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Influence of potable water in the characterization of habitat in African Sub-Saharan countries: Application to Cameroon

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By reason of its necessity, habitat is a fundamental index in the description of the standard of living in a society. This habitat has at the center of its design and function water for consumption and sanitation. The procurement of these two essential elements for life is still a problem in Africa, particularly in Sub- Saharan Africa. Every scheme relevant to the raising of the standard of living of the populations must be based on habitat; the lack of mastery of its typology gravely hinders economic growth. The characterization of human habitat equally avoids waste and additional costs which could be generated by wrong forecasting of the elements which characterize habitat. We propose a model of characterization of human habitat in a country in Sub-Saharan country, which takes into account access to potable water and sanitation. To do this, a household survey and data analysis must be carried out and the results would permit the implementation of this model whose flowchart will characterize the habitat in number and different housing qualities. An application was done to Cameroon by relying on the data obtained from the third general population and habitat census in 2008 and the results obtained give seven types of habitat with many levels of housing quality.

Key words: Habitat, characterization, potable water, sanitation, typology, data analysis, Cameroon.

INTRODUCTION

Every human being possesses a habitat regardless of social status. Habitat is therefore a fundamental index in the description of the standard of living of a society. In Sub-Saharan African countries, habitat has always been a crisis sector even though it is a starting point of all social life and it is found at the intersection of economics, politics and social life (Dubresson, 1993). Habitat cannot be mentioned without citing the problems of potable water and sanitation. Nearly 20% of the world's population does not have easy access to drinking water, and 40% lack proper sanitation facilities. The majority of these people live in developing nations (Ahiablame et al., 2012). A realistic habitat typology cannot be put in place without taking in to account potable water consumption of households. One of the difficulties of statistics linked to the domain of habitat is a poor characterization of habitat typology (Pettang, 1999). This article is aimed at defining a characterization of habitat typology which takes into account potable water consumption. To do this, a model will be defined, which, from a household survey which

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takes into account the presence of potable water and sanitation defines the different habitat.

An application of this model will be done on Cameroon which is a Sub-Saharan African country which is frequently called Africa in miniature, that is to say, in the domain of habitat, it contains almost all the different types of habitat seen in Africa. The results hereby obtained permit the clear differentiation of the housing typology used in Cameroon comprised of four levels of housing quality (high standing, average standign, spontaneous and rural zones) (Pettang, 1998) from ours with seven levels.

If the typology used in Cameroon depends only on the level of housing of a quarter, ours uses a more stringent stratification and clearly shows that it depends on parameters linked to water and sanitation. New islets of high standing houses are frequently found in marginal quarters of spontaneous housing. The quality of housing as presented in Cameroon is simply dependent on the quarter and not on concrete and pertinent parameters obtained from a survey, given that this typology exists since the general population and habitat survey carried out in Cameroon in 1987.

In Sub-Saharan Africa, almost 51% of the population, that is 300 million people do not have access to quality water and 41% do not benefit from decent sanitary conditions, while Africa seems to blessed by the gods with hydric resources, be it great rivers – among which the Congo, the Nile, the Zambezi and the Niger or the Lake Victoria, the second largest in the world; however, Africa is the second driest continent after Australia (Merino, 1998).

We therefore notice in Africa a paradox with an abundance of water resources and the lack of potable water and basic sanitary systems.

In the reaching of the MDGs, the member states of the United Nations committed themselves for 2015 to “reduce to half the proportion of people who do not have access to potable water”. At the Earth Summit in Johannesburg, the additional commitment was taken for 2015 to “reduce by half the proportion of people who do not have access to basic sanitary services”. To fulfill these commitments, an Urban Development Strategy must be put in place in each locality which clarifies habitat issues. These habitat issues will be better taken into account by carrying out a good characterization. This characterization must take into account access to potable water and sanitation.

Habitat in Sub-Saharan countries

Classical models of planned and administered habitat implemented in western countries have often been transported to Sub-Saharan African countries without any modification. The vast operations carried out in Europe in the 1950s were reproduced in African colonies. In the majority of towns, public authorities were overcome by the number and during the years that followed the independence and spatial growth of towns resulted in more illegal extensions and auto production became the dominant form of erection of buildings (Pettang, 1998). But these models were soon proven to be un-adapted to the rapid growth of population and the massive arrival people from rural zones. This was amplified by the fact that imported technology and materials are expensive and do not always meet the real needs of the inhabitants of these countries.

Since the 1970s, many Sub-Saharan African countries got engaged in the search for other alternatives and outlines solutions which can be cited as follows: the possibility of using local materials in the construction of durable housing; implementation of new planning policies. These new alternatives do not seem to have borne fruit because the achievements have been far below of the total urban demand. The analysis and the knowledge of these actual modes of habitat production therefore impose themselves as necessities, so as to avoid the errors observed in these countries.

After the crisis, and in spite of the major efforts made in certain countries by the public authorities, the rate of construction seems to be slowing down in most of the Francophone African capitals (the same observation was made in Anglophone Africa (Ahiablame et al., 2012).

We also note generally in these countries, a bad policy in the design of habitat. The outstanding features of habitat production are an institutional sector not adapted to the majority (difficult access to credit, land problems, administrative slowness, high cost of construction, poor appreciation of collective housing by users, sanitation conditions,…) on the one hand and an informal sector where auto-construction reigns, meeting over 80% of the needs, but marked by the lack of technical know- how, organization and respect for urban design rules on the other hand.

Elsewhere, the use of imported materials, by impeding the recycling of the capital invested in the production of habitat, weakens the housing sector (Pettang, 1999). The institutional production of habitat is generally not adapted and too controlled by the state. Informal production, better adapted to the demand, suffers from a lack of quality, control and organization. It generates a very anarchic urban state and the formation of quarter with spontaneous habitat which cover a large part of these towns.

Be it institutional or formal, this habitat production follows logic widespread across almost all Sub-Saharan countries since colonization (French, British, Belgian …).

From 1950 till today, there has been a demographic explosion in developing countries in general and those in Sub-Saharan Africa in particular, and one of the consequences is the rapid growth of towns and the immoderate habitat needs. One of the solutions outlined to solve this consists in transposing the habitat production models of Northern countries: this ended in a failure, due mostly to the poor knowledge of the cultural;

economic and technological aspects of the Southern countries. Therefore sketches of solutions were brought up, with general scope, like the cardinal recommendations of the Vancouver Conference (1976).

The other conferences and for a which followed were essentially based on the restructuration of slums, the incitation to the use of local materials and on the setting up of new credit structures scanning a larger range of incomes. In each of the countries mobilized by this theme, specific solutions were put in place. But these orientations also knew their limits: they stumble upon the specificity of the production of habitat in Sub-Saharan African countries whose perfect knowledge is indispensable before every proposition and above all where access to potable water and sanitation are primordial factors for habitat. Water is therefore an important element to production as well as characterization of habitat.

Potable water and habitat in Sub-Saharan African countries

The priority of socio cultural factors in the production of habitat cannot be argued, for habitat is part of a spatial and social system which embodies the mode of life. We cannot talk about mode of life without putting drinking water at the center of activity. Therefore, the production of urban habitat will be dictated by anthropology and the presence of water and materials which, according to him, are only modifying factors. In the majority of African towns, urbanization is subject to the presence of infrastructures in which the presence of water is at the center of all concern. The principal criteria of the characterization of habitat in Sub-Saharan African countries are often expressed by household water equipment. High quality habitat generally concerns areas considered as administrative, commercial, regular and residential. The other spontaneous habitats which are named differently (old traditional, rural spontaneous, semi-rural, peri-urban) receive three quarters of the urban population and the potable water and sanitation networks are almost inexistent and even when they exist, their cost does not permit the residents to use them (Ahiablame et al., 2012); even though some countries of this region have made an effort. Therefore in Yaoundé, from 1976 to 1993, the percentage of housing with running water moved from 23 to 25%, that of housing connected to electricity went from 39 to 75%, that of housing with interior water closets from 6 to 23% (DIAL and DCYN, 1993). However the progress in habitat conditions seems to be slowing down: “If until 1987 all the categories of households profited, from this date the improvement has been particularly unequal since it is entirely imputable to households of the formal sector, the precarious situation of informal households is unchanged” (DIAL and DCYN, 1993).

To successfully reach the Millennium Development Goals (MDGs) for water in 2015, the world will need to provide access to potable water to about 248 million people, who do not have access to improved portable water sources and live in Sub-Saharan Africa. There more than elsewhere, the uncontrolled demography, the piling of populations, water shortage, absence of sanitation, favor malnutrition, illnesses, ignorance, poverty and inequalities of all sorts. If in these countries, the majority of populations without access to potable water are found in rural zones, the anarchy of raging urbanization generates sanitation problems and difficulties in the access to potable water especially in peripheral quarters of spontaneous habitat. This is compounded by the fact that the distribution networks are plagued with leaks (Mbemmo et al., 2009).

The urbanization of the planet has shown itself since the last century as an irreversible phenomenon (Nguendo-Yongsi, 2008). Because of the urbanization of Africa (understood here as the growth of the urban percentage of the population) shows itself as the change of the most worrying rural car to more than 80% in 1960 (Mainet and Mainet-Valleix, 2004), about 52% of Africa today is urbanized and it is estimated that in 2030, the continent will have a percentage of 80%. If in Sub-Saharan Africa, this urban growth seems worrying, it is without doubt because of its unplanned nature. In metropolis, the spontaneous and anarchic development is sprinkled throughout the urban space. Actually, the demographic thrust in African towns linked to the conjugated effects of rural exodus and natural surplus, has been expressed by an immoderate extension of towns (Marguerat, 1991).

With only 56% (Sudeshna et al., 2008) of her population having access to clean water, Sub-Saharan Africa lags behind the other regions in terms of access to quality water sources. The actual tendencies seem to indicate that the region will not reach the target fixed by the Millennium Development Goals (MDGs), which consist in giving access to better water supply services to 75% (Sudeshna et al., 2008) of the population in 2015.

This access to clean water, conditions the habitat of these populations to the point where the typology is based on the mode of access to potable water and sanitation. Running water reaches more inhabitants in African urban zones than any other types of water supply even if its quota is less than that at the beginning of the 90s. The more recent data on 32 countries in the data base of the AICD DHS/MICS (Africa Infrastructure Diagnostic) suggest that in Sub-Saharan Africa 39% (Sudeshna et al., 2008) of the urban population is connected to a running water network, against 50% at the beginning of the 90s.

If this problem is insistent in rural settings and in urban settings, an incomprehensible gap is noted. In Bamako for example, less than a quarter of households have a tap for their water supply (21%), and only 7% have a water

closet inside the housing (DPU, 1994).

METHODOLOGY

Flowchart of the model

This flowchart explains the modeling of the characterization of habitat in sub-Saharan countries. The level of quality of housing will be measured from the physical characteristics of the habitat (materials used for the construction), but also taking into account some elements and features indispensable for the comfort of those who live there in especially the notion of water supply and sanitation.

The quality of housing is assessed not only with respect to the materials which go into its construction but also with respect to certain fittings for domestic use which improve the comfort of the habitat.

The characterization of habitat in Sub-Saharan Africa is a fastidious exercise and many characterizations do not take into account the context of the countries of this region, where water and sanitation remain at the heart of their problems.

A survey, and subsequently a data analysis should be carried out so as to guarantee the representative nature of the sample with respect to its configuration; it is therefore fitting to carry out stratification such that each type of quarter is represented. The household surveys can be carried out as the basis of the polls from a file which has the enumeration zones.

The model put in place therefore consists after the implementation of a database, to use the following flowchart which processes survey files from the database.

Description of the algorithm

***Problems*:** characterization of the habitat type (quality) from the data obtained from the survey forms.

***Data*:** survey forms on the characterization of the types of housing.

Goals: From the survey form, find the greatest number of similarity with the data of the characteristics per habitat type and deduce the type of housing.

Functioning of the treatment program

(i) At the entry, we have a matrix comprising in a dispersed manner the characteristics of the habitat and a table with different types of habitat quality.
(ii) A correlation is established between the habitat characteristics and habitat types
(iii) Each habitat characteristic is associated with a table comprising the modes of the corresponding characteristic as shown in the Table 1.

The program follows a principle with points accorded to different housing types, for each characteristic. A counter is therefore reserved for each type of housing which serves to cumulate the points which is accorded to it.
(iv) The correlation matrix between the habitat characteristics and the type of habitat serves as a basis for the assigning of points each time there is a match between the elements and the matrix and the data from the survey forms.
(v) Pour each survey from, we cover all the different characteristics and the associated modalities by adding 1 or 0 each time to the quality meter (type of housing) if there is a match or not with the elements of the matrix.
(vi) After covering the different characteristics, we compare the different values of the quality meters and retain the largest. If this number is greater than or equal to 9 (minimum tolerance threshold, the maximum being 14), the type of housing is that of this type of meter. If not, the housing is classified under the category “other type”.

The characteristics of the habitat being the main source of drinking water supply, mode of evacuation of used water, type of ease, mode of household waste disposal, main access tracks to the households, implantation sites, occupation state of the housing, main soil material, main material in the walls, main material in the roof, type of structure, number of sleeping rooms in the housing, main source of energy for cooking, main mode of lighting.

RESULTS

Presentation of the site

Cameroon is a Central African country which has 10 regions, widely spread in latitude: at the waterside of the Congo basin in the South; it is bordered by the banks of the Lake Chad in the North. Bordered by the Atlantic Ocean, the country is dominated by one of the highest mountainous regions in Africa. All studies carried out in Cameroon agree to the diversity of her nature: the set constitutes a large variety of the bio-geographical domains, such that it has been called Africa in miniature (Figure 1) (DIAL and DCYN, 1993). This comparison can be carried out in the demographic domain: while the West and the North are joined to the high densities of the countries of the Gulf of Guinea, the South and the east have the lower population densities of Central Africa.

In Cameroon, like everywhere else in the world, the people, while adapting to the climate and vegetation, let their genius blossom to build them the type of housing which would best fit their immediate environment.

In the North, domain of the Soudano–Sahelian climate, the habitats are made generally of earth and straw.

In the south, domain of equatorial climate, beaten earth, raphia mats, wood, and bamboos are used. The typical forest habitat is that of pygmies, constituted of branches put together and covered with tree leaves.

The Cameroonian littoral is the domain of huts on piles built in mangroves, and huts in splintered wood (carabot) which are very resistant to humidity.

Five major types of materials are used for the roofs: sheet - metal, cement/concrete, mat/straw/thatch, tiles and earth. However, we observe today in Cameroonian villages, a progressive transformation from habitat constructed in traditional and rudimentary material toward habitat constructed in modern and durable material.

The proportion of small households is larger in urban settings than in rural settings, with the highest proportion of small-sized households (46.7%) found in isolated houses while average-sized households (52.1%) and large-sized households (66.1%) are mostly found in concessions (BUCREP, 2010) (Table 2).

Graph 1 show that the presence of an interior or

Table 1. example of modes of corresponding characteristics for a given habitat.

Characteristic	Modalities
3. Place of ease	1. Internal water closet with toilet flush 2. External private water closet with toilet flush 3. Common water closet with toilet flush 4. Private latrines 5. Common latrines 6. Nature

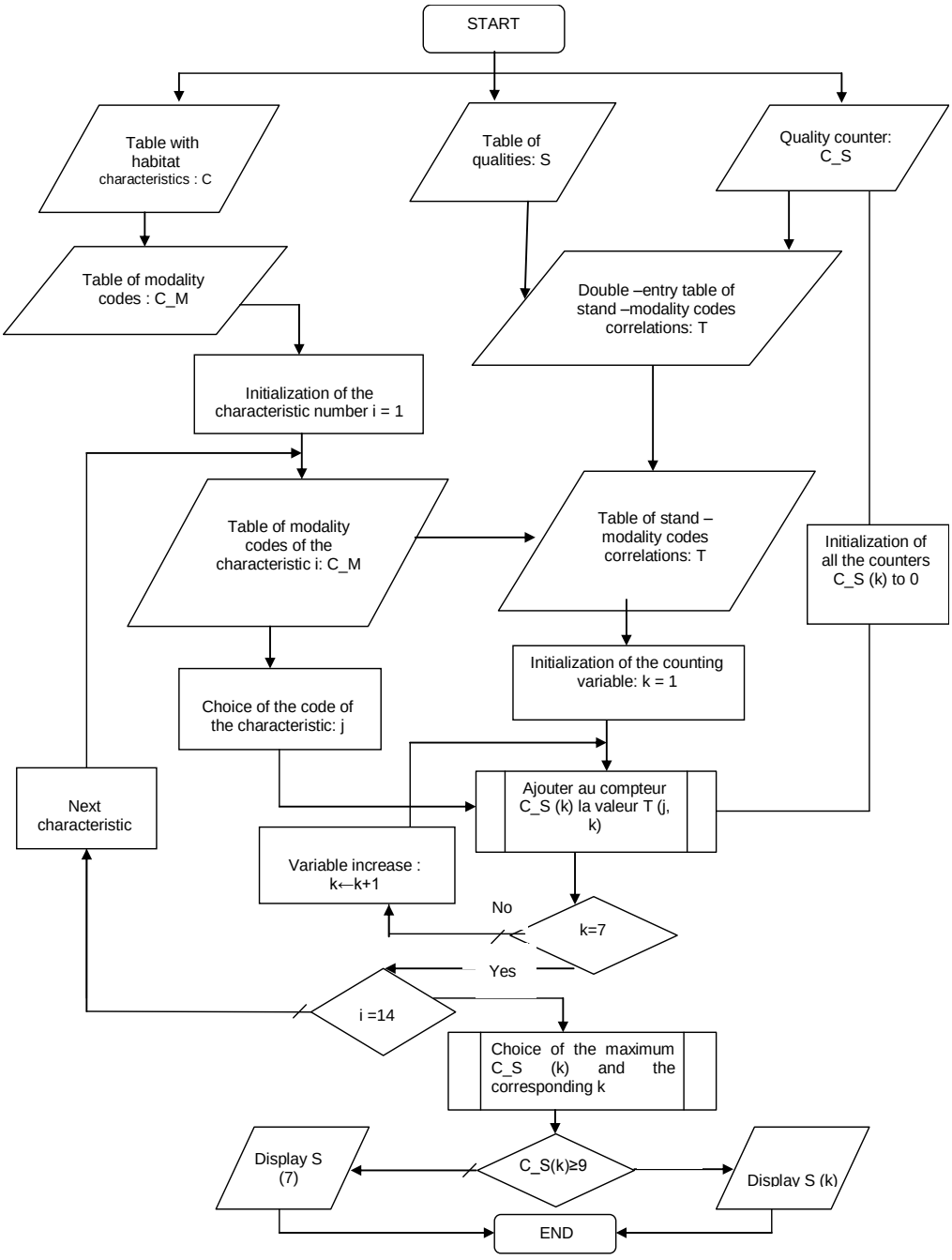
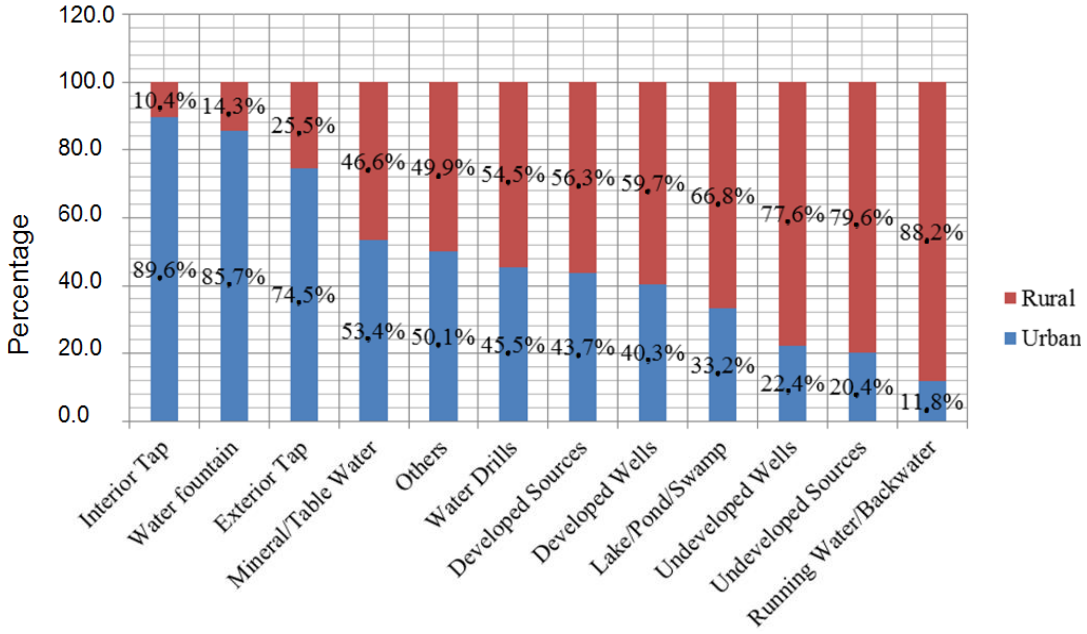


Figure 1. Flowchart for the analysis of survey forms.

Table 2. Distribution (%) of households by type of structure according to the household size.

Type of structure	Household size								
	Whole			Urban			Rural		
	1 to 4	5 to 8	9 and more	1 to 4	5 to 8	9 and more	1 to 4	5 to 8	9 and more
Isolated house	37.3	39.8	30.1	30.1	41.3	36.9	46.7	38.2	25.2
Modern villa	1.7	2.6	2.2	2.6	4.7	4.9	0.5	0.4	0.4
House with many flats	23.7	15.2	11.1	34.9	23.4	18	8.9	6.7	6.3
Building with many flats	3.9	2.8	1.7	5.9	4.5	3	1.4	1	0.7
Concession	31.8	38.2	53.7	25	24.7	36.2	40.7	52.1	66.1
Other	1.6	1.4	1.2	1.5	1.4	1	1.8	1.6	1.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0



Graph 1. Distribution of ordinary households by source of potable water supply according to environment of residence.

exterior tap in a household is much more an urban than a rural phenomenon. 89.6% of households with interior taps are found in urban settings and 74.5% of those with exterior taps, are found in urban settings.

We also have that 77.6% of households using undeveloped wells are in rural settings and 59.7% of those using developed wells are in urban settings (BUCREP, 2010). However, because of numerous factors such as population growth, climate variability and urbanization increasing proportions of groundwater is extracted (Lutz et al., 2011). This leads to the drying up of wells and therefore the increasing scarcity of potable water resources.

Analysis of statistical data

The quality of housing is assessed not only with the materials that enter its construction, but also with respect to some domestic fittings which improve user comfort. The following were taken into account in the construction of the variable “quality of housing”: the mode of water supply of a household, the mode of waste water disposal, the place of ease, the mode of lighting, the type of energy used for cooking, the type of structure, and the nature of construction materials. A household survey was carried out to consolidated the results obtained from the 3rd General Population and Habitat Census (RGPH) carried out in 2008 by the Central Office for Surveying and Population Studies (BUCREP).

The basic mathematical model used to estimate the mean and standard deviation is the “Normal Law” $N(m, \sigma)$. After analysis of this data, the “quality of housing” was therefore constructed following a combination of modalities of these different variables.

The stratified census is defined as follows:

In the case of a stratified random sample, $\frac{\sigma^2}{n}$ is replaced by

$$\sum_{h=1}^{k}\left(\frac{N_h}{N}\right)^2\frac{{\sigma_h}^2}{n_h} \quad (1)$$

N_h is the size of the h strata, n_h is the size of the sample of the h strata and $\frac{{\sigma_h}^2}{n_h}$ is the variance of the population in the h strata. Also, $\frac{S^2}{n}$ is replaced by

$$\sum_{h=1}^{k}\left(\frac{n_h}{n}\right)^2\frac{{S_h}^2}{n_h} \quad (2)$$

Where $\frac{{S_h}^2}{n_h}$ is the variance observed in the sample of the h strata.

In the case where the following conditions are not met in an exhaustive draw, $\frac{\sigma^2}{n}$ is replaced by

$$\sum_{h=1}^{k}\left(\frac{N_h}{N}\right)^2\frac{N_h-n_h}{N_h-1}\frac{{\sigma_h}^2}{n_h} \quad (3)$$

and S^2 by σ^2.

Also, $\frac{S^2}{n}$ is replaced by the expression

$$\sum_{h=1}^{k}\left(\frac{n_h}{n}\right)^2\frac{N_h-n_h}{N_h-1}\frac{{S_h}^2}{n_h} \quad (4)$$

If in each strata, $n_n \leq 0{,}10N_h$ and if the draw is exhaustive, then the Equation (2) estimates the variance.

The law $N\left(\bar{x},\frac{S^2}{n}\right)$ permits the determination of the limits of an interval such that we have 95% chance that the average of the sample $\bar{x}$ takes a value found between the limits $\left[\bar{x}-1{,}96S\sqrt{n};\bar{x}+1{,}96S\sqrt{n}\right]$. There is a 5% chance that it is not found in this interval (Besse, 2000).

After application of this normal law, we obtain the characterization of the habitat in Cameroon presented in Table 3. This table equally gives a description of different levels of housing quality that were defined.

DISCUSSION

Table 3 presents the seven types of housing quality in Cameroon with the corresponding characteristics. This typology permitted not only the determination of habitat characteristics, but also the determination of elements of the lifestyles of the populations.

The interest of data concerning this characterization of habitat sticks to the fact that they permit the calculation of indicators of the progress made in the implementation of the Millennium Development Goals (MDGs) and especially goal no. 7 in two ways adapted by Cameroon to her context namely:

(i) Reduce by half the percentage of the population without durable access to potable drinking water by 2015.
(ii) Considerably improve the habitat of Cameroonians by 2020.

The data analyzed on the different housings permitted us to also note the following facts:

Concerning the type of structure, the use of modern and durable materials, as opposed to traditional materials obtained from nature, is becoming generalized.

Cement is being more and more used in the construction of walls and soils, and roofs are more often covered with sheet-metal.

The proportion of households occupying houses with walls constructed in concrete, masonry blocks or baked bricks went from 7.4% in 1976 to 29.7% in 2005.

Cameroonian households have better access to electricity. Generally, one household out of two is lighted by electrical current, while in 1987, about one household in five had access to this mode of lighting.

The use of combustible solids or biomass (wood, charcoal or sawdust) is still widespread and used in almost 7 households in 10.

Concerning drinking water supply, 18.3% of the population uses surface water. In rural areas, this water is consumed by 71.6% of people. Generally, 47.3% of the population have access to a healthy source of drinking water.

As regards hygiene and sanitation, 7.9% of households do not have any proper easing point, and consequently use nature.

On the ownership of houses, 74% of households were owners of their houses against 65% in 2005. Almost 44.8% of households are built on risk sites.

Because habitat makes up the material support of the society, investing in it enables the improvement of the living conditions of the populations. For the public powers, it is necessary to support habitat policies by

Table 3. Description of the different levels of housing quality.

Description	High quality	Average quality	Low quality	Improved traditional	Simple traditional	Miserable	Other type
Type of structure	- Isolated house - Modern villa - Building	- Isolated house - Modern villa - Building - House with many lodgings	- Isolated House - Modern Villa - Building - House with many lodgings - Concession	- Isolated house - House with many lodgings - Concession	- Isolated house - House with many lodgings - Concession	- Isolated house - House with many lodgings - Concession	All combinations of housing unclassified housing characteristics.
Construction materials	- Durable	- Durable	- Durable - Semi durable	- Durable - Semi-durable - Precarious	- Semi-durable - Precarious	- Semi-durable - Precarious	
Place of ease	- Internal water closet with toilet flush	- Internal water closet with toilet flush - External water closet with toilet flush - Common water closet with toilet flush - Private latrine	- Internal water closet with toilet flush - External water closet with toilet flush - Common water closet with toilet flush - Private latrine - Common latrine	- Common water closet with toilet flush - Private latrine - Common latrine - Nature	- Private latrine - Common latrine - Nature	- Private latrine - Common latrine - Nature	
Lighting	- Electricity	- Electricity - Gas	- Electricity - Gas - Petrol	- All lighting modes	- All lighting modes	- All lighting modes	
Cooking energy	- Electricity - Gas	- Electricity - Gas - Petrol	- All types of cooking energy	- All types of cooking energy	- All types of cooking energy	- All types of cooking energy	
Water supply	- Interior tap - Mineral water - Drilling	- Interior tap - Exterior tap - Mineral water - Drilling	- All of water supply	- All of water supply	- All of water supply except interior tap	- All of water supply except interior tap	
Waste water disposal	- Septic tank	- Septic tank	- All modes of waste water disposal	- All modes of waste water disposal	- All modes of waste water disposal	- All modes of waste water disposal	

implementing measures to facilitate access to basic social services. For the populations, they have to adapt their living modes to the demands of environmental standards. Households should make their living spaces viable so as to make up sustainable human establishments.

The comparison made between the existing typology and that developed from our study as presented in Table 3 rests principally on the characterization of habitats, the quality number, the habitat environment and the elements of the living conditions of the population.

This new typology enables the deduction that habitat as understood until now has been poorly stratified, as well as the needs of the concerned population, thereby limiting the success of habitat policies and investments and new extensions of certain networks in quarters where demand is actually solvable.

Conclusion

Being lodged is a fundamental human right. He needs to be protected against bad weather, to be in security and have a private setting for his domestic activities.

Therefore, this work had as goal to put in place a model for the characterization of habitat in Sub-Saharan Africa.

This model of characterization of habitat uses parameters such as the mode of drinking water supply, the type of place of ease, the mode of waste water disposal, the type of energy used for cooking, the lighting mode, the nature of construction materials, the type of structure, etc.

We carried out the work by proceeding as follows: we first of all carried out surveys on the field and the data collected was combined with existing data. The characterization of habitat in different types of quality results from the model put in place by us. The application of this model to Cameroon, a Sub-Saharan country situated between the Sahara and the Sahel permitted us to observe that in this country, there exist seven (07) levels of housing quality which are the high quality, average quality, low quality, improved traditional quality, simple traditional quality, miserable quality and the “others” quality. This habitat typology of Cameroon in seven types contradicts many other previous works of this type, which did not enumerate more than five (05), and which had as consequence the limitation of the eligibility of the country toward sponsors for financing in this very transversal sector.

We found out about the difficulty in carrying out a habitat typology in a given zone or country since any such characterization depends on hypotheses which are not always expressed in mathematical terms. Also, in many Sub-Saharan countries, data is unavailable because of the scarcity of surveys and censuses in households, and the lack of updates to existing databases. If these different steps are well followed, the characterization of habitat hereby obtained will permit the improvement of housing typology while reaching the goals set during the second United Nations conference on Human Institutions held in 1996 in Istanbul, Turkey.

This work is only a contribution to the characterization of habitats in Sub-Saharan African countries. It is hoped for that it be followed in the sense of collection of data on a more representative household sample. The collection of this data will permit the further refinement of this model. In the same order of ideas, it is desirable to deepen the set of themes on habitat diagnostics (urban and rural) in these countries. Lastly, we can apply our model to other Sub-Saharan African countries, but it is necessary to verify the consistency of the data of the model.

REFERENCES

Ahiablame L, Engel B, Venort T (2012). Improving Water Supply Systems For Domestic Uses In Urban Togo: The Case of a Suburb in Lomé. Water Int. 4:123-124.

Besse P (2000). Practice of Statistical Modelisation L. o. S: A Probability (Ed.) Retrieved from http://www.sv.cict.fr/lest/Besse, p. 93.

BUCREP (2010). Caractéristiques des habitats et cadre de vie des populations, 2(5):188.

DIAL, DCYN (1993). Consumption and Living conditions of Households in Yaoundé. Yaoundé: Department of Statistics and National Accounting.

DPU (1994). Economic Crises, Adjustment Policies and Demographic Dynamics. French centre for population and Development (EHESS – INED – INDEE – ORSTOM) – University of Paris VI.

Dubresson A (1993). Production and Producers In Some Urban Spaces. Afrique Contemporaine, 2:171-186.

Lutz A, Thomas J, Keita M (2011). Effects of Population Growth and Climate Variability on Sustainable Groundwater in Mali, West Africa. Sustain. 3:21-24.

Mainet G, Mainet-Valleix H (2004). African towns: Growth and Regional Diversity: SEDES.

Marguerat Y (1991). Urbanisation in black Africa and its consequence: ORSTOM.

Mbemmo F, Tamo TT, Zineb S (2009). Algorithmic Optimal Management of a Potable Water Distribution System: Application to the Primary Network of Bonaberi (Douala, Cameroon). Water Int. 1:43-53.

Merino M (1998). Water: What stakes for sub-Saharan Africa? France: Foundation for Strategic Research, Université de Pau et de Pays de l'Adour.

Nguendo-Yongsi H (2008). The spontaneous character of sub-Saharan African towns: Formation logic and diversity of situations. Afro Europa, pp. 2-3.

Pettang C (1998). A Diagnostic of Urban Habitat in Cameroon Yaoundé: Yaoundé University Press.

Pettang C (1999). Habitat and Urban Development Yaoundé: Yaoundé University Press, p. 2.

Sudeshna B, Heather S, Vivien F, Cecilia BG, Elvira M, Tarik C (2008). Diagnostics of national infrastructure in Africa: Distribution of water in urban settings in sub-Saharan Africa. Water and Sanitation Program.