Multidimensional Poverty in Sudan: An Empirical Analysis for the Case of Gezira State, 2021

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ABSTRACT

Poverty remains the most pressing socio-economic issue among all states in Sudan. Poverty is a multi–faceted phenomenon. This paper is set to investigate the persistence of multidimensional poverty among households of Gezira state, following the approach proposed by Alkire-Santos model made up of 10 components has been built and used as a means of analysing the data, education dimension presented on two indicators and also two indicators for the dimension of health, while the dimension of the standard of living expressed on six indicators, this model is called Multidimensional Poverty Index (MPI) this index is household-based index rather than an individual-based index. The research relies on primary data aided by structured questionnaires compiled by the staff of Central Bureau of Statistics (CBS), field work covering three localities, where around 57% of the households in the state live in these localities. A total of 756 households randomly selected make up for the data source upon which the research rests, the analysis of poverty decomposed by urban and rural location. The results indicated that 15.89% of the population under the study area are experience a multidimensional poverty, with deprivation equal or less than a third of overall three dimensions, present analysis shows decompositions reveal considerable disparity in MPI, rural areas present high levels of MPI than urban one, and the deprivation seem to be concentrated in all dimensions. Poverty in Janoob Al Gezira and El Hasaheisa localities due to the poor access to clean drinking water, access to improved sanitation, the use of clean cooking fuel, access to electricity and flooring material. El Managil locality presents the highest incidence of the MPI due to poor health. Janoob Al Gezira Locality faced severe deprivations in health of children as child mortality is widely spread among the poor population in urban areas and low level of education was to be found. The paper concludes with policy implications based on the findings that will help the government to identify the poor and where the poor people live.

Keywords: multidimensional poverty, measurement, Household, Sudan, Gezira State

1. Introduction

Eliminating poverty and needs are the focal aims of most nations in our world. Many institutions have committed to ending poverty and poorness by 2030. According to the Sustainable Development Goals, poverty specifically mentioned as multidimensional feature (Alkire, 2018), several methodologies has been developed to assess this problem, Alkire-Foster method is one example used worldwide (Alkire & Foster, 2011), the method adopted nationally by many bodies to calculated Multidimensional Poverty Index (MPI) for different purposes to regions and sub- regions or to groups and sub-groups. Poverty in Sudan affected over a third of its population and 18.3% of the population of Gezira State, where this study rests, are poor. Moreover, the poverty gap ratio (depth) at 1.1% and the poverty gap (severity) at 2.7% according to the African Development Bank Group (2018). The Oxford Poverty and

Human Development Initiative (OPHI) assesses the national MPI for Sudan, the value is 0.279 and for Al Gezira State is 0.167 (OPHI, 2020).

This research tries to answer the questions: what are the factors associated with population deprivations in Gezira state? How unbalanced development leads to disparities among sub-regions and sub-groups? Which locality is the most deprived? And what is the main contributor to multidimensional poverty? The main objective of this study is to calculate the MPI for Gezira State. The specific objectives are to empirically analyse poverty decompositions by urban and rural location, to calculate the MPI by localities and to assess the contribution of factors to MPI. To do this the researcher is set to test the validity of the following working hypotheses: population under the study area experiences multiple deprivations, development in Gezira State is unbalanced, MPI in urban areas lower than rural areas and income poverty will be the main contributor to MPI.

The present study introduces the Alkire-Foster measure that built on the Foster-Greer-Thorbecke index, to explain multidimensional poverty in Gezira State, it focuses mainly on multidimensional poverty in three localities namely, Janoob Al Gezira, El Hasaheisa and El Managil. Primary data compiled by the Central Bureau of Statistics (CBS) on poverty-related indicators for the year 2021.

2. Literature Review

2.1. The Concept of Multidimensional Poverty

What is poverty and how to measure it? No clear answer, the term of the multidimensionality of poverty comes into the ground due to limitations for individuals to define poverty, the limit on all aspects of life (Bourguignon & Fields, 1997; Maleta, 2006; Castro, 2010). The justification to examine poverty from a multidimensional view is because poverty shows different shapes of deprivation in major principles of life, and it refers to pronounced deprivation in one or more facets of the well-being of a person. Furthermore, multidimensional methods offer another guide to explain poverty and how it can be viewed and understood (Alkire & Foster, 2011).

The sustainable development goals accepted as multidimensional phenomena (Alkire, 2018). The agreement on poverty is multidimensional concept has been guided to many others researchers to develop the approach created by Alkire-Foster, this is approach is the most widely used worldwide (Alkire & Foster, 2011), and applied, for example, the OPHI and the United Nations Development Program' Human Development Report Office calculated the MPI globally for comparable measure purposes from one hand, from another hand to help policy makers to reduce poverty. Later, acute multidimensional poverty was computed for above 100 developing nations and updated annually. In a similar line, the World Bank (2017), also uses this method for its specific multidimensional poverty measures. In October 2018 World Bank launched its own method (World Bank, 2018). In addition, some countries have shaped national MPIs as official eternal poverty data, familiarising the technique to their own situation and national concerns.

2.2. Multidimensional Poverty in Sudan

The republic of Sudan is one of the largest countries in Africa, bordered by nine countries, the socio-economic condition has changed dramatically during the past few decades, none the less the nation has been classified as a developing country and failed to achieve the Millennium Development Goals (MDGs) buy end of 2015. Poverty is very widespread in

Sudan (IMF, 2013), analysis of multidimensional poverty by Balloon & Duclos (2015), based on National Baselined Household Survey (NBHS) data conducted in 2009 by the CBS', the results showed high incidence rate of MPI at 49% also a significant state and sub-groups dissimilarities in measuring multidimensional poverty at the individual level and all findings of their study proved higher rates of incidence in all poverty dimensions measures, moreover, the number of poor population in rural areas is higher than in urban areas. Similar finding proved by (Hillo, et al., 2016), found almost half of the Sudan' population is living under poverty line.

The African Development Bank Group (2018), calculated the global poverty prevalence in the Sudan the figure at 36.1% and about 25 percent of its population is extremely poor. The OPHI (2018), stated that the deprivations in standard of living found to be main contributor to MPI in Sudan. A study by World Bank (2018), showed that, the lack of access to basic services is the key deprivations, not only in the all Sudan' regions, but also throughout Sub-Saharan Africa countries.

According to OPHI (July 2020), the global MPI in Sudan is estimated at 0.279 and also computed by sub-region urban and rural which the figures stated at 0.122 and 0.351 respectively. Same study on multidimensional poverty in Sudan conducted in 2021 by Mohmed & Hysum (2021), used the multidimensional poverty approach to assess poverty in Gedaref State and found 47% of the populations are multidimensional poor. Recently, Development Initiatives (2021), examine poverty globally and the result occurred that the extreme poverty increased in most countries around the developing countries especially in Sub-Saharan Africa region that is living on less than $1.90 a day, in the Sudan the number of people living in extreme poverty increased by 0.3 million between 2010 to 2021.

3. Data and Methodology

The MPI classifies many lacks in the same households in the three dimensions. Ten indicators built The MPI, two indicators stand on education and two indicators stand on health, while the six indicators construct the standard of living dimension. All of the indicators should be taken from the same household survey. The next step weighs the indicators and computing the deprivation to set the scores for households individually in the same survey. A cut-off of *33.3* % is used to differentiate between poor and non-poor, the household and all persons are multidimensionally poor if the deprivation score is *33.3* % or greater. Likewise, households are at danger of being multidimensionally poor if the deprivations score equal or greater than *20* % and lower than *33.3* %.

3.1. Aggregation Stage

The three dimensions made up the MPI express by ten indicators, each indicator means a minimum level of satisfaction, generally based on international standards, such as the eight MDGs of the United Nations for example, this minimum level of satisfaction is named a deprivation cut-off (United Nations, 2016). In order to calculate the MPI two steps are then followed to find it.

Step 1: Everyone is measured depending on family achievements to determine if he or she is below the deprivation cut-off in each indicator. A person under the cut-off is considered deprived in that indicator.

Step 2: The deprivation for everyone is weighted by indicator's weight, everyone is considered to be multidimensionally poor if the sum of the weighted deprivations is *33* % or above of probable deficiencies.

3.2. MPI Mathematical Structure

The MPI is the creation of two numbers, the poverty headcount denoted by (H) and the Average Intensity of deprivation denoted by (A), this most valuable because it reflects the ratio of dimensions in which households are deprived. Also the technique has the mathematical structure of one member of a family of multidimensional poverty measures. This member of that family is named M_0.

Where, M_0: an adjusted head count ratio reflects both incidence and intensity of poverty.

Selection of dimensions: M_0 measures poverty in d indicators across all people n. It is important to mention that in the multidimensional framework, distributional data are presented in the formula of a matrix of size $n \times d$. $X^{n,d}$, in which the typical component x_{ij} parallels the attainment of person i in dimension j , with $i = 1,...,n$ and j $1,...,d$. vector x_i contains attainment of person i in the d indicators.

That means, row i of X represents the attainment vector of person i, summarising the person's attainment in all d indicators. Moreover, column j of X represents the vector containing the attainment of all n persons in indicator j.

The supreme common methodology for classifying the poor in the multidimensional framework is to first state a threshold level for each indicator j, below which a person is considered to be deprived. The assortment of these thresholds can be conveyed in a vector of poverty lines $z_j = (z_1,....z_d)$ or $x_{ij} < z_j$, which we refer as the deprivation cut-off of indicator j. the deprivation cut-offs are shortened by the deprivation cut-off vector z. In this way, whether a person is deprived or not in each indicator can be defined. Next judgement is to be made, between those who fall short in some indicator, who is to be considered multidimensionally poor.

A usual opening point is to set all those deprived in at least one indicator, the so named union approach. Other more challenging standards can be used, even to the risk of needful deprivation in all considered indicators, the so-called intersection approach.

In the case of the MPI, as mentioned earlier, most of the deprivation cut-offs are based on the internationally agreed standards, as presented in Table 1. When designing a national measure, different cut-offs may be set based on present policy priorities that exist in the country and who is considered to be deprived or non-deprived agreeing to the nation.

Table 1.
The Dimensions, Indicators, Deprivation cut-offs and Weights

Dimensions	Indicator	Poverty Cut-off	Related to…	Weight
Education (1/3)	Years of education (1/6)	No member of the household has done 5 years of education.	MDG2	16.67%
	Child staffing (1/6)	Any child school-age is out of school in years 1-8.		16.67%
Health (1/3)	Child death (1/6)	One child at least has died in the household in the last 5 years.	MDG4	16.67%
	Food (1/6)	Any child or adult for whom there is nutritional data is undernourished.	MDG1	16.67%
Standard of living (1/3)	Electrical energy (1/18)	The family has no electrical energy.	-	5.56%
	Better hygiene (1/18)	The family's hygiene ability is not better or it is public.	MDG2	5.56%
	Better-quality drinking water (1/18)	The family does not have access to better drinking water, waking up 30 minutes from home-based, roundtrip.	MDG7	5.56%

Flooring (1/18)	The household's ground is dirty, sandy or dunging.	-	5.56%
Cooking gas (1/18)	The family cooks with charcoal, wood or dung.	MDG7	5.56%
Assets (1/18)	The family does not own one of: receiver, television, phone, bicycle, motorcycle or freezer or does not own a car or tractor.	MDG7	5.56%

3.3. Components of the MPI

1) Schooling: the MPI has 2 indicators that balance each other in the schooling element, one focuses on finished years of schooling of family participants, the other at if children are going to school. Years of schooling acts as a proxy for the level of knowledge and understanding of the household members. The deprivation cut-offs for this dimension, the MPI, requires that one member at least in the household has finished 5 years of education and that all children of school-age are attending grades 1 to 8 of school.

   Some important things to mention with the practice of constructing this indicator, sometime occurred that someone living with a family and there one member at least found 5 years of education is stated non-deprived, even though he/she may not be educated. Likewise, someone living in a family and there is one child at least not attending school is stated deprived in this indicator, even though he/she might have finished schooling. Again, members are living in one house where no school-aged children are stated non-deprived in school attendance. Henceforth the rate of deficiency in this indicator will reveal the demographic structure of the family and nation, as well as the educational achievements.

2) Health: the MPI has two health indicators, food of family members and adults or children who are malnourished. A child is under-weight if he/she is two or more standard deviations below the median of the reference population. Noting that, the global MPI does not state adults or children that are overweight as poor in nutrition, unless he/she is malnourished.

   The second indicator uses data on child death. Generally, child deaths are preventable, being caused by infectious disease or diarrhoea. Child malnutrition also contributes to child death. In the MPI each household member is considered to be deprived if there has been at least one observed child death (of any age) in the household. It is important to observe that this indicator differs from the standard mortality statistics.

3) Living Standard: this indicator provides some fundamental indication of the quality of housing for the household these are: access to better-quality drinking water, access to better hygiene and the use of clean cooking gas, access to electricity and flooring material.

   The indicator covers the ownership of some consumer goods, each of which has a literature describing them: receiver, television, phone, bicycle, motorcycle or freezer or does not own a car or tractor. The cut-offs for each one can be determined according to the nature of the country under study, the assets index of the MPI by default is the same for all countries, it is relative cut-off rather than an absolute cut-off for, and rarely used for comparable purposes across countries or across time. Also prices have been difficult to use to build the asset index as the surveys lack information on the price, quality or age of assets. Clearly, all the living standard indicators are means rather than ends, some of the common classification that has been identified as follows:

- Water: water for family needs do not include vendor-provided water, tankers trucks or unprotected wells and springs, if the water source is/or piped water, public tap, borehole or pump, protected well, protected spring or rainwater and it is within a distance of 30 minutes' walk (round-trip) a family is not poor in this term of drinking water. If it fails to satisfy these conditions, then the household is considered deprived of access to water.
- Hygiene: if the household has some type of flush toilet or latrine, or ventilated improved pit or composting toilet, a person is considered to have access to improved hygiene, provided that they are not shared, otherwise, it is considered deprived of hygiene.
- Electrical energy: if a person does not have access to electricity it is considered to be deprived here.
- Flooring: if the floor material is dirty, sandy or dunging counts as deprivation in flooring.
- Cooking gas: a household is measured deprived of cooking gas if no gas is available, it cooks with dung, charcoal or wood.
- Assets: if a household does not own at least one receiver, television, phone, bicycle, motorcycle or freezer or does not own a car or tractor then each person in it is measured poorly.

Table 2.
Definitions of Cut-off Points for each Dimension Employed by the Empirical Model

No.	Dimension	Cut-off Points
1	Years of schooling	No one has completed at least 8 years of schooling.
2	Child status	At least one child, age 7-14, is not currently enrolled in school.
3	Child death	One or more children have died in the last 5 years.
4	food	At least one member is malnourished.
5	Electricity	No electricity.
6	Hygiene	No access to improve hygiene.
7	Safe drinking water	If the water source piped outside the house.
8	Shelter	Household lives in a mud house or hut.
9	Cooking gas	The household cooks with dung, wood or charcoal.
10	Assets ownership	None of these assets: receiver, television, phone, bicycle, motorcycle or freezer or does not own a car or tractor.

3.3.1. Case Study: Gezira State

Gezira State has a total area of 27,549 km^2 with population 3,575,280 persons, the second most populous after Khartoum state, about 9.1% of total population of Sudan, see Table 3. Administratively, the state is divided into 7 localities, Sharg El Gezira, El Kamlin, El Hasaheisa, Um Algora, Wad Madani Alkobra, Janoob Al Gezira and El Managil with 40 administrative units.

Table 3.
Population by Localities

State's Localities	Population	
	Male	Female
Sharg El Gezira	217,795	245,359
El Kamlin	201,488	200,442
El Hasaheisa	291,544	314,845
Um Algora	104,101	114,377
Wad Madani Alkobra	213,429	210,434
Janoob Al Gezira	265,078	290,172
El Managil	430,895	475,321
Total	1,724,330	1,850,950

Source: Estimate from NBHS 2014-2015.

3.4. Data Source

Primary data had to be analysed to test the hypotheses relating to the objectives of the study. According to NBHS 2014-2015 the total population size in Gezira State is 3.6 million, 1.77 million males and 1.80 million females and 589 thousand households, the average size is 6 persons. This study attempts to examine the poverty in Gezira state, relies on primary data on education, health and standard of living, field work cover three. The state consists of seven localities, each locality consisting of a number of administrative units, which are similar in terms of demographic characteristics and economic activities. Table shows the details of it.

3.5. Sample Design and Sample Selection Procedures

To draw the sample size of the study a two stage cluster sampling design was employed in each locality. The groups were distributed to urban and rural areas, proportional to the size of urban and rural populations in the localities. In the case of rural areas we choose the villages and *alhai* in the case of urban areas, they hence constitute the primary sampling unit. Random selections to the urban and rural clusters in each administrative unit were with the probability of selection proportional to size.

The sample size for the survey was determined by the accuracy and degree of precision required for the survey assessments for each administrative unit. The number of households selected within each village or town (*alhai)* was determined keeping in observation the study objectives. It was accepted that for estimations at national level, it would be more effective to have proportional distribution of the sample to the national state based on its approximate population. Given the large variability in the population by locality as well as cost of field operation, it was decided to select three localities, namely: Janoob Al Gezira, El Hasaheisa and El Managil. The rationale behind this choice may be summarised as follows:

a) According to the distribution of the households by localities, as given in Table 4, we observe that 57% of the households in the state live in these localities.
b) The administrative units of the three localities constitute *55*% of the localities in the state as shown in Table.
c) Consideration related to geographical accessibility and the transportation and communication constraints. .
d) Considerations related to time and cost of data collection.

Table 4.
Distribution of Household by Locality in the Gezira State

| Locality | No. of Adm. Units | % | No. Households | |
			Size	%
Wad Medani Alkobra	6	15	69008	12
Janoob Al Gezira	7	18	86618	14
Sharg El Gezira	5	13	80915	13
El Hasaheisa	7	17	102447	17
Um Algora	3	7	39217	6
El Kamlin	4	10	71304	12
El Managil	8	20	154690	26
Total	40	100.0	604199	100.0

Source: NBHS 2014-2015.

Table 5, summarises the administrative structure and households' distribution of selected localities, each of which is divided into rural and urban. Within each administrative unit, there are many residential clusters, which are called villages in rural areas and *ahia* in urban

areas. Based on the administrative structure and distribution of households given in Table 3.2, the study sample was drawn.

Table 5.
Distribution of Administrative Unites and the Number of the Households in Selected Localities

Locality	No. of Urban/ Rural			No. of Households			
	Alhi	Village	Camp	Urban	%	Rural	%
Janoob Al Gezira	16	418	178	2408	6	90134	30
El Hasaheisa	56	359	190	17118	39	83947	28
El Managil	79	416	280	23710	55	127326	42
Total	151	1137	648	43236	100	301407	100

Source: NBHS 2014-2015.

3.6. The Study Sample

The cartographic work from the 2008 National Population and Housing Census were used as a sampling frame and hence the census constituted the primary sampling units. The sample did not include nomadic population due to lack of a proper sampling frame for them and problem of accessibility. Also institutional households, camps etc as well as the homeless part of the population were excluded from the sample; this will be the first sample stage.

A second sample stage will be conducted by listing all households within the selected in the sample unit. From the Table we observe that rural households dominate, constituting 87% of total households in the selected localities, compared to 13% in urban areas. Because of this variation, the sample of households will be drawn from all rural and urban, using the multistage stratified random sampling method. A representative village is selected randomly from each stratum. Though, due to small numbers of households in these villages, each village is state as a residential group on its own.

In the urban areas, where there are big numbers of households, a two-stage sampling procedure was adopted. In the first stage, the housing areas were divided according to population size. Thus two levels were defined, namely high-density populated areas, this area count above five hundred households and low density populated areas count five hundred households and below. From each level, housing groups (*ahia*) were selected randomly in proportion to the number of administrative units in that level. To ensure adequate representation of both urban and rural areas, the researcher excludes all administrative units that are classified as a rural area, the others are randomly selected.

3.7. The Sample Size

In order to having a random and representative sample, in addition to provide good geographic coverage, the households' sample size is determined on the base of the following equation, given by:

N=P(1−P)Z^2/D^2

Where:
N: the sample size.
P: the prevalence of the phenomena in the population under study.
(1-P): being the probability of failure.
Z: the critical standard value corresponding to the 95% confidence level.
D: the degree of precision.

For the calculation of the sample size, at 95% confidence interval (*D*) is assumed to be 5% level of significance of the true value, as such (*Z*) is equal to 1.96. Based on a previous study, the NBHS (2014-2015), about 46.5% of the Northern Sudan' population is found below the national poverty line, at that time the poverty line was 113.8 SDG per person per month. Therefore, the estimated population proportion (*P*) is set at 0.46, setting (*D*) = *0.05*, using these values into the above equation, we obtain the sample size of 378 households.

In order to increase precision, which might be lost as a result of adopting a multi-stage random sampling method and allowing for some non-response in the survey, we multiply the sample size by the design effect factor, which is equal to 2, so that the final sample size drawn from the population under study approximately a total of 756 questionnaires were administered to households while a total of were administered to healthcare providers and teachers staff. This sample size was a geographically stratified random sampling procedure. Only 73 respondents of the selected sample had not fully responded, where 683 had actually fully responded in terms of respondents' age and interview duration as well. Which in turn reflect their poverty, however, all the questionnaires collected from healthcare providers and teachers staff were used for analysis.

The total sample of households is selected on the basis of the cluster sampling methods and will be distributed between administrative units of the study area according to the probability proportionate to the population size in each unit. In cases where a selected village could not be reached because of unsafe or access difficulties, it was changed by a nearby village in the sampling framework. Not all groups has been selected were fully covered after a household listing was carried out, due to people claim resulting on lifting government subsidies on fuel and rains and floods damaged reflect in response of people to provide information regard some question in the questionnaire shows that the urban population makes up about 15% of the study sample, it means approximately 15% = 114 of households were drawn from *alhi* and 85% = 642 were randomly selected throughout villages.

3.8. Questionnaire

Two sets of interviewer-administered questionnaires were used to obtain data for the study. The first set was administered to households while the second to healthcare providers and teachers. The data include a range of household well-being issues collected through interviews, using structured form with the head of the family or other educated members. The questionnaire administration was sectional in nature, It investigates households' financial, social and demographic data.

The form modules designed by expert team of OPHI, the data will be collected associated with CBS' staff located in Wad-Medani. The sample design follows two-stage stratified sampling. Two questionnaire forms are to be designed, in order to get accurate data and minimise bias, the questionnaire prepared in Arabic language. The first is the household questionnaire, referred to as the core sample questionnaire structured to elucidate data and information necessary to construct the MPI for the state, and was administered in ~ 30 minutes per household.

Overall time management is left to the enumerator staff, as many factors will determine how many villages and *Alhai* can be surveyed per day depending on the distances between houses. All the respondents are in good health and in age between 16-65 years old, therefore, this study did not try to distinguish men and women. However, local conditions, weather, road quality and other factors will determine which houses have been randomly selected.

The household-level information will be based on the definitions of the MDGs, which are often important for assessment of health deprivation. To do this, information will be collected in relation to MDGs 4, 5 and 6 or nutritional status pertaining to MDG 1 is required. Deprivation relating to housing characteristics was assessed using indicators: electricity for lightening, sanitation and quality material for flooring.

The questionnaire is divided into two main sections. Section (1), at the top of the household questionnaire, for basic demographic information is referred to the respondent and the head of the family (overview). The questions in this section relate to variables such as the head of the household's age and gender, respondent's age and gender and married status of the household' head.

Section (2) is meant to collect data on a household's income by source. Section (3) relates to information on a household's expenditure by item, including expenditure on food, housing, source of fuel, clothing, education, medical treatment. Section (4) is devoted for questions related to some poverty correlates, these include house characteristics such as tenure status, kind of cooking gas or none, type of electricity energy or none, source of improved drinking water. Section (5) includes questions related to ownership of valuable assets, which may provide information on variables other than income and expenditure that could influence households' standard of living.

The questionnaire is interviews with CBS Wad Medani office staff, each respondent is an adult household member. Random sampling technique will used because of the homogeneity of the household's socioeconomic characteristics within each study area, done by random selection by villages from each locality, followed by random selection of household in each village within a multi-sage type of sampling (the sample selected based on a stratified two stage sampling procedure), this will be done in rural area. In urban areas the same procedure was used to select the households from *alhi*.

The second is a community questionnaire including access to services. Field work began on 30 September to 9 of October 2021. The questionnaire was used as a research instrument to support seven enumerators employed to collect data from the households identified for this study under the supervision of the director of CBS in Wad Medani town. The data collection involved 756 household interviewers, and village/town healthcare officials/employee and educational leaders and supervisors. Respondents were requested to give personal information such as their sex, age, educational achievement and marital status, data coding and processing presented in Table 6.

Table 6.
Binary Scoring Indicators/ Poverty Cut-off

Indicator	Definition of Indicator
Years of Schooling	1 if any member uncomplete 8 years of schooling; 0 otherwise.
Child Status	1 if any child, age 7-14, not enrolled in school; 0 otherwise.
Child death	1 if any child has died during past 5 years; 0 otherwise.
Food	1 if any child/adult household's member is malnourished; 0 otherwise.
Electricity	1 if the electricity is not available; 0 otherwise.
Hygiene	1if the household doesn't use a flush toilet or shared; 0 otherwise.
Drinking water	1 if the water source piped outside the house; 0 otherwise.
Shelter	1 if the house is built with mud; 0 otherwise.
Cooking gas	1 if the household has no gas; 0 otherwise.
Assets	1 if the household doesn't have a refrigerator or television and doesn't have bicycle, car or tractor; 0 otherwise.

4. Results and Discussion

A total (756) of households was interviewed, (114) for urban areas and (642) for rural areas. Only (8) of the urban households have not completed the questionnaire and (60) of rural households with unavailable information. Our final sample size contains (688) households; these were analysed using Statistical Package for the Social Sciences software and a number of statistical analysis techniques were employed to identify the methodology indicators. The results presented to urban areas and rural areas separately, the researcher could reach the following findings. Of these, about 79% in rural areas do not live in houses with improved floor material, 13% use unimproved cooking fuel and approximately 84% do not have improved hygiene facilities.

By contrast most of the houses are electrified but most households also have no assets, such as a phone, television and motor vehicle about 34%. A large percentage of the subjects were literate as only 43% had completed their primary education and 17 % completed higher education in this regard. The result is better off for male 31% had completed their primary education and 36 % completed higher education. About 16% of them are malnutrition with child mortality more than 47%.

For urban areas where the health indicators show that child mortality is about 50 % within the past five years and only 6.6% are malnutrition. 19% of females are illiterate, 47% had completed their primary education and 25 % completed higher education. About 13% of male are illiterate, 33% had completed their primary education and 42 % completed higher education. About 63% live in houses with improved floor material with electricity supply 100% to all population, 81% live in households with access to safe water inside the house. About 63% of them lived in households where the hygiene facility was shared and not improved and only 26% had a car/tractor or bicycle.

Table 7, 8 and 9 show the values of deprivation indicators that constructed the MPI, for El Hasaheisa Locality, Janoob Al Gezira Locality and El Managil Locality respectively. The 10 indicators are equally weighted, and several features stand out. The study outcomes indicate that there are remarkable variations among groups in terms of present condition in respect to all over the research method indicators. Moreover, incidence of deprivation across indicators and according to regions registered different values. The figures below present the composition of poverty to the three localities, data presented in Figure 1 and 2 for El Hasaheisa rural and urban areas, Figure 3 and 4 for Janoob Al Gezira rural and urban areas and Figure 5 and 6 for El Managil rural and urban areas.

Janoob Al Gezira Locality faced severe deprivations in health of children as child mortality is widely spread among the poor population in urban areas and low level of education was to be found. Some exceptions include electricity and cooking fuel. Individuals without education tend to be poorer and have poor sanitation facilities as well in El Hasaheisa rural area; the result of El Managil locality presents the highest incidence of multidimensional poverty and reveals interesting differences among rural people.

The study proved the validity of the first hypothesis, the structure of poverty among the poor among locality groups. About 15.89 % of the population under study lived in multidimensional poverty, with deprivation at a third of the dimensions of health, education and standard of living. Researcher plots the Figure 7 which shows the different values of the MPI of the localities.

Another result of the present analysis esteems the disparities between the urban and rural, rural areas present high levels of MPI, the main contributor to total multidimensional poverty is the values of rural areas as much as in urban areas. Sub-regional corrosions are very

valuable as they clearly tell the current disparity in poverty within a state and show the need for varied policies within a country, however, decomposition by rural/urban is adding further insights. The result of localities presented in Figures 8. Therefore, without any exception, in rural and urban areas the deprivation seems to be concentrated in all dimensions. The higher contribution to MPI of the standard of living dimension also results elsewhere.

For instance, deprivations in electricity, energy, hygiene and cooking gas, contribute most to the poverty of El Hasaheisa locality, with high concentration of deprivation in schooling because of their low education levels. Health dimension in terms of malnutrition and child mortality contributes relatively little to poverty. The Figure describes the behaviour of the dimensional that the most prevalent deprivations are the low level of living standard while the health dimension contributes less to poverty than education contribution. According to graphs major differences were observed. The standard of living in rural Areas presents a high contribution to poverty, and better health situations clearly appear in the area. On the contrary, insufficient education in terms of school attendance and child enrollment appear to contribute significantly to poverty.

The contributions of standard of living and education on poverty are quite equal and both are higher than health contributions. Poverty in Managil also reveals interesting differences among rural areas and the result of El Managil locality presents the highest incidence of multidimensional poverty. And the deficiencies appear to be more scattered in the dimension related capabilities such as, drinking water source, electricity energy, shelter and hygiene. This reveals interesting differences among urban areas, standard of living is the main contributor to multidimensional poverty, almost 57% in rural areas and 48% in urban areas, this is somewhat surprising given improvements in households.

5. Conclusions and Recommendations

The present paper provides an analysis of poverty in Gezira State, as a topical issue to sustainable development as well as targeting alleviation of poverty as a highly rated development objective and perhaps a critical one for our study area. We were account the MPI for rural/urban areas and for all-over state relies on primary data which covers a broad spectrum of socio-economic parameters based on three Gezira State localities. The value was computed is significantly high, about sixteen percent of population under the study area lived in multidimensional poverty, with deprivation at least a third of the dimensions of health, education and standard of living. The standard of living dimension considered the main contributor to poverty, El Managil locality presents the highest incidence of the multidimensional poverty, the current status in regard to most these indicators are far from being satisfactory. The study conclusions are summarised as follows: about sixteen percent of populations are multidimensionally poor, El Managil locality proves higher value of MPI, and the MPI value in rural areas is significantly higher than in urban areas and mainly contribution to MPI comes from deprivation in the standard of living.

The study recommendations are outlined: equitable and balanced development is a top priority for eliminating poverty; paying attention to rural areas, government should create official multidimensional poverty indicators, increasing expenditure on education and health; implement programs designed to fight illiteracy, build more schools and hospitals and providing school meals, rehabilitate the health system infrastructure, by national program support for the malaria, tuberculosis including provision of drugs and laboratory supplies and focus on maternal and newborn health, treatment children with severe acute malnutrition.

Table 7.
MPI Indicators of Deprivation for El Hasaheisa Locality

Domain	Dimension	Urban Area	Rural Area
Education	Years of Schooling	29.17	37.82
	School Enrolment	7.29	0
% of MPI		36.46	37.82
Health	Child Mortality	7.29	10.61
	Nutrition	13.37	7.00
% of MPI		20.66	17.61
Standard of Living	Electricity	0	1.14
	Hygiene	11.34	14.56
	Improved drinking water	4.86	0
	Shelter	11.34	13.55
	Cooking gas	1.62	1.01
	Assets ownership	13.78	14.29
% of MPI		42.94	44.55
Total MPI		6.29	13.30

Table 8.
MPI Indicators of Deprivation for Janoob Al Gezira Locality

Domain	Dimension	Urban Area	Rural Area
Education	Years of Schooling	20.00	30.47
	School Enrolment	0	0
% of MPI		20.00	30.47
Health	Child Mortality	40.00	4.37
	Nutrition	0	14.63
% of MPI		40.00	19.00
Standard of Living	Electricity	0	1.71
	Hygiene	13.34	13.73
	Improved drinking water	0	1.10
	Shelter	13.34	13.73
	Cooking gas	0	7.04
	Assets ownership	13.34	13.22
% of MPI		40.01	50.53
	Total MPI	8.77	15.43

Table 9.
MPI Indicators of Deprivation for El Managil Locality

| Domain	Dimension	Urban Area	Rural Area
Education	Years of Schooling	16.80	21.07
	School Enrolment	6.11	1.11
% of MPI		22.91	22.18
Health	Child Mortality	39.72	29.83
	Nutrition	16.80	18.05
% of MPI		56.52	47.88
Standard of Living	Electricity	0	1.64
	Improved Sanitation	9.93	10.23
	Improved Drinking Water	0	0.35
	Shelter	8.91	9.82
	Cooking Fuel	0	1.11
	Assets Ownership	1.78	6.79
% of MPI		20.62	29.94
	Total MPI	8.87	19.76
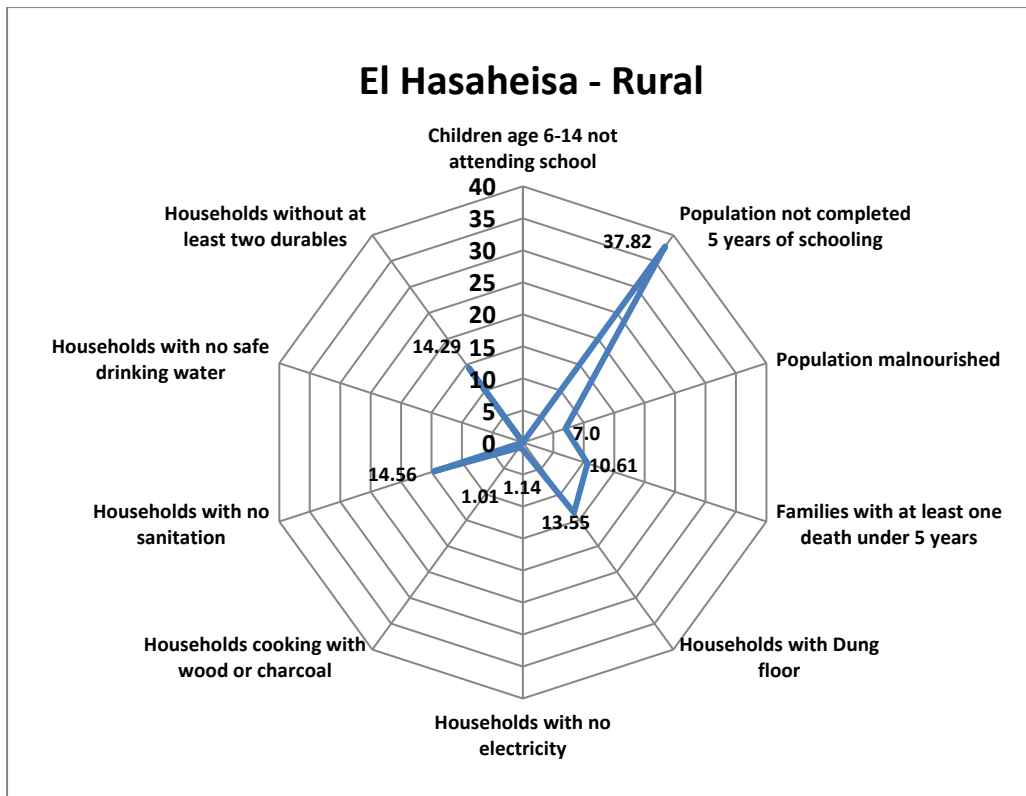
Figure 1. The Contribution of Indicators to Rural El Hasaheisa Locality
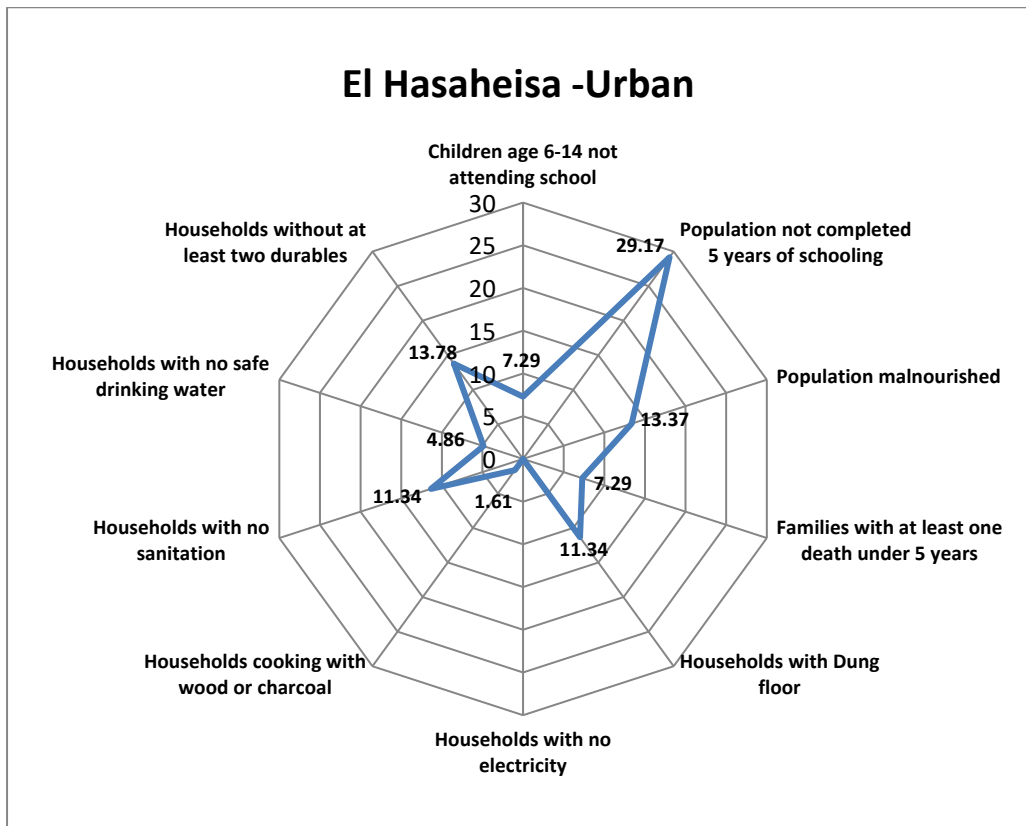
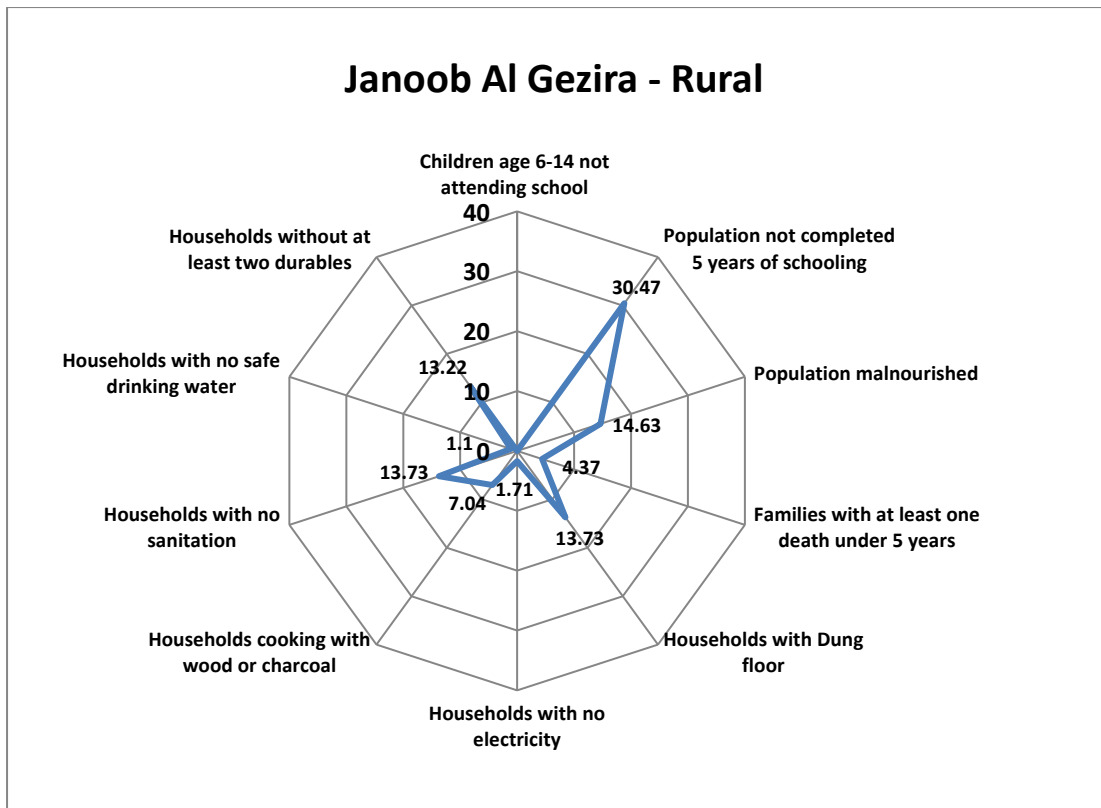*Figure 2.* The Contribution of Indicators to Urban El Hasaheisa Locality

Janoob Al Gezira - Rural

Figure 3. The Contribution of Indicators to Rural Janoob Al Gezira Locality
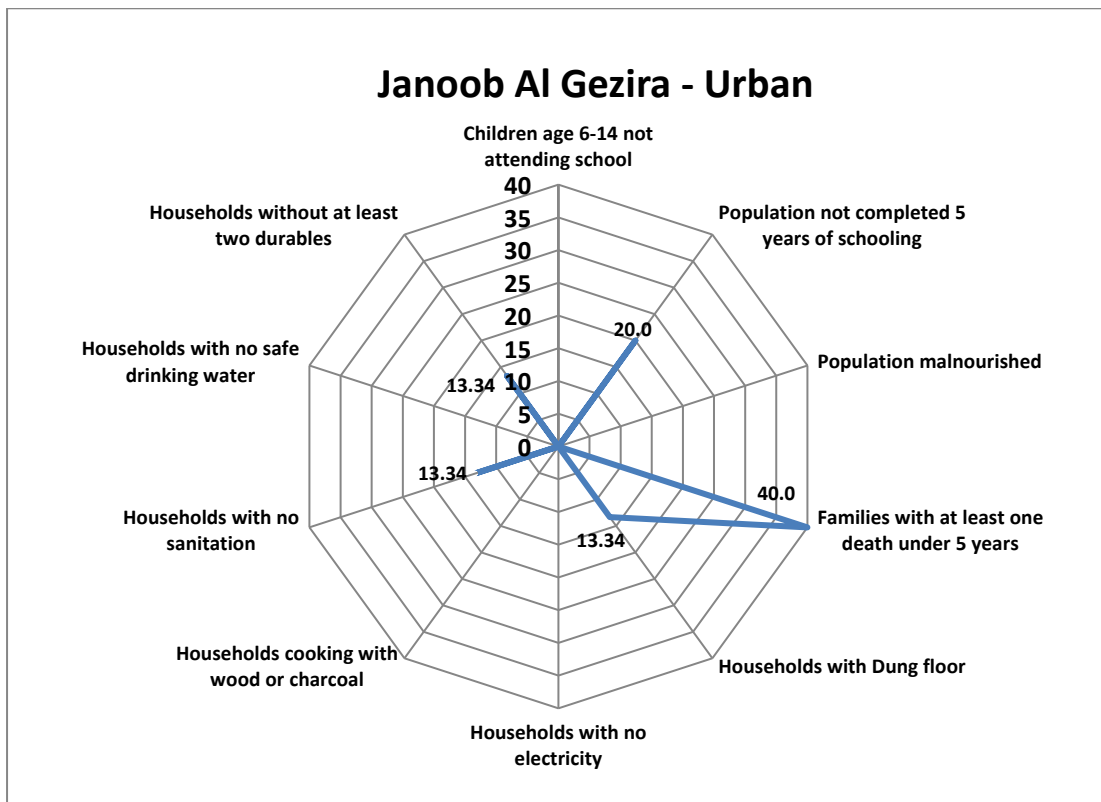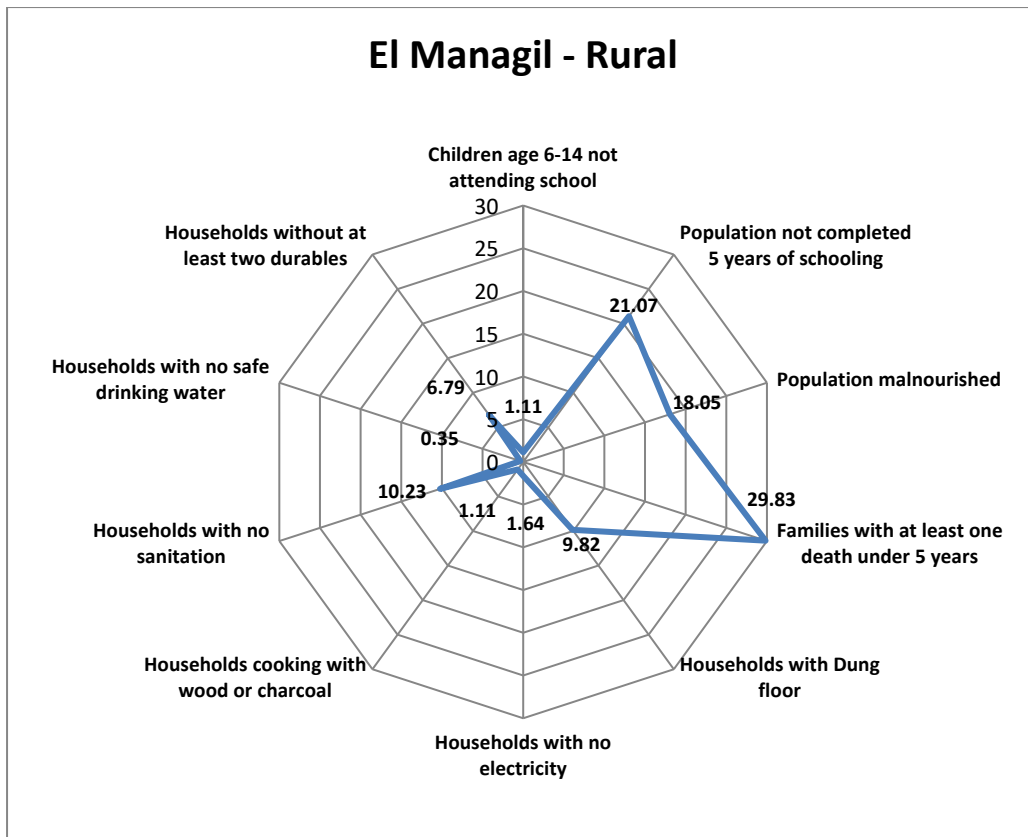
Janoob Al Gezira - Urban

Figure 4. The Contribution of Indicators to Urban Janoob Al Gezira Locality

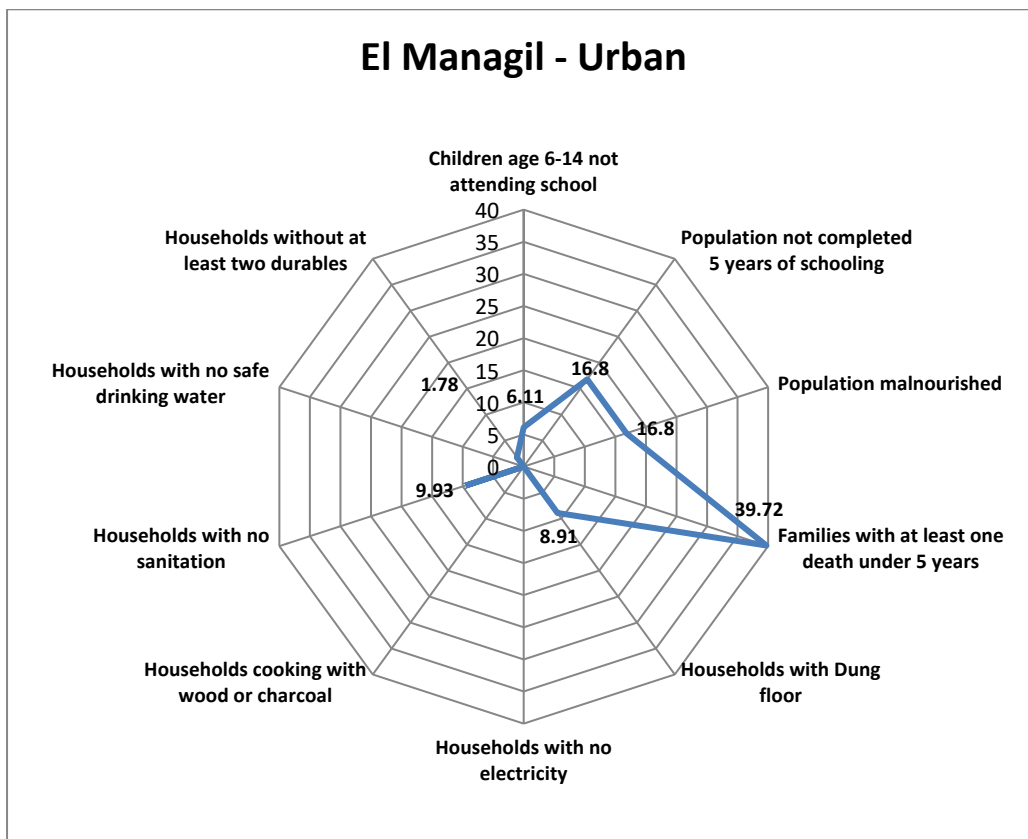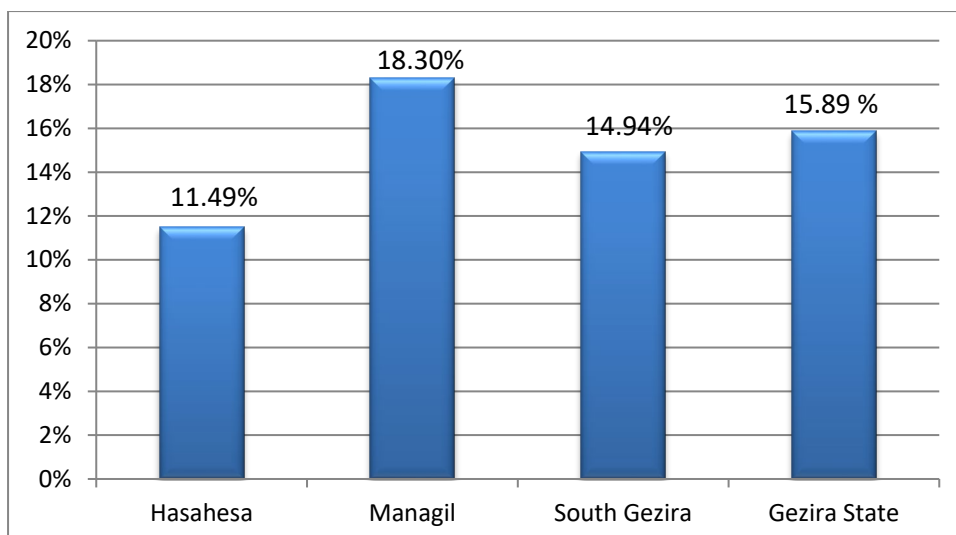*Figure 5.* The Contribution of Indicators to Rural El Managil Locality

Figure 6. The Contribution of Indicators to Urban El Managil Locality
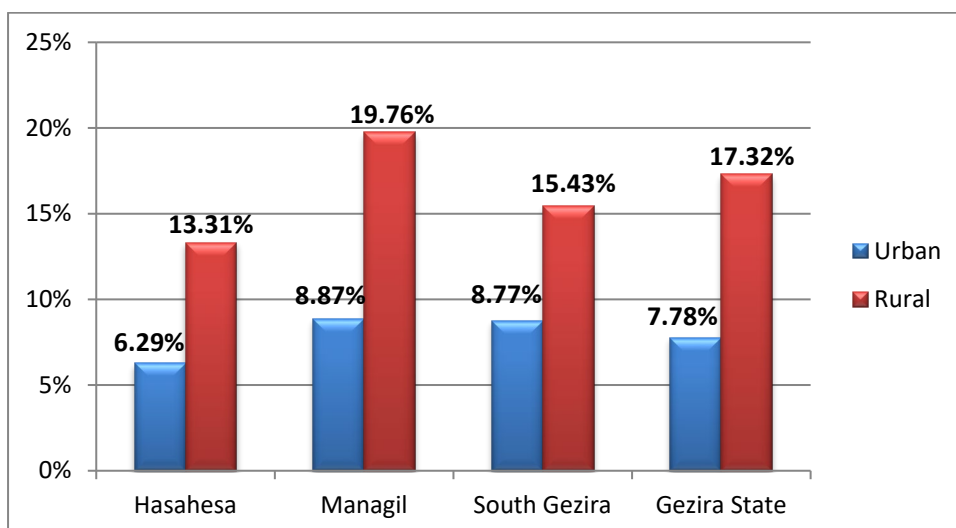
Figure 7. The MPI Values by Localities

Figure 8. The Urban – Rural MPI Values by Localities and over the State

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