# Toward a Children-Youth Development Index (CYDI):

## A tool for assessing the effectiveness of Youth-Oriented Policies in the West and Central Africa Region

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**TABLE DES MATIERES**

# 1. INTRODUCTION

In recent years, a growing need of addressing the issues of youth development has sharpened the necessity of constructing a youth growth index that highlights the Importance of the youth in the development policies. Many countries, rich and emergent ones, set up this index with more or less common variables. Among those variables, we could underline access to education, health and well-being, and, employment and opportunities. Other more questionable variables are political and civil participation that capture the interest of international institutions for their youth-oriented development policies.

At first glance, it is difficult to accept that the computational criteria are the same, whether the country is rich or poor. These indices seek through time to follow and monitor how well development policies incorporate the way young people gain access to education, employment and political activities.

In this project, we claim that much more needs to be done to make the youth index development operational in terms of its ability to help visualizing and effectively monitoring youth policies in Africa.

More specifically, we attempt to *tropicalize* the domains and variables that constitutes our input to get a better synthetic index that measures and follows in a sufficiently realistic, plausible and steady manner the youth development in the West and Central African Region (WCAR).

To achieve this goal, we seek to improve the Youth Development Index (YDI) by considering two additional dimensions:

First, introducing variables that better account for the concerns of youth in Africa. In particular, it seems not realistic to ignore the impact of family or nutrition on youth Well-being. In addition, it seems very relevant to consider the propensity to emigrate both inside and outside the country. Indeed, the propensity to migrate captures most of the fears and dreams of African youth. Such a variable is relevant to the construction of an index based on the distinction between rural and urban.

Second, constructing a Youth Development Composite index based on three sub-indices. The first sub index is related to the age interval 0 to14. People in this range are more confronted with issues such as begging, child labor or nutrition, in addition to the traditional problems of schooling and health. The second sub index relates to the year interval 14 to 19. Most likely the issues of health, education and drug abuse are acutely related to this category of young people. Finally, the last sub index to be considered is related to the age group 20 to 24.

In conclusion, the possibility of disaggregating the composite index into three sub-indices could be better help refining the development policies dedicated

# 2. METHODOLOGICAL APPROACH

## 2.1. General Approach

The youth development index we construct takes largely advantage from the recommendations of the "Commonwealth Youth Development Index National and Regional Toolkit". It utilizes the Analytic Hierarchy Process (AHP) and the banding method in a new way that allows to produce steady, realistic and better-looking youth development indices for countries that was qualified by the data availability in the Western and Central African region (WCAR). We pretend that our index is highly efficient to monitor the youth development issue, in static and dynamic as well.

First of all, to common domains as education, health and well-being, employment and opportunities, the study adds family, reproductive health, and nutrition as sufficiently independent domains. We do not include political participation as a major dimension in assessing the well-being of young people. In the region that is the focus of our attention, other parameters seem also relevant.

We do not follow previous works in considering political participation as a significant domain that relevantly characterizes the youth development. Indeed, it is accurate to consider the political participation as a sign of an environmental awareness. Young who are involved in politics are more likely to be better informed than young who are not. However, it is difficult to consider it as a sign of young development, unless to consider political participation as a quickest way to achieve economic dreams like getting a desirable job. We drop this variable because of its questionable nature. On the other hand, we include family as a very relevant domain that weighs in the children development evaluation. By family, we mean the fact for the young of living or not with their parents. In this line, many cases could be noticed:

- Both parents live with the young in the same home.

- Parents are living but divorced.

- At least one of the parents is dead.

Although, these variables could not be viewed as realistic instrumental variables—at least, not on the short run—to improve and engage youth towards development, they characterize very significantly the state of mind and well- being of some categories of Youngs. Consequently, we include them to capture the state of satisfaction or frustration when it comes to family well-being.

Secondly, the second specificity of our index is to consider that young age between 0 and 24. In general, their no consensus on ages that should be included in the Youth interval. To give an example, the Commonwealth index defines as youth those whose ages are between 15 and 29. The youth age interval is very Depending of the kind of studies that are conducted. In our study, we specify the youth age to be between 0 to 24. The development issue from 15 to 24 is largely dependent on how young people has spent their lives between 0 to 14. This lead to disaggregates the youth index into three indices: the children, the adolescent, and the youth development indices.

### 2.2. The Composite Youth Development Index and Sub-Indices Formula

Our approach is first to determine the sub-indices on the basis of the weights assigned to the different variables. The weights are determined using the Analytic Hierarchy Process technique. For the sub-indices the following formula is adopted:

$$I_i = \sum_{j=1}^{n} P_{ij} X_{ij}, \ \sum_{i=1}^{n} P_{ij} = 1 \text{ and } i = children, adolescent \ or \ adult.$$

The Composite Youth Development Index will be constructed using the three sub-indices corresponding to the three age groups. The composite index is then constructed as follows:

$$I = \sum_{i=1}^{3} \omega_i I_i \ where \ \sum_{i=1}^{3} \omega_i = 1$$

## 2.3. Data Normalization

we proceeded to the normalization of the variables entering in the construction of the 4 indices, namely the children, the adolescent, the adult youth and the composite development indices, in the following way:

Whenever the variable entering the index has a positive connotation (gross rate enrollment, completion rate, etc.), we use direct linear extrapolation, known in the literature as the banding technique to normalize it, i.e., assign it a value from 0 to 1.

The following formula is adopted for a direct extrapolation:

$$x(cv) = \frac{cv - m}{M - m}; \text{ where } x(m) = 0, x(M) = 1$$

- $cv$ is the current value of the variable to normalize.

- $M$ and $m$ represent the two extreme values that each variable can take, corresponding respectively to the highest and lowest value.

- $x(cv)$ is the linearly normalized value, ranging from 0 to 1.

$M$ and $m$ are specified as follows:

For each variable, we assign the extreme values observed in our group of countries or even in any other country outside our field of analysis.

Otherwise, we construct our extrema based on the data set available for each variable using the following formula:

$$m = Minimum\ value\ observed\ in\ the\ dataset - \frac{Corresponding\ Standard\ Deviation}{4}$$

$$M = Maximum\ value\ observed\ in\ the\ dataset + \frac{Corresponding\ Standard\ Deviation}{4}$$

Preliminary calculations reveal that not choosing the right extremes implies high volatility in dynamic youth indices.

If the variable entering the index has a negative connotation, as is the case for HIV or stunting, the calculation shows that an extrapolation based on the linearly normalized value amplifies the contribution of this variable to the generated index. Hence, applying linear extrapolation to negatively connected variables leads to high youth development index. We found that it is possible to scale down all the indices of all countries in such a way they are more realistic, without altering the order or the dynamic evolution of the youth development index over the time. The idea is the following:

In a first step we get $x(cv)$, the linearly normalized value of the variable. Then, in a second step, we make a nonlinear extrapolation of $x(cv)$ through an increasing and convex function defined from 0 to 1 and for which the values generated are between 0 and 1. To get this, we use the following function:

$$y[x(cv)] = 1 - (1 - x(cv)^2)^{1/2} ; \text{ where } \frac{dy}{dx} > 0 \text{ and } \frac{\partial^2 y}{\partial x^2} > 0$$

We recall that for a variable that is negatively connected, $x(m) = 1$ and $x(M) = 0$. In that case, we easily show that: $y[x(m)] = 1$ and $y[x(M)] = 0$.

As shown in the graph below, scaling down the values of the negatively connoted variables is equivalent to pulling the red line down to the green curve.
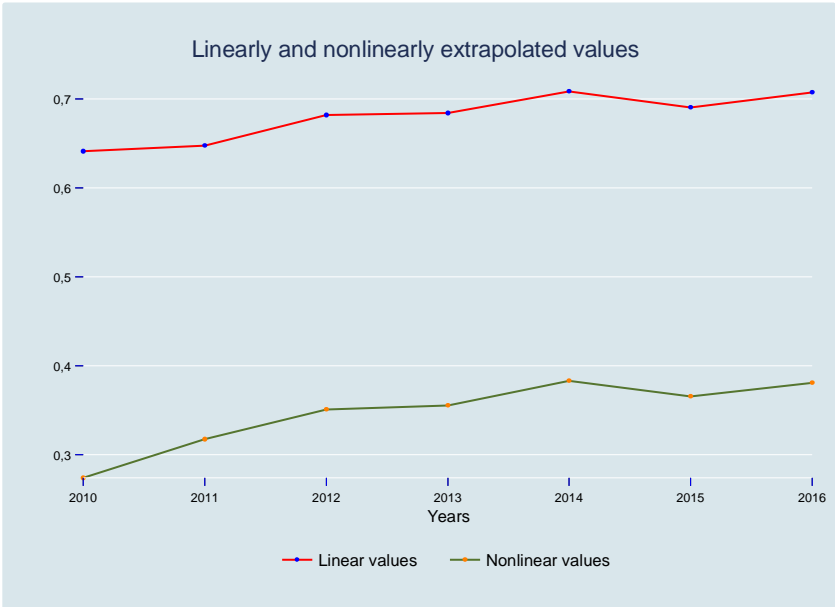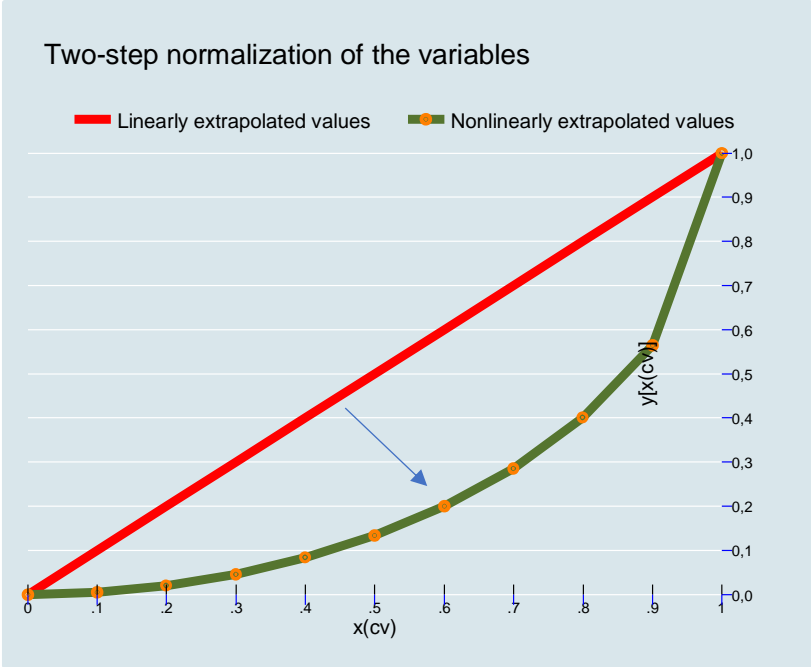




*How the choice of good extrema and the nonlinear extrapolation of the variable produces steady, slowly evolution, realistic and good-looking indices: the case of Senegal*

We could have data on Senegal from 2010 to 2016. This helps us verifying how steady and robust were the indices constructed. The following tables show two ways of constructing the index. The first one is just obtained after applying the banding technique to all the variables entering in the children youth

index (see the green curve). The second is the one obtained after applying the nonlinear extrapolation to all the negatively connoted variables. This pull down the youth index without distorting the curving (see the red line). This final youth development index is the one that we will adopt.

## 2.4. Domains, Variables and Weights

In practice, building the Youth Development Index requires a careful review of the areas to be included in the construction of the index. Each area entering in the YDI construction is selected based on its importance and ability to impact youth development. There is a wide range of multidimensional factors that can influence a person's life from birth to adulthood. For the WCAR countries, selection has at most been made on 6 areas that could relevantly contribute to the youth development: Education, health, reproductive health, nutrition, family, and work and opportunities, as in the following figure:
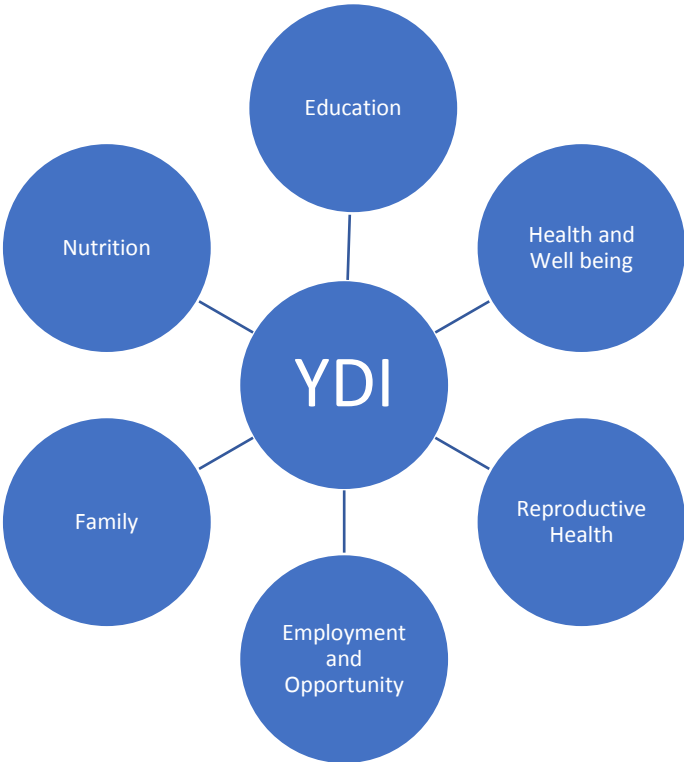


Tables 1, 2 and 3 successively present the domains, the variables selected, and their respective weights required to calculate the three sub-indices: the children, the adolescent adult, and the young adult development indices. Each of the tables use the Analytical Hierarchy Process (AHP). This technique can be, at first glance, viewed as a "technique for multi-attribute decision-making" (Saaty, 1987). For an AHP weighting technique to be operational, we should have a goal, some alternatives, and a criterion for weighting the different alternatives. For our case, the goal is to generate a composite index that better monitors the youth development. the alternatives are the domains—and more strictly—the variables intervening in the achievement of the youth development. Finally, as criterion, we use a pairwise comparisons of the domains  and variables.  The technique is a kind of ordinal and cardinal mixture of the microeconomic hierarchization of preferences. In fact, the approach adopts a pairwise comparison built on a subjective basis provided by the experts and investigation inside the community. From this point of view, it recalls the ordinal approach. On the other hand, the existence of some proportionality between alternatives obeying to a symmetric rule gives a cardinal nature to the approach.

Table 1 presents Children's Youth Development Index, the first sub index entering the composite youth development index. Children ages are between 0 to 14. Weights are obtained based on expert and public assessments in combination with the Analytical Hierarchy Process (AHP). It appears that nutrition has the highest weight (0.439), then health with a weight of 0.301, education with 0.16 and finally the family with a weight of 0.1. We admit that the variables belonging to the same indicator have the same weights.

**Table 1**: **Domains for Children Development Index**

| Domains | Variables | Variable weights | Data sources | Domain weights |
|---|---|---|---|---|
| Nutrition | Stunted children | 0,146 | DHS | 0,439 |
| | Wasted children | 0,146 | DHS | |
| | Underweight Children | 0,146 | DHS | |
| Health | Infant mortality rate | 0,100 | World Bank | 0,301 |
| | Tuberculosis | 0,100 | World Bank | |
| | Malaria | 0,100 | ourworldindata.org | |
| Education | Gross enrollment rate | 0,053 | World Bank | 0,160 |
| | Pupil to teacher ratio | 0,053 | World Bank | |
| | Completion rate | 0,053 | World Bank | |
| Family | Children with dead parents | 0,033 | DHS | 0,100 |
| | Orphan-hood | 0,033 | World Bank | |
| | Children without biological parents | 0,033 | Ourworldindata.org | |

*Table 1:  Domains for Children Development Index*

In Table 2, we differentiate Health and reproductive health. It is because that the reproductive health is a major public health concern that deserves a closed and specific monitoring. It is granted a weight of 0.215. The indicator '' work and opportunity '' is the one with less weight (0.093) in this category of age group (15-19). Our pairwise comparison considers young people job not very relevant for the well-being of this group.

**Table 2**: **Domains for Adolescent Youth Development Index**

| Domain | Variables | Variable weights | Data sources | Domain weights |
|---|---|---|---|---|
| Reproductive health | Teenager mothers | 0,07 | World Bank | 0,215 |
| | Condom use | 0,07 | World Bank and DHS | |
| | Contraception | 0,07 | World Bank and DHS | |
| Health | Drug use | 0,115 | World Bank and DHS | 0,346 |
| | HIV | 0,115 | World Bank | |
| | Malaria | 0,115 | Ourworldindata.org | |
| Education | Gross enrollment rate | 0,117 | World Bank | 0,350 |
| | Pupil to teacher ratio | 0,117 | World Bank | |
| | Completion rate | 0,117 | World Bank | |
| Employment and opportunities | Unemployment rate | 0,046 | World Bank | 0,093 |
| | Labor force participation ratio | 0,046 | World Bank | |

*Table 2: Domains for Adolescent Youth Development Index*

As in Tables 1 and 2, table 3 presents the domains, the variables used and their respective weights for young adults for who ages are between 20 to 24 years. For this age group, the job variable work has

the greatest weight (0.47). The second significant variable is the reproductive health and health indicators with weights respectively of 0.26 and 0.17. Education comes last with a weight of 0.1.

**Table 3**: **Domains for Youth Adult Development Index**

| Domain | Variables | Variable weights | Data sources | Domain weights |
|---|---|---|---|---|
| Reproductive health | Condom use | 0,13 | World Bank and DHS | 0,260 |
| | Contraception | 0,13 | World Bank and DHS | |
| Health | Drug use | 0,057 | World Bank and DHS | 0,170 |
| | HIV | 0,057 | World Bank | |
| | Malaria | 0,057 | Ourworldindata.org | |
| Education | Gross enrollment rate | 0,050 | World Bank | 0,100 |
| | Pupil to teacher ratio | 0,050 | World Bank | |
| Employment and opportunities | Unemployment rate | 0,235 | World Bank | 0,470 |
| | Labor force participation ratio | 0,235 | World Bank | |

*Table 3: Domains for Youth Adult Development Index*

## 3. MAIN RESULTS

We display the results in two steps. First, we look at the ranking of the development indices of the countries according to the three age groups. At this stage, we even examine the ranking of the countries inside the domains. As a matter of fact, the performance of a country vis-à-vis of different domains will help better identifying the factors that influence the youth development index. Then, we display the general ranking of the countries selected on the basis of the Composite Youth Development Index (CYDI)

### 3.1. Results on the Sub-Indices

#### 3.1.1. The Children Development Index Ranking in WCAR

Table 4 gives countries' classification according to their score[1]. Gabon and Ghana have the highest scores (respectively: 0.40 and 0.38). This could be explained by the implementation of efficient strategies to improve nutrition and education. From another point of view, these countries have recorded noticeable improvements on health and child protection areas. The second group consists of Sao Tome e Principe, Senegal and Benin with an average score of 0.32. It should be noted that the contribution of each domain to the overall score of these countries differs from one country to another. The scores for Sao Tome and Principe and Senegal are mainly driven by their efforts in the areas of health and family. Senegal has also made major efforts in favor of child nutrition.

Benin's high score could be viewed as a result of its persevering work for education and child protection. The third group includes countries like Gambia, Liberia, Togo, Republic of Congo and Cameroon with an average score of 0.26. These countries have made significant progress in the areas of nutrition and child rearing. Exceptions to that are Liberia in the field of education and Congo in the area of nutrition.

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[1] Star signs: \*\*\* indicate countries with a high score, \*\* countries with medium score, and \* countries with a lower score.

**Table 4: 2015 Children development index ranking with respect to countries**

| Countries | Global score | Global rank | Countries' rank by domains | | | |
|---|---|---|---|---|---|---|
| | | | Nutrition | Health | Education | Family |
| Gabon*** | 0,400 | 1 | 1 | 11 | 2 | 17 |
| Ghana | 0,380 | 2 | 2 | 7 | 3 | 9 |
| Sao Tome et Principe | 0,330 | 3 | 9 | 2 | 9 | 6 |
| Senegal | 0,330 | 4 | 3 | 5 | 15 | 3 |
| Benin | 0,300 | 6 | 8 | 13 | 6 | 1 |
| Gambia | 0,270 | 7 | 10 | 6 | 12 | 15 |
| Liberia | 0,260 | 8 | 5 | 9 | 19 | 10 |
| Togo | 0,260 | 9 | 6 | 18 | 5 | 11 |
| Congo, Republic | 0,250 | 10 | 13 | 10 | 8 | 12 |
| Cameroon | 0,250 | 11 | 4 | 15 | 7 | 19 |
| Nigeria | 0,230 | 12 | 19 | 8 | 10 | 7 |
| Cote d'Ivoire | 0,220 | 13 | 7 | 16 | 13 | 16 |
| Sierra Leone | 0,210 | 14 | 12 | 22 | 4 | 18 |
| Guinea | 0,210 | 15 | 11 | 17 | 16 | 14 |
| Afrique Centrale | 0,200 | 16 | 14 | 14 | 22 | 4 |
| Chad | 0,190 | 17 | 15 | 12 | 20 | 13 |
| Mali | 0,170 | 18 | 16 | 21 | 21 | 2 |
| Burkina Faso | 0,160 | 19 | 17 | 20 | 17 | 5 |
| Niger | 0,150 | 20 | 20 | 19 | 14 | 8 |

*Table 4: 2015 Children development index ranking with respect to countries*

### 3.1.2.The Adolescent Development Index Ranking in WCAR

In Table 2, we keep classifying countries according to whether their score is very high, high and medium. The first group consists of Sao Tome e Principe, Benin and Ghana. These countries recorded high score in fields as education, health and reproductive health for adolescents. It should be noted, however, that Sao Tome and Principe should more act on reproductive health. Senegal, Gambia, Togo and Cameroon are the second group with an average score of 0.385. The score of Senegal is due to its efforts recorded in areas like health and reproductive health. However, more efforts should be done on education for the adolescent age group. The group with low score is made up of 10 countries with an average score of 0.289. These countries present poor results in the fields of education, health and reproductive health.

**Table 5: 2015 Adolescent development index ranking with respect to countries**

| Countries | Score | Global Ranks | Countries' rank by domains | | | |
|---|---|---|---|---|---|---|
| | | | Education | Health | Reproductive health | Work and Opportunity |
| Sao Tome et Principe | 0,518 | 1 | 4 | 1 | 15 | 21 |
| Benin | 0,481 | 2 | 1 | 7 | 6 | 4 |
| Ghana | 0,466 | 3 | 3 | 8 | 1 | 8 |
| Senegal | 0,415 | 4 | 10 | 3 | 4 | 14 |
| Gambia | 0,395 | 5 | 6 | 5 | 9 | 22 |
| Togo | 0,381 | 6 | 11 | 11 | 3 | 3 |
| Cameroon | 0,350 | 7 | 8 | 16 | 5 | 2 |
| Liberia | 0,319 | 8 | 12 | 12 | 11 | 13 |

| Congo, Republic | 0,316 | 9 | 7 | 17 | 8 | 15 |
| Nigeria | 0,312 | 10 | 9 | 13 | 12 | 18 |
| Burkina Faso | 0,302 | 11 | 17 | 15 | 7 | 5 |
| Sierra Leone | 0,294 | 12 | 5 | 20 | 14 | 12 |
| Guinea | 0,289 | 13 | 16 | 9 | 13 | 11 |
| Mali | 0,282 | 14 | 13 | 14 | 16 | 7 |
| Cote d'Ivoire | 0,267 | 15 | 15 | 18 | 10 | 16 |
| Niger | 0,261 | 16 | 20 | 10 | 17 | 1 |
| Chad | 0,252 | 17 | 19 | 6 | 18 | 6 |

*Table 5 : 2015 Adolescent development index ranking with respect to countries*

### 3.1.3.The Young Adult Development Index as Criterium of Countries Ranking

Table 6 is related to the countries ranking with respect to the Youth Adult Development Index for which the ages of the group is between 20 to 24.

The high score sub-group consists of Niger, Togo, Burkina Faso, Cameroon, Ghana and Benin with an average score of 0.481. Compared with other countries, these countries have the particularity of having set up the labor market in a way that facilitates the integration of young people and reduces unemployment. In addition, these countries have done considerable work in the area of reproductive health. However, they must make significant efforts for the health and education of young adults.

The medium score sub-group consists of Cape Verde, Senegal, Sao Tome, Republic of Congo, Liberia, Chad, Mali and Guinea with an average score of 0.402. Although belonging to the same group, these countries present some peculiarities concerning the contribution of the different domains on their respective ranks. For example, the scores for Cape Verde, Sao Tome and Senegal are mainly explained by their efforts in the areas of health and education of young adults. At the same time, the scores of countries like Chad and Mali are mainly explained by their efforts to integrate young adults to the labor market.

The low score sub-group comprises Ivory Coast, Nigeria, Gambia and Mauritania. These countries record disastrous scores with regard to the development of young adults. In addition, Ivory Coast and Nigeria must make additional efforts towards healthcare in favor of young adults. Finally, Gambia and Mauritania need to make more sacrifices towards education.

**Table 6: 2015 Young Adult development index ranking with respect to countries**

| Countries | Score | Global Rank | Countries Rank by domains | | | |
| | | | Work and Opportunity | Reproductive health | Health | Education |
| Niger | 0,492 | 1 | 1 | 19 | 10 | 6 |
| Togo | 0,491 | 2 | 3 | 7 | 11 | 14 |
| Burkina Faso | 0,482 | 3 | 5 | 8 | 15 | 7 |
| Cameroun | 0,478 | 4 | 2 | 3 | 16 | 16 |
| Ghana | 0,472 | 5 | 8 | 6 | 8 | 12 |
| Benin | 0,471 | 6 | 4 | 12 | 7 | 8 |
| Cape Verde | 0,455 | 7 | 19 | 5 | 2 | 1 |
| Senegal | 0,42 | 8 | 14 | 9 | 3 | 13 |
| Sao Tome et Principe | 0,409 | 9 | 21 | 15 | 2 | 2 |
| Congo, Republic | 0,395 | 10 | 15 | 4 | 17 | 4 |
| Liberia | 0,392 | 11 | 13 | 11 | 12 | 10 |

| | | | | | |
|---|---|---|---|---|---|
| Chad | 0,387 | 12 | 6 | 23 | 6 | 5 |
| Mali | 0,381 | 13 | 7 | 18 | 14 | 19 |
| Guinea | 0,38 | 14 | 11 | 16 | 9 | 9 |
| Cote d'Ivoire | 0,365 | 15 | 16 | 10 | 18 | 3 |
| Nigeria | 0,335 | 16 | 18 | 13 | 13 | 11 |
| Gambia | 0,291 | 17 | 22 | 14 | 5 | 15 |
| Mauritania | 0,276 | 18 | 20 | 21 | 4 | 18 |

*Table 6 : 2015 Young Adult development index ranking with respect to countries*

### 3.2. The Countries Ranking Based of the Composite Youth Development Index

The interest of table 7 is double. on the one hand, it shows, the global scores and ranks of the various countries according to the composite index of youth development (0-24 years). On the other hand, it gives at the same time the ranks of each country according to the different sub-indices (child, teenager and young adults). These countries can be classified into three main groups according to whether their score is high, medium or low. Sao Tome, Ghana, Benin and Senegal come at the top position with an average score of 0.421. These countries have noticeable children and adolescent development sub-indices. They however need to apply efficient policies for the upper age group. In the light of these results, it appears that a well-prepared childhood is essential to elevate the young well-being. The second group consists of Togo, Cameroon, Gambia, Liberia and Congo with an average score of 0.331. These countries have made significant progress in adolescent development and to a lesser extent in children. However, they must redouble their efforts to increase the well-being of young adults. The low score group consists of Nigeria, Burkina, Guinea, Ivory Coast, Niger, Mali and Chad with an average score of 0.272. These countries present a catastrophic situation for children and adolescents' welfare, as well. As a matter of fact, they record the lowest ranks in the areas of education, health and reproductive health.

**Table 7: 2015 Composite Young Development Index**

| Countries | Global score | Rank | | | |
|---|---|---|---|---|---|
| | | Global | Child | Adolescent | Young Adult |
| Sao Tome et Principe | 0,438 | 1 | 3 | 1 | 9 |
| Ghana | 0,437 | 2 | 2 | 3 | 5 |
| Benin | 0,420 | 3 | 6 | 2 | 6 |
| Senegal | 0,387 | 4 | 4 | 4 | 8 |
| Togo | 0,361 | 5 | 9 | 6 | 2 |
| Cameroun | 0,338 | 6 | 11 | 5 | 4 |
| Gambia | 0,335 | 7 | 7 | 7 | 17 |
| Liberia | 0,313 | 8 | 8 | 8 | 11 |
| Congo, Republic | 0,308 | 9 | 10 | 9 | 10 |
| Nigeria | 0,288 | 10 | 12 | 10 | 16 |
| Burkina Faso | 0,286 | 11 | 19 | 11 | 3 |
| Guinea | 0,277 | 12 | 15 | 13 | 14 |
| Cote d'Ivoire | 0,270 | 13 | 13 | 15 | 15 |
| Niger | 0,265 | 14 | 20 | 16 | 1 |
| Mali | 0,263 | 15 | 18 | 14 | 13 |
| Chad | 0,253 | 16 | 17 | 17 | 12 |

*Table 7 : 2015 Composite Young Development Index*