DIVERSITY INDEX ANALYSIS OF WATER SUPPLY FOR DOMESTIC PURPOSES TO ACHIEVE SUSTAINABILITY IN THE 12 LGA'S OF KATSINA SENATORIAL ZONE, KATSINA STATE

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ABSTRACT

This study is focused on the application of diversity index analysis in demography in the area of water supply for domestic purposes to achieve sustainability. Demographic analysis has received increasing attention despite its complexity and unresolved issues. Moreover, little is known in terms of the changing spatial differentiation patterns among distinctive communities. The study uses Nigerian population and housing census of 2006 data for 12 local government areas in Katsina Senatorial Zone, Katsina state. Shannon Diversity Index method is employed for the purpose of this study. The analysis bases on more diverse, diverse, and less diverse in terms of high and low quality water supply. The result shows that majority of local government areas in the zone are less diverse in qualitative water supply.

Keywords: Water supply, domestic purpose, *distinctive communities*

INTRODUCTION

The demographic and socio-economic structure in a population is a pervasive strength of a country. The uniqueness nature of Nigerian population which constitutes a multi-ethnic entity fascinated the idea to harmonize demographic and socio-economic variables for statistical analysis. Geo-demography is defined as an analysis of people by where they reside . This definition put emphasis on residence and its surrounding activities. Demographic characteristics influence human behaviour socially, economically and politically. In a geo-demographic analysis, census data is often used to model human interaction and way of life including strive to get portable drinking water. moreover such geo-demographic models consider geographical units such as blocks, district, LGAs or state as an independent isolated entity rather than as an entity surrounded by other geographic units with which it interact. *Economic water policy models have evolved in concept, theoretical and technical methods, scope and application to address a host of water demand, supply and management policy questions (Bookers et tal, 2012)*

Sustainable development on the other hand refers to development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It is therefore of immense important to consider feature generation especially in the area of water supply due to its vitality for human live.

The Sustainable Development Timescale

There have been researches, international conventions and conferences since the early 1960th that were aimed at ensuring sustainability in all spheres of developments among nations and states. The most recent, starting from 2000 are the UN millennium development goals which is the largest ever gathering of world leaders who agreed to a set of time bound and measurable goals for combating poverty, hunger, disease, illiteracy, environmental

degradation and discrimination against women, all to be achieved by 2015. In 2002, World Summit on Sustainable development was held in Johannesburg South Africa. Equally in 2005, the Kyoto protocol enters in to force by legally binding developed countries on goals for greenhouse gas emission reductions and the establishing of the clean development mechanism for developing countries (IISD, 2010).

The N*ational Aeronautics and Space Administration* NASA in 2006 made a report that; the ozone layer is recovering, due particularly to reduce concentrations of CFCs, phased out under the Montreal Protocol. There was also the emergence of more signs of ecosystem tress despite an earlier prediction that fish stocks could disappear in 50 years, scientist assert that sharks and bee colonies are also at risk (IISD, 2010). In 2008 marks the convergence of world food, fuel and financial crises, in the year global food prices increase to about 43% in one year, growing energy demand in china, India and elsewhere send energy prices soaring, financial institutions falter over the collapse of mortgage lending in the United State and markets tumble, sending the world in to recession (IISD, 2010). The promises made by G20 to phase out of fossil subsidies was stunted after experts estimated that annual subsidies could amount to $500 billion which is equal to 1 percent of world GDP (Global subsidies, 2008). Moreover, sustainable development is a global issue and is typically tackled in multilateral settings (Van den Brande, 2011).

MATERIALS AND METHODS

The method employed in the conduct of this research is the ENTROPY INDEX from the Shannon Diversity Index, (Shannon, 1948). This index can use more than two variables making it different from other traditional diversity indexes used such as Duncan and Duncan index (Duncan & Duncan, 1955). Moreover, it suits the context of this study for it allows analysis of different sources of water for domestic purposes. The 2006 population and housing census data were used in the index analysis. The index is viz;

$$SND= -\sum_{i=1}^{n} pi * \ln pi$$

Where i is the percentage of a source of drinking water relative to the number of sources (pi), (Inpi) is the natural logarithms of (pi) and is subject to the product of -1. The values of SDN start from 0. A zero value indicates a perfect homogenous distribution. Increase in the values of SDN suggests higher heterogeneity in distribution.

This index though previously used in ecological studies, is receiving an increased attention from demographers. It has also contributed in understanding how diverse various communities are, helping immensely to address social issues that could hinder peaceful co-existing among communities.

RESULTS

The results indicated that Batagarawa, Dutsinma, and Jibia are more diverse than the rest of Local governments with index values of 1.70, 1.95 and 1.96 respectively. Moderately diverse LGAs are Katsina, Danmusa, Rimi, and Safana with index values of 1.61, 1.62, 1.65, and 1.66 respectively. The less diverse LGAs include Kurfi, Mashi, Kaita, Charanchi and Batsari. Their respective index values are 1.05, 1.16, 1.32, 1.35, and 1.47 respectively.

Table 1: Shannon Diversity Index (12 LGAs of Katsina Senatorial)

LGAs	SD Indexes
Batagarawa	1.696
Batsari	1.47
Charanchi	1.347
Dan musa	1.62
Dutsinma	1.947
Jibia	1.964
Kaita	1.324
Katsina	1.609
Kurfi	1.049
Mashi	1.164
Rimi	1.648
Safana	1.661

Source: research analysis 2012

The descriptive statistics results shows on table 2 bring a mean value of 1.54, however the standard deviation results of 0.28 indicates that a value of 0.28 has deviates from the actual mean value that reflects the extend of dispersion from the mean. When a lot of the individual measurements are found far from the mean, then the dispersion is great (Matthews, 1981)

SD Indexes
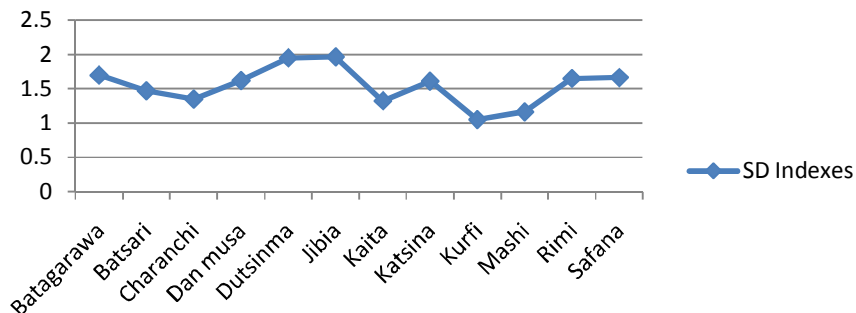
Figur 1. Shannon Graph of SD Indexes

Source: Research analysis 2012

Table 2: Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
F2	12	1.5416	0.28259	1.05	1.96

Source: research analysis 2012

DISCUSSIONS

The source of water supply for domestic purposes can be grouped in to qualitative and less qualitative. The qualitative sources from this study are PBID, PBOD and BOREHOLE. The less qualitative source include TS/WV, WELL, RAINWATER, R/S/S, D/P/L/D/P, and Others. The Diversity Index Analysis used in this research unveils a mean value of 1.54 describing a situation in which the distribution shows heterogeneity, meaning that there are multiple sources of water supply within the community, hence there is diversity in the sources of water for domestic purposes. However, the total qualitative water supply i.e PBID+PBOD+BOREHOLE amounts to 71,772 while the less qualitative source amounts to 313,686 which more than quadrupled the qualitative source.

It is apparent that majority of the populace are vulnerable to water born diseases. Most of the domestic water they used comes from source termed "less qualitative" with WELL source carrying a significant proportion. These sources could be contaminated and not to be drink for health wise, though with increased efficiency in the delivery and use, water for domestic purposes would have less herm to human beings (Rutherford & Finlayson, 2011).
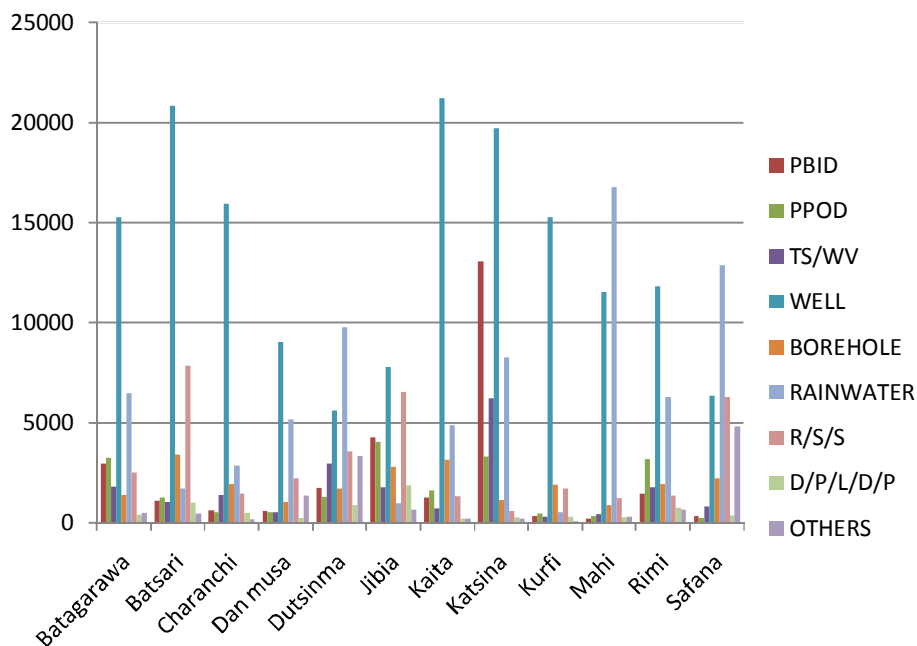

Figure 2. Distributions of Regular Households by Source of Water Supply for Domestic Purposes
Source: research analysis 2012

Table 3: HC9: Distribution of Regular Households by Source of Water Supply for Domestic Purposes

LGAs	Total	PBID	PPOD	TS/WV	WELL	BOREHOLE	RAINWATER	R/S/S	D/P/L/D/P	OTHERS
Batagarawa	34678	2958	3251	1836	15298	1404	6488	2526	420	497
Batsari	38765	1116	1292	1038	20834	3425	1708	7869	1007	476
Charanchi	25516	637	534	1410	15959	1946	2873	1468	505	184
Dan musa	20779	600	537	547	9051	1047	5157	2229	245	1366
Dutsinma	30939	1731	1319	2972	5609	1698	9783	3575	892	3360
Jibia	30778	4288	4048	1755	7805	2829	981	6543	1881	648
Kaita	34581	1256	1603	703	21217	3159	4905	1334	204	200
Katsina	52835	13076	3335	6214	19705	1131	8277	598	284	215
Kurfi	20970	351	470	328	15297	1912	527	1697	309	79
Mashi	32046	202	367	444	11544	892	16757	1212	305	323
Rimi	29180	1455	3168	1751	11845	1958	6259	1364	733	647
Safana	34391	342	219	839	6363	2216	12889	6308	376	4839

Sources: Population and housing census (2006)

CONCLUSION

The need to have qualitative water for human consumption should be given a due consideration if a successful sustainable development is to be achieved. First and foremost, a healthy community is hence attained that could undertake all spheres of human life. Manpower is needed both skilled and unskilled to man the administrative, political and economic developments which include the social aspect geared up to facilitated sustainable development.

The research therefore, gives a clue on how diverse the source of water for domestic purpose in the study area is. It is therefore going to be relevant to policy makers in decision making and implementation on general water supply and distribution among communities. The research on the other hand is limited in specifying only the diversity indexes, it does not include the socio-economic parameters, this research therefore suggest for further research to incorporate the socio-economic aspect of water supply for domestic purposes.

ACRONYMS

CFS =Chlorofluorocarbon
PBID = Pipe-borne inside dwelling
PBOD = Pipe-borne outside dwelling
TS/WV = Tanker supply/water vendor
R/S/S = River/Stream/Spring
D/P/L/D/P = Dugout/Pond/Lake/Dam/Pool

REFERENCES

Booker et al., (2012). "Economics and the Modeling of Water Resources and Policies." *Natural Resource Modeling* 25, 1: 168-218.

Chi, Guangqing, & Jun Zhu. (2008). "Spatial Regression Models for Demographic Analysis." *Population Research and Policy Review* 27, 1, 17-42.

Harris et al., (2007). "Neighborhoods, Ethnicity and School Choice: Developing a Statistical Framework for Geodemographic Analysis." *Population Research and Policy Review* 26, 5: 553-79.

MATTHEWS, & JOHN, A. (1981). *Quntitative and Statistical Approaches to Geography: A Practical Manual*. Edited by W.B. Fisher, Pergamon Oxford Geographies. U.K: Robert Maxwell, M.C.

Rutherfurd, I. A. N. & Finlayson, B. (2011). "Whither Australia: Will Availability of Water Constrain the Growth of Australia's Population?" *Geographical Research* 49, 3: 301-16.

Van den Brande et al., (2011). "Multi-Level Interactions in a Sustainable Development Context: Different Routes for Flanders to Decision-Making in the Un Commission on Sustainable Development." *Environmental Policy and Governance* 21, 1: 70-82.