MEASURING THE EDUCATIONAL EFFICIENCY OF AREA DEVELOPMENT PROGRAMMES OF WORLD VISION GHANA-NORTHERN SECTOR

Sam, Napoleon Bellua, MSc, BSc, HND
University for Development Studies, Ghana
Sebil, Charles, MPhil, B.Sc
Kwame Nkrumah University of Science and Technology, Ghana
Bumbokuri, Jude, BEd, MSc
World Vission, Nadowli, Ghana

Abstract

Purpose: In this age of knowledge economy, Non-governmental organisations play an important role in the development of a country. As donors expert judicious and effective use of their monies, non-governmental organisations are obviously obliged to put to efficient use of their resources. This study evaluates the relative efficiencies of educational efficiency of the area development programmes of World Vision Ghana-Northern sector in the year 2009.

Design/methodology/approach: This study applies Data Envelopment Analysis (DEA) to assess the relative efficiency of the educational area development programmes. The inputs were number of staff and number of vehicles, while the outputs were BECE pass rate and completion rate at JHS level. The potential improvements were computed for inefficient ADP.

Findings: Results show that the average efficiency score was 91.6% and that there were three (3) efficient ADPs (Zabzugu ADP, Soboba ADP and Nadowli ADP) out of the four (4) studied. It was noted that Gushegu ADP would have to reduce its number of staff and number of vehicles to 5 and 2 respectively in order to become efficient.

Keywords: Area development programme, educational efficiency, non-governmental organisation, data envelopment analysis, and improvement

Introduction

Ghana is experiencing a growing and deepening poverty in its rural areas, especially in the three northern and central regions. Traditionally, economic activity in the northern sector of the country is centered on agriculture with about 80 percent of the population engaged in crop farming (World Bank, 1995). Research done on poverty in Ghana noticed that in 1990 the three northern regions of Ghana, which make up of 22 percent of the total population of the country accounted for 28 percent of the poor and 31 percent of the very poor (using the lower poverty line) (Boateng et al., 1990). The 2008 Ghana Living Standards Survey Report indicates that school attendance rates are generally high in all localities except in rural savannah. While the rates range from a high of 97.0 percent in the other localities, in rural savannah it is 63.5 percent for males and 56.6 percent for females. The three regions in the northern part of Ghana have the highest illiteracy rates in the country, with Upper East having 76.5 per cent of the population, 15 years and older being totally illiterate. The corresponding rates for Northern and Upper West regions are 76.2 per cent and 73.4 per cent. The three regions in northern part of Ghana are very seriously handicapped in almost every human development indicator including education. Northern has one of the worst educational records, falling behind the Upper East and Upper West in many literacy and enrolment criteria from primary to the tertiary levels.

In light of these challenges, World Vision Ghana, a Christian relief, development and advocacy organisation has set up a number of poverty alleviation interventions aimed at developing its catchment areas. World Vision's operations in Ghana started in 1979. The main sectors of their intervention include, education, health, water, sanitation and hygiene (WASH), agriculture and food security, humanitarian and emergency affairs (HEA), micro-enterprise development activities, gender and development as well as Christian commitment.

Since its inception in 1979, World Vision has impacted several lives in Ghana. However, the problem of acute poverty in Northern Ghana still persists. This coupled with the fact that the scarce resources usually employed in these developmental interventions are gotten from international donors communities mostly in developed countries. In light of this, a research into the extent to which these hard-earned resources are efficiently used in poverty alleviation is more important than ever before.

Methodology

Charnes, and associates (1978) were the first to propose the DEA methodology as an evaluation tool for decision units. DEA has been applied successfully as a performance evaluation tool in many fields including manufacturing, school, banks, pharmacies, universities, small business development centers, and nursing home chains. Seiford (1990) provided an excellent bibliography of DEA applications. We employed a mathematical planning model (CCR model) to measure the efficiency frontier based on the concept of Pareto optimum. The basic idea of DEA is to identify the most efficient decision-making unit (DMU) among all DMUs. The most efficient DMU is called a Pareto-optimal unit and is considered the standard for comparison for all other DMUs. In this, a single firm is considered DEA Pareto efficient if it cannot increase any output or reduce any input without reducing other output or increasing other input. An efficient firm can enjoy efficiency scores of unity, while an inefficiency firm receives DEA scores of less than unity.

Efficiency is the ratio of the weighted sum of a firm to the weighted sum of inputs. The efficiency of any firm is computed as the maximum of a ratio of weighted firms to weighted
inputs, subject to the condition that similar ratios, using the same weights, for all other firms under consideration, are less than or equal to one. Here, we denote the maximum efficiency as $\boldsymbol{E_k}$, $\boldsymbol{Y_{kj}}$ as the *j*th output of the *k*th DMU and $\boldsymbol{X_{ki}}$ as the *i*th input of the *k*th DMU. If a DMU employs *p* input to produce *q* output, the score of *k*th DMU, $\boldsymbol{E_k}$, is a solution from the fractional linear programming problem:

$$\boldsymbol{Max\ E_k = \frac{\sum_{j=1}^{q} U_j Y_{kj}}{\sum_{i=1}^{p} V_i\ X_{ri}} \quad i = 1, 2, \ldots\ldots, p \quad j = 1, 2, \ldots\ldots, q}$$

$$\boldsymbol{s.t \quad \frac{\sum_{j=1}^{q} U_j Y_{rj}}{\sum_{i=1}^{p} V_i\ X_{ri}} \le 1 \quad r = 1, 2, \ldots\ldots, K, \ldots\ldots, R}$$

$$\boldsymbol{U_j, V_i \ \ge\ \varepsilon > 0 \quad for\ i, j}$$

Where $\boldsymbol{U_j}$ and $\boldsymbol{V_i}$ are the variable weights in the *j*th output and the *i*th input, respectively.

The former model can be reformulated by adding $\boldsymbol{\sum_{r=1}^{r} \lambda_r = 1}$ to the problem, which provides
valuable information about the cost benefits:

$$\boldsymbol{Min\ TE = \theta - \varepsilon\left(\sum_{i=i}^{p} S_{ki}^{-} + \sum_{i=i}^{p} S_{kj}^{+}\right)}$$

$$\textbf{s.t.}\ \boldsymbol{\sum_{r}^{r} \lambda_r X_{ri} - \theta X_{ki} + S_{ki}^{-} = 0}$$

$$\boldsymbol{\sum_{r}^{r} \lambda_r Y_{rj} - S_{kj}^{+} = Y_{rj}}$$

$$\boldsymbol{\sum_{r=1}^{r} \lambda_r = 1}$$

$$\boldsymbol{\lambda_r \ge 0, \qquad S_{ki}^{-} = 0, \qquad S_{kj}^{+} \ge 0, \qquad for\ \ i, j, k, r}$$

Where $\boldsymbol{\theta}$ is the efficiency score and $\boldsymbol{\varepsilon}$ is a non-archimedean quantity which is very minute.

We can calculate the relative efficiency score from the above model and further estimate the targeted value for each output/input of ADP.

Results and Analysis

DEA model for a given campus system can be formulated as follows:

Target DMU (Max θ) $= v_1 y_{1o} + v_2 y_{2o} + \cdots + v_r y_{ro}$

s.t. $u_1 x_{1o} + u_2 x_{2o} + \cdots + u_m x_{mo} = 1$

$v_1 y_{1i} + v_2 y_{2i} + \cdots + v_r y_{ri} \leq u_1 x_{1i} + u_2 x_{2i} + \cdots + u_m x_{mi}$, $\quad i = 1, \ldots, n$

$u_1, u_2, \ldots., u_m \quad \geq 0$

$v_1, v_2, \ldots., u_r \quad \geq 0.$

y_r= amount of output r

v_r= weight assigned to output r

x_i= amount of input i

u_i= weight assigned to input i

The linear programming formulated out of the data:

Max: Zabzugu ADP = $43u_1$+$60.5u_2$

Subject to: $4v_1$+$2v_2$=1

$43u_1$+ $60.5u_2 \leq 4v_1$+$2v_2$

$83u_1$+ $34.9u_2 \leq 3v_2$+$2v_2$

$91.4u_1$+ $36.05u_2 \leq 7v_1$+$3v_2$

$55.7u_1$+ $65u_2 \leq 6v_1$+ $2v_2$

$u_1 \geq 0$; $u_2 \geq 0$; $v_1 \geq 0$; $v_2 \geq 0$

Max: Saboba ADP = $83u_1$+ $34.9u_2$

Subject to: $3v_2$+$2v_2$ =1

$43u_1$+ $60.5u_2 \leq 4v_1$+$2v_2$

$83u_1$+ $34.9u_2 \leq 3v_2$+$2v_2$

$91.4u_1$+ $36.05u_2 \leq 7v_1$+$3v_2$

$55.7u_1$+ $65u_2 \leq 6v_1$+ $2v_2$

$u_1 \geq 0$; $u_2 \geq 0$; $v_1 \geq 0$; $v_2 \geq 0$

Max: Gushegu ADP=$91.4u_1$+ $36.05u_2$

Subject to: $7v_1$+$3v_2$ =1

$43u_1$+ $60.5u_2 \leq 4v_1$+$2v_2$

$83u_1$+ $34.9u_2 \leq 3v_2$+$2v_2$

$91.4u_1$+ $36.05u_2 \leq 7v_1$+$3v_2$

$55.7u_1$+ $65u_2 \leq 6v_1$+ $2v_2$

$u_1 \geq 0$; $u_2 \geq 0$; $v_1 \geq 0$; $v_2 \geq 0$

Max Nadowli ADP = $55.7u_1$+ $65u_2$

Subject to: $6v_1$+ $2v_2 = 1$

$43u_1$+ $60.5u_2 \leq 4v_1$+$2v_2$

$83u_1$+ $34.9u_2 \leq 3v_2$+$2v_2$

$91.4u_1$+ $36.05u_2 \leq 7v_1$+$3v_2$

$55.7u_1$+ $65u_2 \leq 6v_1$+ $2v_2$

$u_1 \geq 0;\ u_2 \geq 0; v_1 \geq 0;\ v_2 \geq 0$

Table 1 : Efficiency scores of the ADPs

DMU	Efficiency
Zabzugu ADP	1.0000
Saboba ADP	1.0000
Gushegu ADP	0.6643
Nadowli ADP	1.0000

The efficiency score of the ADPs ranges from 0.6643 to 1.The maximum efficiency score was 1 whilst minimum efficiency score was also 0.6643.The average efficiency of all ADPs is 0.9161. This implies that the input for an average unit may be reduced by 8.4%.

From table 1, Zabzugu ADP, Soboba ADP and Nadowli ADP performed better than Gushegu ADP because each of them has an efficiency score of one (1). Gushegu ADP may consider Nadowli ADP or Zubzugu ADP or Soboba ADP as a benchmark for improving its efficiency.

Table 2: Optimal weights for Zabzugu ADP as the target DMU

DMUs	Original Value	Final Value
Completion rate	1	0.006527567
BECE pass rate	1	0.011889498
Number of staff	1	0.043268446
Number of vehicles	1	0.413463108

From tables 2, the best input weights were given as 0.413463108 for number of vehicles and 0.043268446 for number of staff. The best output weights were also 0.011889498 BECE pass rate and 0.006527567 completion rate.

The ratio of the input weights gives= $\frac{0.413463108}{0.043268446}$=9.5558.To maximize efficiency number of vehicles should have weight 9.5558 times that of number of staff. It therefore means that when you reduce the number of vehicles it will have a bigger effect on efficiency than reducing the number of staff.

Improvement for Gushegu ADP

Gushegu ADP was inefficient. To improve the performance of Gushegu ADP, we must set one of the ADPs that were efficient as a benchmark. Thus input target is equal to actual input for inefficient ADP times relative efficiency of inefficient ADP. This implies that:

Input target=Actual input for inefficient ADP x Relative efficiency for inefficient ADP.

Therefore for Gushegu ADP we have:

Input target = (7 staff+3 vehicles) x 0.6643 = 5staff + 2 vehicles.

This means that Gushegu will be efficient if it reduces its number of staff and number of vehicles to 5 and 2 respectively and yielding the same output.

Conclusion

There are lots of advantages of DEA which encourage more and more organizations willing to use it in efficiency analysis. One of the advantages is that it is able to handle multiple inputs and outputs. This research used Data Envelopment Analysis approach to measure the educational efficiency of the area development programmes of World Vision Ghana-Northern sector. The DMUs of the research are four (Zabzugu ADP,Sabooba ADP , Nadowli ADP and Gushegu ADP) and the study covered the year 2009. Two input and two output variables were selected to represent these area development programmes' efficiencies. Number of staff and number of vehicles are used as inputs, while the outputs include number Basic Education Certificate Examination (BECE) pass rate and Basic Education completion rate. World Vision Ghana may have to reconsider their number of vehicles and staff in an ADP in order to perform more efficiently.

The following were findings and conclusions that were made with respect to efficiency of education projects of some ADPs and how to improve their inefficiencies:

Zabzugu ADP, Sabooba ADP and Nadowli ADP were identified as efficient. These ADPs serve as benchmark to Gushegu ADP which is inefficient. Gushegu ADP may use any of these ADPs as point of reference to adjust its resources in order to become efficient.

For Gushegu ADP to be efficient, it has to reduce its number of staff by two and number of vehicles by one.

World Vision could create other avenues for employment in other areas of intervention especially deprived areas of Ghana to avoid laying-off extra hands.

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