# Evolution of the universal primary education indicators in sub-Saharan Africa [from 1980 to 2004]

**Summary**

Born of a personal reflection and involvement in the education – but transferable to other fields thanks to its methodology –, the purpose of this work is to show, in a global way, the evolution of the universal primary education indicators in the sub-Saharan Africa. We studied them during many decades. We used the Principal Component Analysis (PCA) tool; a method that perfectly matches the observation of the temporal dimension. It allows spotting the right practices and so highlighting the decision. For example, we show that the adult literacy rate appears to be an important factor that gives to some countries the opportunity of an earlier "take-off" as far as primary schooling is concerned.

## 1. Education for All and monitoring indicators.

Ensure education for all means that one of the eight Millennium Development Goals is to give to all boys and girls in the world the means to complete a full course of primary schooling from now on to 2015. Decided in September 2000 during the "Millennium Statement of the United Nations", the "plan of campaign" will assess the achieved progress in this universal primary education on taking into account for each country the three following indicators:

1°- **Net enrolment rate [NER] in primary school.** It is, for a given year, the ratio between the amount of enrolled pupils of legal age and the amount of children old enough for that level of schooling. This participation indicator gives information about the proportion of the population of official schooling age that really goes to school.

2°- **Survival rate in the 5 th grade [SUR].** It is the proportion of a cohort of pupils starting the 1st grade in the primary school and completing the 5th. This indicator enables to assess the chances of a continuous literacy demanding a minimal attendance at the first years of a basis teaching.

3°- **15 years old and over literacy rate [LIT].** It could correspond, in the age bracket under consideration, to the proportion of people who can both read and write with understanding a short everyday life statement. But each country has its own standards and things are far from being that easy. While waiting the launching by the UNESCO – beginning of 2007 – of the **L**iteracy **A**ssessment and **M**onitoring **P**rogram and its results, we are based on the existing data mainly collected by the UNESCO Institute for Statistics among the national sources.

The UNESCO Institute for Statistics, in charge of the collection the data and the universal primary education indicators, was our main data source. It is from statistics published on its website[1] that we made the tables submitted to analysis[2].

## 2. Principal Component Analysis [PCA].

### 2.1. Principles

The Principal Component Analysis is an exploratory method of data organized in the form of large charts. It is based on the same principles as the other methods called "factor methods", uses the same whole mathematical battery and applies very near calculation procedures and interpretation mechanisms.

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[1] http://www.uis.unesco.org

[2] http://www.uis.unesco.org/en/stats/centre.htm (data before 1999)

The Principal Component analysis notably gives a global and organized in hierarchy vision of the information inside the initial chart in the form of graphic representations generated by axis called "factor axis".

## 2.2. Global development of primary schooling from 1970 to the beginning of the 2000's

### - First table submitted to analysis

In order to initiate the reading of the graphic that will make the matter of this article in the last part, here is a table made of five lines and six columns. Each line represents an occurrence of the sub-Saharan Africa for which we give the average net enrolment rates, survival rate in the 5 [th] grade, literacy rate, etc. for the corresponding decade, calculate on the whole countries for which we had data.

**NER-MF** : Net enrolment rate in % (Total Male and Female)
**SUR-MF** : Survival rate in the 5th grade in % (Total Male and Female)
**LIT –MF** : 15 years old and over literacy rate in % (Male and Female)
**NER-PI, SUR-PI, LIT-PI** : express the parity index Female/Male according to the above defined rates (also expressed in percentage).

| | NER-MF | NER-PI | SUR-MF | SUR-PI | LIT-MF | LIT-PI |
|---|---|---|---|---|---|---|
| Sub-Saharan Africa-70 | 56.7 | 87.2 | 65.4 | 90.0 | 28.4 | 48.6 |
| Sub-Saharan Africa-80 | 56.6 | 85.3 | 66.7 | 98.0 | 42.6 | 58.2 |
| Sub-Saharan Africa-90 | 59.9 | 87.2 | 69.4 | 99.2 | 52.7 | 67.0 |
| Sub-Saharan Africa-00 | 66.2 | 92.2 | 71.1 | 98.6 | 61.0 | 76.6 |
| Sub-Saharan Africa (average for the 4 decades) | 59.9 | 88.0 | 68.2 | 96.5 | 46.2 | 62.6 |

Sources: UNESCO Institute for Statistics and ADEA
Average data calculated from the available data for each country from 1970 to 2004.
Note: only the 15 years old and over literacy rate was available for the considered decades. That the one we considered and not the 15 to 24 years old literacy rate.

### - Interpretation of the first factor plan
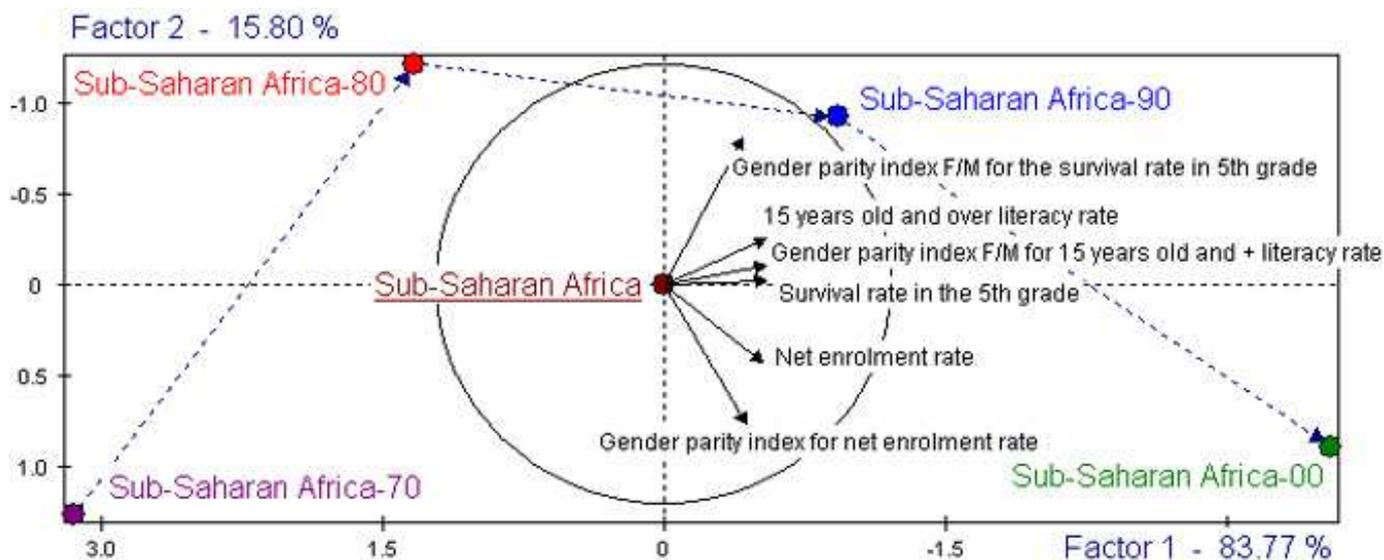


The first axis (83.77%) and the second factor axis (15.80%) concentrates, in this first plan, the almost totality (99.57%) of the information of the initial data table.

The four decennial occurrences of sub-Saharan Africa from the 1970's to the beginning of the 2000's, are positioned from left to right on the first factor axis. It points out the increase of the literacy rate, but even more a marked improvement of the associated parity index. This index takes

indeed about ten points from a decade to another and confirms the more and more important part of the women in the global phenomenon of literacy.

The circle of the correlations is always associated to such a principal component analysis. But it is not superimposed on the points-individuals space. It emphasizes the links between the diverse variables (here, indicators and indexes) and it states the meaning of the axis. It notably makes clear here, on the second axis and in a directional way, the evolution modalities of the sub-Saharan African decennial occurrences. So, the transition from sub-Saharan Africa 70 to sub-Saharan Africa 80 has been characterized by an increase of the gender parity index for survival rate of the 5$^{th}$ grade that moved from 90% to 98% from a decade to another without regressing anymore; it proves the equal success of both sexes.

As for the transition from sub-Saharan Africa 90 to sub-Saharan Africa 00, the improvement of the net enrolment rate (that measures the enrolment effort made on children old enough to be actually enrolled), as well as the improvement of the corresponding parity index plays an important part in the final position of sub-Saharan Africa of the years 2000.

At last, the final line of the data table: "sub-Saharan Africa" is an average point. It represents the "**cloud's gravity centre**" of the four other decennial occurrences. It is placed at the spatial origin of the factor axis. The other lines of the table revolve around it, and it consequently takes part in the reading and interpretation of the whole clouds of points.

In what is coming next, we study in details the comparative evolutions during three decades of a great number of sub-Saharan African countries.


## 3. Evolution during three decades of the sub-Saharan African countries regarding corresponding indicators and parity indexes.

### 3.1. The data table

The initial data table – here is an extract – has **104** lines (104 "countries-years") and **6** columns corresponding to the indicators and parity index defined in the previous part. There are no occurrences for any kind of country for the decade 1970 because the data about the wanted indicators for that period are insufficient.

The three decennial occurrences: Benin80, Benin90 and Benin00 prove that it was possible to calculate the average indicator for Benin of the respective 1980, 1990 and beginning of 2000 decades.

The partial unavailability of data explains that countries such as Cameroon or Zimbabwe are only under two decennial occurrences.

At last, the almost total unavailability of data for some countries eliminates them de facto from this analysis (Angola, Liberia, Sierra Leone, Somalia, etc.).

| Countries-years | NER-MF | NER-PI | SUR-MF | SUR-PI | LIT-MF | LIT-PI |
|---|---|---|---|---|---|---|
| Benin80 | 51.0 | 50.3 | 47.9 | 97.5 | 21.5 | 38.1 |
| Benin90 | 56.0 | 55.0 | 60.6 | 96.1 | 33.5 | 49.5 |
| Benin00 | 71.3 | 75.3 | 73.3 | 92.2 | 34.7 | 48.6 |
| ................... | ............. | ............. | ............. | ............. | ............. | ............. |
| Cameroon80 | 76.1 | 86.7 | 71.0 | 99.8 | 47.0 | 54.0 |
| Cameroon90 | 73.6 | 87.3 | 80.7 | 128.7 | 60.0 | 66.2 |
| ................... | ............. | ............. | ............. | ............. | ............. | ............. |
| Zambia80 | 82.1 | 92.0 | 88.8 | 94.3 | 60.5 | 70.6 |
| Zambia90 | 75.8 | 97.7 | 78.2 | 87.5 | 75.5 | 81.0 |
| Zambia00 | 67.6 | 98.8 | 78.7 | 94.5 | 68.0 | 78.4 |
| Zimbabwe90 | 85.7 | 100.1 | 80.8 | 101.2 | 83.5 | 88.2 |
| Zimbabwe00 | 82.8 | 100.8 | 64.8 | 104.7 | 90.0 | 92.5 |

**3.2. The first factorial plan [see pages 6 and 7]**

It concentrates more than three quarters of the information of the initial table (75.67%). As for a geographical map, its reading is made easier thanks to the colours (red: the decade 80, blue: the decade 90 and green: beginning of the 2000). Besides, we chose the representation of the cloud's points proportionally to "countries-years"' contribution in the formation of each factor axis.

In order to improve the understanding, we give two versions of the map from which we recommend the concomitant reading.

- On the first version, the 104 countries are represented (see page 6). The reader can appreciate the different trajectories of schooling development for a given country while following the order of the decades. The first axis is mainly the literacy progress axis, the indicator which variability during the three decades is the most important. We notice that the occurrences 2000 (green) of some countries stay on the left side of the graph (Niger00, Mali00, Burkina Faso00, Guinea00, Chad00, Ethiopia00, etc.), when the occurrences 80 (red) for others (Botswana80, Mauritius80, Lesotho80, Swaziland80, etc.) already were on right side allowing sizing up how late the firsts are compared to the seconds.

- On the second (see page 7), we extracted from the previous version a few examples of "countries-years" likely to show the different modalities of schooling development. We outline a short commentary.

The three decennial occurrences of Niger, on the left side of the graph, conflict with the three decennial occurrences of Botswana on the right side. We can then appreciate the extent of the progress that the indicators of the first must realize to balance the seconds.

The remarkable "U-turn" of Madagascar in the decade 90 makes its progression of the beginning of the 2000's significant. The "loops" of Chad and Zambia prove, from the taken into account indicators point of view, the regressively atypical trajectories compared to all the considered countries.

The trajectory of Mauritania is exemplary. From left to right, it crosses the plan from the decade of the 80's to the beginning of 2000's on following the increase and development directions of the indicators and indexes given by the circle of correlations. Without being superimposed on the "countries-years" space, this circle takes part, like in the previous part, in the interpretation of the meaning of the axis.

While the axis 1 is linked to the literacy rate - that is closely connected to the net enrolment rate and its respective parity index - the axis 2 shows the importance of the survival rate in the 5th grade and its parity index. The quadrature like position of the literacy rate and the enrolment rate with the survival rate shows a low correlation, even the almost independency between these indicators. Among the effects of this almost independency, we notice (see factor map page 6) that some countries such as "Equatorial Guinea00" has an important net enrolment rate (86%) while their survival rates in 5th grade (and consequently of continuous literacy) remains low (33%). The "South Africa00", on the contrary, presents a high net enrolment rate (90%) with a relatively high survival rate too (85%).

## 4. Conclusion

The map allows then seeing the evolution of the universal primary education in the diversity and the process of each country's trajectories. It significantly shows the courses' inequality of countries such as Niger, Burkina Faso, Mali, etc. which all the decennial occurrences gather in the lower left quadrant of the graph contrasting with the Mauritanian trajectory, close to the profile of these countries in the decade 80, but significantly moving away in the decades 90 and beginning of the 2000's thanks to a remarkable enrolment effort in the primary.

The pre-eminence of the adult literacy rate positively related to the net enrolment rate might show the propensity of literate parents to send more their children to school when the facilities enable it. The enrolment growth marked by an increase of this net enrolment rate could result of an improvement - that can be historically easy spotted – of this literacy for some countries that took part in the different past experiences[3]. The adult literacy rate appears to be an important factor that enables some countries to realize earlier their "take-off" as far as the primary schooling is concerned.

If the net enrolment rate underestimates the schooling cover and only gives an average value, insufficient to describe the learning life of the pupils, the "**survival rate in 5th grade**" provides this additional information. It is then possible to assess some level of achievement in primary school necessary for the perpetuation of any kind of literacy tuition. We noticed that they are no obvious link between the two indicators[4]. The counter-example of Equatorial Guinea in the beginning of the 2000's suggests that the net enrolment rate must be coupled with a satisfactory survival rate in the 5th grade to actually improve the future literacy rate.

The assessment of the universal primary education progress made obviously necessary the setup of monitoring indicators. Criticisms already occurred regarding the pertinence of the taken into account indicators. It seems today that the notion of "education profile" including both the access rate and achievement rate enables a more suited assessment to the achieved progress and above all to what remains to achieve.

Indeed, the indicators relate to those who actually have access to the education system. Why wouldn't be the idea to understand the reasons and define the characteristics of those who are excluded? In this respect, the practice of sample survey may be very informative.

At last, we come to the conclusion that this type of analysis can be extended. The "Dakar Pole"[5], the assessment platform serving the objectives of the Education for All, produced some sub-Saharan African "country-profiles" under the form of index cards that we submitted to a factor analysis. The number and variety of considered indicators (access, cover, internal effectiveness and financial indicators) enable to make up a statistic set that was comprehended by exploring tools of data multidimensional analysis, similar to the one we just saw.

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[3] UNESCO "World education report 2000". See «The Experimental World Literacy Programme (EWLP)» and the similar experiences related in the report [see page 34 and following].

[4] The lack of link is confirmed by a bi-varied analysis that we made between the net enrolment rate and the survival rate in 5th grade for the whole "countries-years" considered in the article. See also the methodology note of the "Pôle de Dakar" by **Nicolas Reuge** [2004] : "*Mesurer l'avancée vers la scolarisation primaire universelle*" ("*Measuring the progress towards universal primary education*") that uses the bi-varied analysis between the gross enrolment rate and the primary achievement rate and concludes to the lack of link between the two indicators too.

[5] http://www.poledakar.org

Sub-Saharan Africa. Development of primary schooling during 3 decades. PCA [104 countries-years x 6 indicators].

Factor 1 - 60.11 %

Factor 2 - 15.56 %

Sub-Saharan Africa. Primary. PCA - The circle of the correlations [104x6]. Examples of trajectories for some "countries-years".