said that the search for suitable programming framework to handle these issues is underway. These points reflect, however, the need to improve the understanding of the diversity in the Sudan and, helping the nation's TV service to be more influential and better oriented towards the nation's building. Equally, the service must pay more attention to the cultural, ecological, development and political diversity in the Sudan.

5-The Republic of the Sudan-programming variables:

5.1 Geography:

The republic of the Sudan, bounded by seven countries and the Red Sea, is one of the largest countries in Africa. Sudan has a total area of more than one million sq km, divided into 18 states and about 100 Localities. Khartoum is the capital and largest city with population more than 7 million persons. The country's climate is tropical continental constituting of systems range from the desert to the equatorial with evident mountain and maritime climatic pockets in western amid eastern regions. Sudan consists of a huge plain underlying most of the Nile system. Mountains and low hills interrupt the plain on three sides.

Generally, the Sudan is comprised of three major regions, ranging from desert in the north, through a vast semiarid region of steppes and low mountains in central Sudan, to a region of woodland savannah and rain forest in the southern areas. Vast fertile clay plains and cultivable soil are also noticeable. The country also has vast areas of grasslands and considerable areas of forests, including acacia forests, the source of Gum Arabic, (Encarta 2002, Metz, 1991 and Barbour, 1961).

Currently, the Sudan is ruled by federal, regional and local executive, legislative and judicial government systems. The population of Sudan is composed principally of Arabs of mixed ancestry in the north and indigenous Africans in the south. Other ethnic groups in northern Sudan include the Beja, Nubian, Baggara, Nuba, and Nilotic tribes. Recent (2013) estimated population size was about 40 million, giving the country an overall population density of 15 persons per sq km. Generally, about 30 percent of the nation's population occupying 7 % of the land and concentrated around Khartoum the capital region. Moreover, 60 % of the population lives within 300 kilometres of Khartoum. Nevertheless, about 40 percent of Sudanese population is urban and the rest still live in rural areas. Sudan's population is growing according to 2002 estimates at a rate of 2.73 percent annually. Half of the

Sudan's population is under eighteen years of age. The civil war and famine in the south (Blue Nile and South Kordofan States) and Darfur was estimated to have displaced up to 1.5 million. Some 70 percent of economically active people are engaged in agricultural or pastoral activities, another 22% are employed in services, and only 9 percent have jobs in manufacturing, construction, and mining, (Metz, 1991 and Encarta , 2002)

5.2 Economy:

Agriculture continues to dominate the economy of Sudan. Agriculture and livestock raising provided livelihood for about 80 percent of population and roughly 95 percent of exports in early 1990s. Agriculture characterized by modern market-oriented sector of irrigated and mechanized rain fed farming concentrated in central part of country and large traditional sector engaged in subsistence activities elsewhere. Principal modern sector crops include cotton, sorghum, groundnuts, sugarcane, wheat, sesame. The traditional sector produces crops such as sorghum, millet, sesame and groundnuts. Fisheries still largely subsistence occupation. Apart from Gum Arabic, a major export, forests used mainly for fuel. The livestock population in 2001 included 38.3 million cattle, 48 million sheep, 3.9 million goats, 3.2 million camels, and 38 million poultry. Small deposits of many

different minerals such as chromium, copper, and iron ore occur. Considerable petroleum amounts produced and exported via 1600 km pipeline from south-western Sudan to the Red Sea. (Encarta , 2002, Farah, et al, 1982, Lebon, 1965 Ahmed, 1987 and Abu Sin,1985) .

Sudan's about 4,800 kilometres railways connect the country from Port Sudan to most major interior production and consumption centers. The road system extends to a length between 20,000 and 25,000 kilometres, of which more than 3,000 kilometres paved or asphalted and about 3,700 kilometres gravel. Remaining roads fair-weather earth and sand tracks. About 2500 kilometres of pipelines serve the country's newly established oil industry. By 1990, about 1,750 kilometres of the inland waterways are navigable. Government-owned Sudan Airways in 1990 provided scheduled domestic air transport service to about twenty Sudanese towns. Port Sudan, Sawakin and Bashair on Red Sea are major marine ports for Shipping and oil exportation.

5.3 Culture:

The Sudan is an area of mixed cultures dominated by Afro-Arab Islamic culture. Christian and European culture and traditional African customs have presence among Coptic community, the educated southerners, and indigenous communities especially in the south.

About 70 percent of the people of Sudan are Muslims, some 15 percent are Christians, and most of the remainder follow traditional religions. More than half of the total population is Muslim, most living in north where Muslims constitute 75 percent or more of population. Relatively few Christians, most living in south. Most people in south and substantial minority in north adherents of various indigenous religions. The Sudan speaks about 400 languages and dialects. Arabic is a primary and official language with English considerably spoken as a common second (After local Arabic) language in south. Other major languages and dialects include Beja in the east, Nubian in the north, Fur, Nuba in the west and Dinka, Zandi, Nuer, and Shuluk in the South (Encarta 2002 and Metz, 1991).

Education is free and compulsory in Sudan between the ages of 6 and 13. In the 1998-1999 school-year 2.5 million pupils attended elementary schools, and 1 million students were enrolled in secondary schools and vocational institutions. Estimate of adult literacy about 30 percent. The south and many northern communities still suffered from shortage of schools and teachers. Most schools in urban locations. Universities producing adequate numbers of highly educated. Institutions of higher education include about thirty national and regional universities such as the

University of Khartoum (1905, 1956), Omdurman Islamic University (1912), the University of Juba (1975), The University of Gezira (1977). Different academic programmes are offered by these universities in many fields such as humanities, education, engineering, medicine, technology, agriculture, fine and applied art, music and drama, (Encarta 2002).

5.4 National problems: Civil war, political instability, national integration and development issues persist as major problems for the Sudan since independence. Problems of internal migration caused by war and environmental degradation created major shifts in population distribution, producing overpopulation in areas that could provide neither services nor employment. In addition, many tropical diseases such as malaria and poverty diseases are still difficult to manage due to weak health system. Furthermore, Sudan has suffered a continuous "brain drain" as its finest professionals and most skilled laborers emigrated, while simultaneously there has been an influx of more than 1 million refugees, who not only lacked skills but required massive relief. Droughts in the 1970s, 1980s, and 1990s have undermined Sudan's food production, and the country would have to double its production to feed its expected population within the next generation. For more than a decade the gross domestic product of Sudan had not kept pace with the increasing population, a trend indicating that Sudan would have difficulty in providing adequate services for its people. Moreover, half of the population is under eighteen years of age and therefore were primarily consumers not producers, (Metz, 1991).

Though it is becoming an oil producing country, the Sudan still has energy problems in spite of vast potential hydroelectric resources from the Nile. This raises the demand for charcoal, which in turn leads to the clearing of more forests and woodlands. Deforestation, overgrazing, and poor land management practices all speed the process of desertification.

6- Cultural mapping:

TV programming can be supported by a system of cultural mapping. Cultural mapping is presented as a technique for building communities and as a tool for mainstreaming cultural diversity for social and economic development. Cultural mapping has been recognized by UNESCO as a crucial tool and technique in preserving the world's intangible and tangible cultural assets. Cultural Mapping emerges as a necessity to the state as well as to the cultural landscape and communities (Gewin, 2004). The mapping of culture must be:

    a. Representative (geographically, socially)

b. Multilingual
c. Based on Digital data/database
d. Dynamic
e. Comprehensive
f. Illustrated
g. Simple-to-Complex
h. Thematic -Cultural maps
i. Usable and applicable.

Cultural mapping encompasses a wide range of techniques and activities from community-based participatory data collection and management to sophisticated mapping using Geographic Information Systems.

GIS will be a substantial data management and mapping system and should specifically fulfil the following:

a. Accurate data;
b. project GIS staff be highly experienced;
c. Level of GIS technology to be the highest and the latest.
d. GIS shall be the core of all operations
e. have a good (GUI) friendly to those with minimum GIS knowledge;
f. Able to generate a state-of-the-art database and cultural mapping of all scales.
g. Capacity building for GIS and data management.
h. Integrated to cultural decision support

Cultural mapping themes cover varied and diverse elements that include,

a. Anthropological
b. Sociological
c. Archaeological
d. Genealogical
e. Linguistic
f. Topographic
g. Musicological
h. Botanical
i. Others

The data source include archives, maps and mapping sites, satellite remote sensing data and field surveys. The data scales and time can be as follows:

Space scale (Spatial Resolution):

a. Local
b. Regional
c. National

Time scale (Temporal Resolution)

a. Monthly,
b. Quarterly,
c. Biannually
d. Annually

7-Methodology:

Geographical Information Systems (GIS) is used in this article to study and analyze the current Sudan national television service programming and programme coverage. GIS is an information system capable of input, manipulation and analysis of geographical/spatial data. The GIS system can be applied to make spatial-temporal analysis of the components of television services within a particular coverage area. Broadcasting a programme requires a service station, service policy, time, content-context, programme target level and the target viewer/viewing unit in a particular space or coverage area.

Obviously, the objective of this paper is to explain how GIS and spatial modelling methods and procedures

(Fotheringham, and Rogerson 1994 and Fotheringham *et al* 2000) are applied in cultural mapping and database building. The explanation is made within the framework of the geography of television and related terms such as broadcasting, narrowcasting, station profile, viewing levels, TV penetration, pre-emption, demographics, psychographics, frequency and rating and coverage area.

Furthermore, common TV programming concepts are coupled to GIS spatial procedures and models. Samples from SNTV programmes scheduled and broadcasted in the period 2005-2012 were used as data to analyze, using GIS, the ability of such programmes to represent and to reflect the cultural geography of the nation. In addition, digital cultural maps and spatial database building for the country are considered as necessary for better TV programming and broadcasting policies.

These objectives relate to the many assumptions about the current Sudan national television service which include the following:

a.   The programming system and policy does not achieve the so called a typical 'national television culture'

b.   The programmes content and context are not suitable for such a diverse nation.

c.   The service coverage follow the technical broadcasting model rather than geographical model (based on viewers spatial domain characteristics).

d.   Using GIS can improve the television services which must adopt a bottom-up service policy

7-1 The questions:

a.   How to perceive and represent the country's culture and natural landscapes and resources?

b.   How to representatively present the geo-cultural diversity within the Sudan National Television Service (SNTV) programmes and programming system?

c.   How to render SNTV programmes reflect inter cultural and ecological relationships within the country's geography using spatial modelling in GIS? (Haggett, 1965, Haggett, and Chorley 1969, Berry and Marble, 1968, Beville,1988, Wilson, and Bennet 1985, Wilson, *et al* 1981 Taylor, 1977 and Wilson and Kirkby 1975).

7-2 The Scenarios:

1- **Programme to place (geography) from TV programmer to Viewer:**

a.   If the programme is P1, and Time is T1, and targeted Viewer is V1, and Month is M1, and Day is D1, then our coverage will be National.

b.   If the programme is P1, and Time is T1, and targeted Viewer is V1, and Month is M1, and Day is D1, then our coverage will be Regional and Local then the regions/localities that should be covered are R1, R2, etc.

The attributes of coverage regions would be as shown in the database and that means the programme success will be assessed according to number of regions (wide coverage) and the interesting attributes such as

population density level of education etc. this will help assessing our programme success. Or the programme content and level (general, medium, special service) Pc and Pl and programme language level or kind Ll, Lk. And the viewer's interest is V1, V2 etc

2- Place/geography to programme: from Viewer interest to TV programmer:

If the place is Pl1, Pl2, Pl3 etc. the Viewer's Interest and type are V1, V2 etc, the Month is M, the Day is D, the Time is T, the Profession is Pr, the Culture is C Then the programme should be P1 (i.e. cultural or educational) and its Level is L1(i.e. simple, moderate, complex) and the language is L (Arabic, Colloquial Arabic or local or foreign language)

and its content is (general or specific) (Fig 3, Fig 4)

7-3 The Assumptions

a. Better TV programming, this paper assumes, won't be possible without careful integration of the broadcasted material (i.e. programmes) to viewer's geographical and cultural elements on either of the national, regional or local levels.

b. It is also assumed that Geographical Information Systems (GIS), as a spatial information science and technology, can play substantial and vital role in planning and management of TV services, (Goodchild *et al* , 1993 ,(Chuvieco, 1993, Maguire *et al*, 1993 Richardson, 2004, von Rimscha, 1996 and Robinson and Frank 1987).

Fig (3) Programming spatial and temporal levels
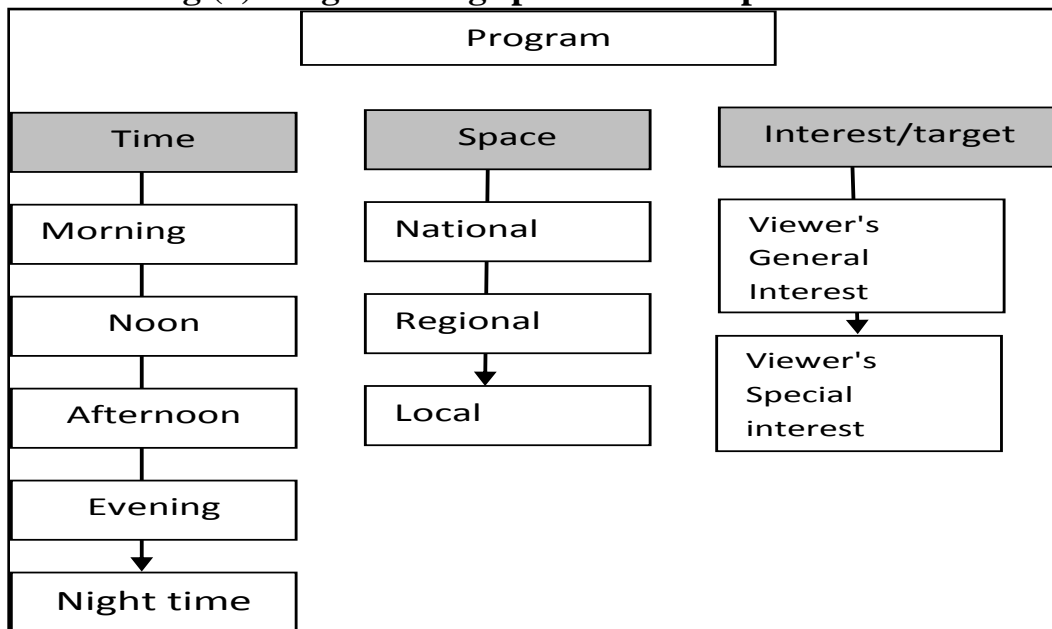
# Fig (4) Programming considerations (questions) about viewers' characteristic elements and expectations

Who?	Where?	When?	Which?	How?
Viewer's characteristics	Viewer's geography	Viewing time	Program elements and contents	How to program (language,
- Age - Culture - Religion - Language - Interest ad life style - Education - Work/profession	- Scale (national, regional, local) - Environment - Culture - Society - Liabilities - Development - History	- Hours - Day - Month - Season	- Political 1- Hours 2- Day 3- Month 4- Season - Constitutional and legal - Environmental - Entertainment - Economic - Tourism - Social - Scientific - Wildlife	- Language level - Literacy level - Technical level 1. Scale (national, regional, local) 2. Environnent 3. Culture 4. Society 5. Liabilities 1. Age 2. Culture 3. Religion

8- Analysis and results:

The analysis is based on spatial raster modelling that involves derivative mapping reclassification, map algebra and overlaying in GIS. ArcGIS software (ESRI, 2014) is used to analyse basic data layers (Fig 5).

The map layers included geographical data such as administrative, settlements road networks etc. Additional data included cultural elements and population density and demographics. Data about physical and socio economic characteristics of viewer environment were also added to analysis.

Fig (5) Data layers analysis in GIS
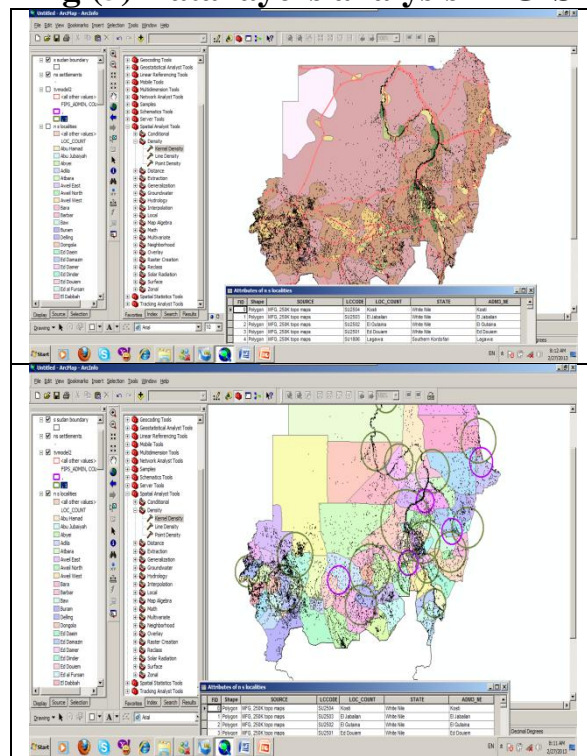
The results which include spatial mapping, buffers, spatial statistics and models (Fig 6) (Fig 7) show that:

- SNTV needs to consider GIS and cultural mapping in order to improve its programmes and programming plans and policies in relation to cultural, social integration to economic development. This needs more geographical understanding and representation of coverage/viewer elements in the country.
- Spatial analysis and modelling of SNTV programmes has shown some imbalances in coverage area and schedule regarding many programmes (i.e. the cultural and developmental).
- The benefit from other programmes is rather minimized by many unconsidered factors such as; language type and level, optimum times in relation to viewers' economic activities, size of viewers and the availability of viewing facilities particularly in rural areas.
- A GIS spatially-based model for programme designing, scheduling and broadcasting considering the "what", "when" and "where" elements of TV programming is needed.
- Finally, as a recommendation, research and monitoring of viewers opinion and expectations through projects and regular surveys are needed for better feedback and programme updates.
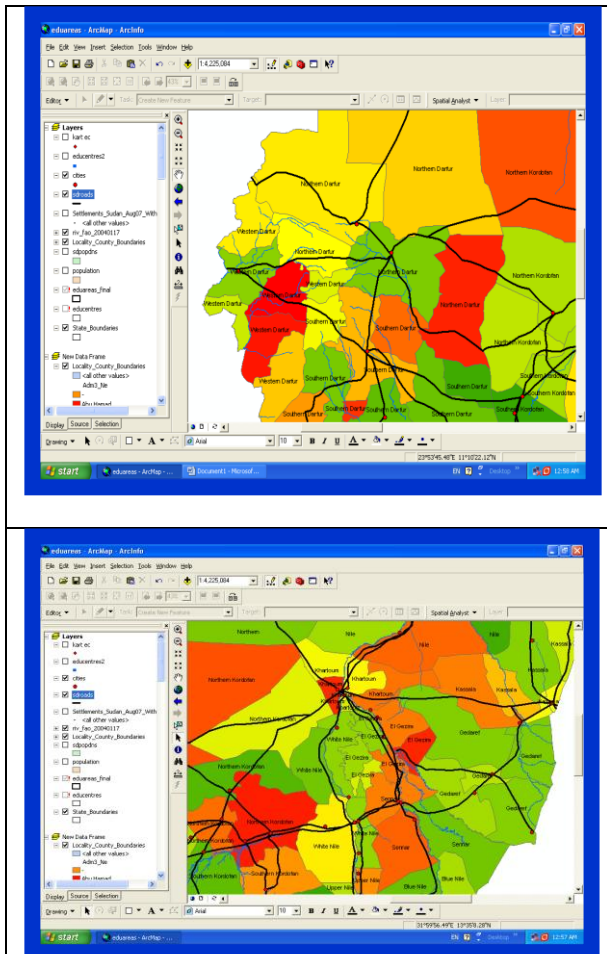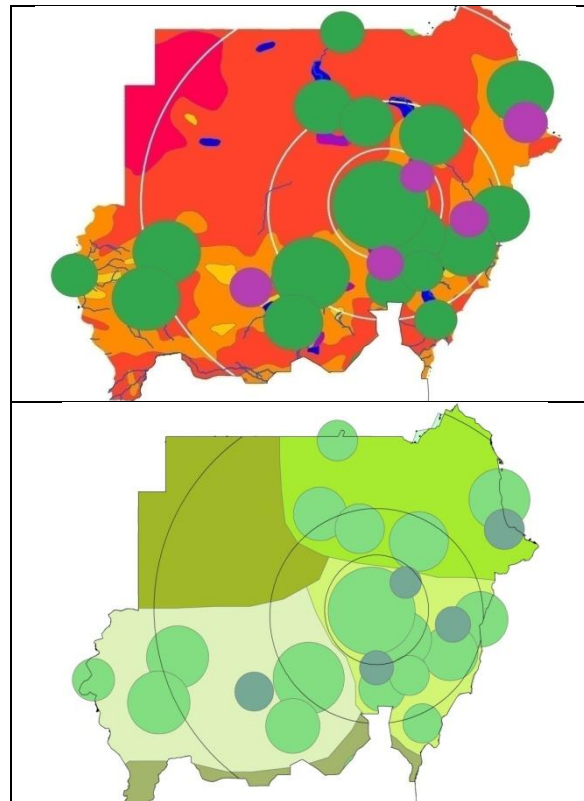
Fig (6) The socio cultural mosaic of TV viewers
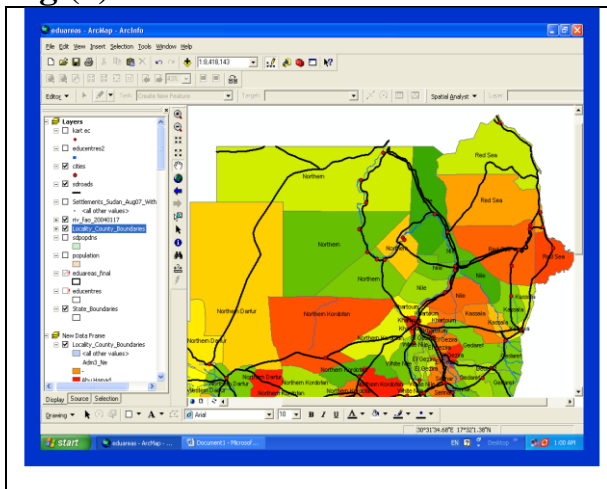
Fig (7) Coverage area by urban, population and geographical region characteristics

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