**Document of the Inter-American Development Bank**

**Belize**

**Education Quality Improvement Program**

**(BL-L1018)**

**Economic Analysis**

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EXECUTIVE SUMMARY

This document describes the economic analysis of the “Education Quality Improvement Program” (BL-L1018). The economic analysis encompasses Components I and II of the project for which a cost-benefit analysis is conducted. The assessment concludes that the principal combined effect of these two program components will be the improved academic achievement of students in the targeted primary schools. This in turn is expected to reduce repetition and dropout rates, increase the number of students completing their primary education and that initiate secondary education. The students who complete secondary education are expected to obtain higher wages, which will benefit the economy as a whole. The analysis also estimates cost-savings from the implementation of the quality assurance system, including the Education Management Information System (EMIS). The sensitivity analysis presents the effects of a conservative, neutral, and optimistic scenario.

Under our conservative scenario, Component I represents 43% of the investment and 96.68% of total program benefits (2.24 percentage points come from savings in recurrent costs by reducing repetition rates and 94.45 percentage points from higher income due to greater schooling). The ex-ante evaluation of the benefits of the Component I indicates that the net present value (NPV) is positive and reaches 109.26% of its costs.

NPV Benefits Component I

|  |  |  |
| --- | --- | --- |
| **BENEFITS COMPONENT I** | **US$** | **%** |
| Savings in recurrent costs by reducing repetition rates | 828,811 | 2.24 |
| Higher income due to greater schooling | 37,019,516 | 94.45 |
| **TOTAL PROGRAM BENEFITS** | **37,078,308** |  |

Source: Calculations based on model

Under our conservative scenario, the benefits of Component II represent 3.32% of total program benefits. The ex-ante evaluation of the benefits of Component II indicates that the NPV is positive and reaches 106.40% of its costs.

NPV Benefits Component II

|  |  |  |
| --- | --- | --- |
| **BENEFITS COMPONENT II** | **US$** | **%** |
| EMIS’s savings | 1,229,981 | 3.32 |
| **TOTAL PROGRAM BENEFITS** | **37,078,308** |  |

Source: Calculations based on model

The results of the sensitivity analysis are summarized in the below tables:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **CONSERVATIVE SCENARIO** | |  | **NEUTRAL SCENARIO** | |  | **OPTIMISTIC SCENARIO** | |
|  |  |  |  |  |  |  |  |
| **ECONOMIC**  **INDICATOR** | **VALUE** |  | **ECONOMIC**  **INDICATOR** | **VALUE** |  | **ECONOMIC**  **INDICATOR** | **VALUE** |
| **NPV 12,0%**(US$) | 3,112,923 |  | **NPV 12,0%**(US$) | 38,394,874 |  | **NPV 12,0%**(US$) | 79,614,584 |
| **IRR** (%) | 12.5% |  | **IRR** (%) | 15.4% |  | **IRR** (%) | 17.5% |
| **COST/BENEFIT** | 1.09 |  | **COST/BENEFIT** | 1.63 |  | **COST/BENEFIT** | 2.01 |
| **Payback Period** | 20 |  | **Payback Period** | 17 |  | **Payback Period** | 16 |

Source: Calculations based on model

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# Introduction

* 1. This document presents the ex-ante economic analysis for the Education Quality Improvement Program, which will be implemented by the Ministry of Education Youth and Sports (MOEYS) between 2015 and 2018. The analysis includes a cost-benefit analysis of the perceived costs and benefits associated with this particular project investment.
  2. The program aims to “contribute to the improvement of the quality of education” at the primary education level, through three main components: Component I: Improving the Quality of Teachers; Component II: Governance of the Education System; and Component III: Evaluation. The amount invested will be US$10,100,000.
  3. Through the development of Component I: Improving the Quality of Teachers, an expected 1,200 in service teachers and 500 pre-service teachers will be trained in content and pedagogy. The investment in teacher training is expected to improve student achievement in the targeted primary schools. This in turn is expected to reduce repetition and dropout rates, and increase the number of students completing their primary education and initiating secondary education. The students who complete secondary education are expected to obtain higher wages, which will benefit the economy as a whole.
  4. Component II will support efforts to improve the governance of the education system, including investments in principal, parental, and MOEYS officer training in planning and quality assurance at various levels of the education system (schools, District Education Centers, and central national level). The training will benefit approximately 129 principals, 450 parents, and some 50 MOEYS staff at the central and district officer levels. The component also supports the creation of an Education Management Information System (EMIS). The EMIS, combined with the training, will provide a solution to current economic inefficiencies related to data collection and management. The combination of these investments is expected to free up human resources of the District Education Centers, which currently collect this information manually, and, thanks to the implementation of the EMIS, could devote their working hours to pedagogical and curriculum support to schools.
  5. Through the development of Component III: Evaluation, the program will support the system of feedback and adjustments to comply with the goals of the program. However, this component doesn´t have an impact on the projected cash flows.
  6. In combination, the three components aim to reduce teacher content and pedagogical gaps, improve school management, and ultimately raise the performance of targeted primary students. This in turn is expected to reduce repetition and dropout rates, raise the levels in the transition between the last grade of primary education and enrollment in secondary education. As a result, the number of secondary education graduates is expected to increase, which in turn is expected to increase future earnings.
  7. This note is organized into seven chapters. Following this introductory chapter, chapter two will provide a brief overview of the methodology used for the analysis, the methodological limitations and the underlying assumptions of the analysis.
  8. The third chapter will present the direct expected benefits of investing in teacher training as well as the benefits derived from it. This chapter will discuss the benefits of improved teacher content and pedagogical knowledge, as well as the savings of the MOEYS from having a modern EMIS.
  9. The fourth chapter describes the implementation and program execution costs, as well as incremental costs that are generated by the program. Chapter five describes the economic return to the project. The economic return will be represented by the cost benefit ratio, and the net present value of benefits and costs, considering the assumptions made for the analysis of this program. In chapter six, the economic return will be subject to a sensitivity analysis, which will allow for a review of the model’s behavior under different scenarios and with it, the strength of the results. The note ends with chapter seven, which summarizes the conclusions and provides some recommendations.

# Methodology and Assumptions

## Methodology

* 1. The economic analysis of the Education Quality Improvement Program is done by assigning values to each of the expected impacts, including the costs (negative impacts) and the benefits (positive impacts).
  2. Once the costs and expected benefits of the investment have been measured and discounted, we present the results in three ways: (i) the benefit cost ratio, which measures the ratio of discounted future benefits to discounted costs; (i) the net present value of the project, which is the value of discounted benefits minus discounted costs; and (iii) the internal rate of return of the investment, which is the rate of interest that equates the discounted present value of expected benefits and the present value of the costs of the project.
  3. In the base situation, what would normally occur in the absence of the project is described (i.e. what would happen if the program would not have been realized), commonly called situation “without project.” The objective situation is what would happen in if the proposed project is undertaken, commonly called "project situation". For purposes of this evaluation, three “project situation" scenarios are calculated from a conservative, neutral, and optimistic viewpoint.
  4. In order to make a more conservative analysis, and considering possible delays in the execution of the loan, the project benefits are expected to begin only at year five.
  5. Taking into consideration that during the average working life of teachers benefited by the program, the effectiveness of the training given may decrease, or new skills can be taught, it is important to avoid overestimating the benefits of this program. To address this concern the model encompasses the income only for the first 13 cohorts in the case of the conservative scenario, 15 first cohorts in the case of the neutral scenario, and 18 first cohorts in the case of the optimistic scenario. These revenues are estimated from the time in which the cohorts complete their secondary education, and are projected until the theoretical age of retirement estimated for Belize at the age of 60.
  6. The information collected about the educational system and the macroeconomic situation of Belize included volatile data for some indicators. Perhaps most strikingly, the first grade repetition rates fluctuated greatly from year to year. The model includes adjustments for some of the most extreme outliers.
  7. Moreover, it was not possible to attain specific characteristics about the sample (benefited teachers) in terms of the average age and salary level. Therefore, the analysis is based on the average age of primary school teachers in Belize, and the average of salaries of current teachers at this level of education.
  8. The spreadsheet in [Annex 1](http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=38691161) shows the economic model that supports the analysis. The content and encoding of each of its Excel sheets is summarized in the following table:

Table 1. Description of the Content Presented in Annex 1

|  |  |  |
| --- | --- | --- |
| **ABBREVIATION** | **NAME** | **CONTENT** |
| **FRONTP** | Front page | Contains cover page with the name of the Program |
| **CONTENTS** | Table of Contents | Contains the index and a description of the tabs used in the calculations |
| **G.INFO** | General Information | Contains general information (descriptive, economic, population, education , etc.) that served as input during the assessment |
| **SUMMARY** | Summary | Contains the results of the economic indicators for Program evaluation scenarios |
| **SEC.STAT** | Secondary Statistics | Contains Secondary level statistics that supported part of the calculations developed |
| **PRI.STAT** | Primary Statistics | Contains Primary level statistics that supported part of the calculations developed |
| **REP.RATES.S** | Repetition Rates | Contains the projected evolution of repetition rates and their supports |
| **BEN** | Repeaters – Target | Contains the target of the repetition analysis |
| **REP** | Repeaters by scenario | Contains the number of repeaters by scenario |
| **REP.CAL** | Repeaters cost by scenario | Contains the repeaters costs by scenario |
| **REP.SAV** | Savings in recurrent cost – repetition rates | Contains the savings in recurrent costs by reducing repetition rates |
| **ENROL** | Enrolment | Contains data about the cohorts (students) which will be monitored according to the expected benefits |
| **REVENUE** | Revenue | Contains the estimated salary income by educational attainment, for each of the scenarios |
| **REC.SPEND** | Recurrent Spending | Contains information about the recurrent costs associated with both students and teachers beneficiaries |
| **INVEST** | Investment | Contains the flow of investments to be supported by the Program |
| **CCF** | Conservative Cash Flow | Contains cash flow of the Program in the conservative scenario |
| **NCF** | Neutral Cash Flow | Contains project cash flow in the neutral scenario |
| **OCF** | Optimistic Cash Flow | Contains cash flow of the Program in the optimistic scenario |

## Assumptions Associated with the Expected Number of Beneficiary Students

* 1. The analysis is based on the assumption that the future student-teacher ratio will be equal to the average ratio of the past decade, adjusting for extreme outliers. This provides us with an average student-teacher ratio of 22.5 (see [Annex 1](http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=38691161) sheet Enroll), which multiplied by the number of trained teachers produces a beneficiary group of about 38,197 students.[[1]](#footnote-1)

Table 2. Historic Primary Student-Teacher Ratios

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **2004-05** | **2005-06** | **2006-07** | **2007-08** | **2008-09** | **2009-10** | **2010-11** | **2011-12** | **2012-13** | **Average** |
| 23.7 | 22.8 | 22.9 | 22.6 | 22.6 | 22.2 | 21.9 | 21.5 | 22.6 | 22.5 |

Source: Calculations based on MOEYS data

## Assumptions Associated with the Benefits Derived from the Increase in the Academic Performance, the Retention, and the Dropout of Students

* 1. The identified savings from reducing repetition rates are based on the premise that having fewer students per grade-level will reduce costs in terms of teacher salaries, teaching materials, text books, and administrative expenses, lowering the recurrent expenditure per student.
  2. The expected reduction in repetition rates are based on the average repetition rates between the years 2004 and 2012 (Table 3). To avoid possible alterations from outliers, these were eliminated as described in paragraph 2.6 above (see [Annex 1](http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=38691161) sheet PRI.STAT).

Table 3. Repetition rate - Primary level for the baseline

(without project)

| **GRADE** | | **AVERAGE** |
| --- | --- | --- |
| 1 | Beginners | 4.1% |
| 2 | Infant 1 | 13.3% |
| 3 | Infant 2 | 7.8% |
| 4 | Standard 1 | 8.0% |
| 5 | Standard 2 | 7.5% |
| 6 | Standard 3 | 6.6% |
| 7 | Standard 4 | 5.9% |
| 8 | Standard 5 | 5.7% |
| 9 | Standard 6 | 1.5% |

Source: Calculated based on MOEYS data

* 1. The model constructed assumes equal reductions during years 6, 7, and 8 of the project. The model presents three scenarios of project impact on repetition rates, bringing the rates of the lower grades closer to those of the upper grades. Depending on the scenario (conservative, neutral, or optimistic), the target values are set as shown in Table 4.

Table 4. Scenarios of Decrease in Repetition Rates

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CONSERVATIVE SCENARIO** | | | | | | | | | | |
|  | | **Beginners** | **Infant 1** | **Infant 2** | **Standard 1** | **Standard 2** | **Standard 3** | **Standard 4** | **Standard 5** | **Standard 6** |
| **Actual Rate** | | 4.1% | 13.3% | 7.8% | 8.0% | 7.5% | 6.6% | 5.9% | 5.7% | 1.5% |
| **Goal (rate)** | | 3.1% | 10.0% | 5.9% | 6.0% | 5.6% | 4.9% | 4.4% | 4.3% | 1.1% |
| **Difference** | | 1.0% | 3.3% | 2.0% | 2.0% | 1.9% | 1.6% | 1.5% | 1.4% | 0.4% |
| **Variation** | | 0.3% | 1.1% | 0.7% | 0.7% | 0.6% | 0.5% | 0.5% | 0.5% | 0.1% |
| **Year** | **6** | 3.8% | 12.2% | 7.2% | 7.3% | 6.9% | 6.0% | 5.4% | 5.2% | 1.4% |
| **Year** | **7** | 3.4% | 11.1% | 6.5% | 6.6% | 6.2% | 5.5% | 4.9% | 4.8% | 1.2% |
| **Year** | **8** | 3.1% | 10.0% | 5.9% | 6.0% | 5.6% | 4.9% | 4.4% | 4.3% | 1.1% |
|  |  |  |  |  |  |  |  |  |  |  |
| **NEUTRAL SCENARIO** | | | | | | | | | | |
|  | | **Beginners** | **Infant 1** | **Infant 2** | **Standard 1** | **Standard 2** | **Standard 3** | **Standard 4** | **Standard 5** | **Standard 6** |
| **Actual Rate** | | 4.1% | 13.3% | 7.8% | 8.0% | 7.5% | 6.6% | 5.9% | 5.7% | 1.5% |
| **Goal (rate)** | | 2.0% | 6.7% | 3.9% | 4.0% | 3.7% | 3.3% | 3.0% | 2.9% | 0.7% |
| **Difference** | | 2.0% | 6.7% | 3.9% | 4.0% | 3.7% | 3.3% | 3.0% | 2.9% | 0.7% |
| **Variation** | | 0.7% | 2.2% | 1.3% | 1.3% | 1.2% | 1.1% | 1.0% | 1.0% | 0.2% |
| **Year** | **6** | 3.4% | 11.1% | 6.5% | 6.6% | 6.2% | 5.5% | 4.9% | 4.8% | 1.2% |
| **Year** | **7** | 2.7% | 8.9% | 5.2% | 5.3% | 5.0% | 4.4% | 3.9% | 3.8% | 1.0% |
| **Year** | **8** | 2.0% | 6.7% | 3.9% | 4.0% | 3.7% | 3.3% | 3.0% | 2.9% | 0.7% |
|  |  |  |  |  |  |  |  |  |  |  |
| **OPTIMISTIC SCENARIO** | | | | | | | | | | |
|  | | **Beginners** | **Infant 1** | **Infant 2** | **Standard 1** | **Standard 2** | **Standard 3** | **Standard 4** | **Standard 5** | **Standard 6** |
| **Actual Rate** | | 4.1% | 13.3% | 7.8% | 8.0% | 7.5% | 6.6% | 5.9% | 5.7% | 1.5% |
| **Goal (rate)** | | 1.0% | 3.3% | 2.0% | 2.0% | 1.9% | 1.6% | 1.5% | 1.4% | 0.4% |
| **Difference** | | 3.1% | 10.0% | 5.9% | 6.0% | 5.6% | 4.9% | 4.4% | 4.3% | 1.1% |
| **Variation** | | 1.0% | 3.3% | 2.0% | 2.0% | 1.9% | 1.6% | 1.5% | 1.4% | 0.4% |
| **Year** | **6** | 3.1% | 10.0% | 5.9% | 6.0% | 5.6% | 4.9% | 4.4% | 4.3% | 1.1% |
| **Year** | **7** | 2.0% | 6.7% | 3.9% | 4.0% | 3.7% | 3.3% | 3.0% | 2.9% | 0.7% |
| **Year** | **8** | 1.0% | 3.3% | 2.0% | 2.0% | 1.9% | 1.6% | 1.5% | 1.4% | 0.4% |

* 1. The reduced repetition rates, combined with improved training and tutoring of principals, primary education teachers and parents, is expected to reduce dropout rates and increase the number of potential secondary education graduates. The expected reductions in drop-out rates are based on the average rates between the years 2004 and 2012 (Table 5). To avoid possible alterations from outliers, the model is based on adjustments of extreme values as described in paragraph 2.6 above (see [Annex 1](http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=38691161) sheet PRI.STAT).

Table 5. Dropout rate - Primary level for the baseline

(without project) scenario

|  |  |  |
| --- | --- | --- |
| **GRADE** | | **AVERAGE** |
| 1 | Beginners | 0.0% |
| 2 | Infant 1 | 0.2% |
| 3 | Infant 2 | 0.2% |
| 4 | Standard 1 | 0.3% |
| 5 | Standard 2 | 0.4% |
| 6 | Standard 3 | 0.6% |
| 7 | Standard 4 | 1.2% |
| 8 | Standard 5 | 2.0% |
| 9 | Standard 6 | 2.0% |

Source: Calculations based on MOEYS administrative data

* 1. The model presents three alternative scenarios for changes in dropout rates (conservative, neutral, or optimistic). The target values are set as shown in Table 6.

Table 6. Scenarios of Decreases in Primary Education Drop-out Rates

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CONSERVATIVE SCENARIO** | | | | | | | | | | |
|  | | **Beginners** | **Infant 1** | **Infant 2** | **Standard 1** | **Standard 2** | **Standard 3** | **Standard 4** | **Standard 5** | **Standard 6** |
| **Actual Rate** | | 0.0% | 0.2% | 0.2% | 0.3% | 0.4% | 0.6% | 1.2% | 2.0% | 2.0% |
| **Goal (rate)** | | 0.0% | 0.2% | 0.2% | 0.3% | 0.4% | 0.4% | 0.9% | 1.5% | 1.5% |
| **Difference** | | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.2% | 0.3% | 0.5% | 0.5% |
| **Variation** | | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.1% | 0.1% | 0.2% | 0.2% |
| **Year** | **6** | 0.0% | 0.2% | 0.2% | 0.3% | 0.4% | 0.5% | 1.1% | 1.8% | 1.8% |
| **Year** | **7** | 0.0% | 0.2% | 0.2% | 0.3% | 0.4% | 0.5% | 1.0% | 1.7% | 1.7% |
| **Year** | **8** | 0.0% | 0.2% | 0.2% | 0.3% | 0.4% | 0.4% | 0.9% | 1.5% | 1.5% |
|  |  |  |  |  |  |  |  |  |  |  |
| **NEUTRAL SCENARIO** | | | | | | | | | | |
|  | | **Beginners** | **Infant 1** | **Infant 2** | **Standard 1** | **Standard 2** | **Standard 3** | **Standard 4** | **Standard 5** | **Standard 6** |
| **Actual Rate** | | 0.0% | 0.2% | 0.2% | 0.3% | 0.4% | 0.6% | 1.2% | 2.0% | 2.0% |
| **Goal (rate)** | | 0.0% | 0.2% | 0.2% | 0.3% | 0.3% | 0.3% | 0.6% | 1.0% | 1.0% |
| **Difference** | | 0.0% | 0.0% | 0.0% | 0.0% | 0.1% | 0.3% | 0.6% | 1.0% | 1.0% |
| **Variation** | | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.1% | 0.2% | 0.3% | 0.3% |
| **Year** | **6** | 0.0% | 0.2% | 0.2% | 0.3% | 0.3% | 0.5% | 1.0% | 1.7% | 1.7% |
| **Year** | **7** | 0.0% | 0.2% | 0.2% | 0.3% | 0.3% | 0.4% | 0.8% | 1.3% | 1.3% |
| **Year** | **8** | 0.0% | 0.2% | 0.2% | 0.3% | 0.3% | 0.3% | 0.6% | 1.0% | 1.0% |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  | Table 6 cont. |  |  |  |  |
| **OPTIMISTIC SCENARIO** | | | | | | | | | | |
|  | | **Beginners** | **Infant 1** | **Infant 2** | **Standard 1** | **Standard 2** | **Standard 3** | **Standard 4** | **Standard 5** | **Standard 6** |
| **Actual Rate** | | 0.0% | 0.2% | 0.2% | 0.3% | 0.4% | 0.6% | 1.2% | 2.0% | 2.0% |
| **Goal (rate)** | | 0.0% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.6% | 1.0% | 1.0% |
| **Difference** | | 0.0% | 0.1% | 0.1% | 0.1% | 0.2% | 0.5% | 0.6% | 1.0% | 1.0% |
| **Variation** | | 0.0% | 0.0% | 0.0% | 0.0% | 0.1% | 0.2% | 0.2% | 0.3% | 0.3% |
| **Year** | **6** | 0.0% | 0.2% | 0.2% | 0.2% | 0.3% | 0.4% | 1.0% | 1.7% | 1.7% |
| **Year** | **7** | 0.0% | 0.2% | 0.2% | 0.2% | 0.2% | 0.3% | 0.8% | 1.3% | 1.3% |
| **Year** | **8** | 0.0% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.6% | 1.0% | 1.0% |

* 1. The secondary education repetition and dropout rates were included in the analysis to estimate the number of students that will complete this level of education. Given that the program targets the primary education level, in our model the secondary education repetition and dropout rates are the same as those of the baseline scenario or “without project” scenario. These rates are held constant for the three scenarios. The baseline scenarios were constructed from averaging the repetition rates between the years 2004 and 2012 (Tables 7). To avoid possible alterations from outliers, these were eliminated as described in paragraph 2.6 above ([Annex 1](http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=38691161) sheet SEC.STAT).

Table 7. Average repetition and dropout rates – Secondary level for the baseline

(Without project)

| **Grade** | | **Repetition** | **Drop-out** |
| --- | --- | --- | --- |
| 1 | Prep | 4.1% | 11.6% |
| 2 | Form 1 | 9.6% | 11.7% |
| 3 | Form 2 | 8.5% | 8.8% |
| 4 | Form 3 | 9.1% | 7.3% |
| 5 | Form 4 | 43.0% | 3.4% |

Source: Calculations based on MOEYS data

## Assumptions Associated with Long-term Effects of the Program: Future Income of the Beneficiary Cohorts

* 1. The literature indicates that the salary structure of any labor market is a function of the educational level of the economically active population (Patrinos y Psacharopoulos, 2004; Barro: 1991; Mankiw et al: 1992; Romer; 1986; Lucas, 1988; Guisán y Aguayo: 2001; UNESCO: 2005; Hanushek-Kimko: 2000). Thus, the future income of the beneficiary cohorts depends on their education level. Belize population census data (2010) confirms this association between education attainment and income levels. The greater the level of education, the higher the income received. Secondary education graduates have an average annual salary of US$7,410 per year, compared to US$5,400 in the case of workers with an incomplete secondary education. Workers with an incomplete primary education earn on average less than five thousand dollars per year.

|  |  |  |
| --- | --- | --- |
| Table 8. Average income by highest level of education attained (US$) | | |
| **Level** | **Monthly** | **Annual (\*)** |
| None | 404.46 | 4,853.53 |
| Primary | 450.02 | 5,400.21 |
| Secondary | 617.55 | 7,410.57 |
| Post-Secondary | 798.23 | 9,578.80 |
| University | 1,151.55 | 13,818.58 |
| Other | 442.08 | 5,305.01 |
| Not Reported | 624.70 | 7,496.43 |

\*Own calculations –Estimated value

Source: 2010 Population Census data

* 1. When calculating the number of beneficiaries that will benefit from a higher wage once inserted into the labor market, the model considers the unemployment rate. The unemployment rate used in the model is 11.1%, the 2001-12 average after adjusting for extreme values (See [Annex I](http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=38691161) sheet GEN.INFO).

Table 9. Average Unemployment Rate

|  |  |
| --- | --- |
| **UNEMPLOYMENT**  **RATE** | **%** |
| 2001 | 9.1% |
| 2002 | 10.0% |
| 2003 | 12.9% |
| 2004 | 11.6% |
| 2005 | 11.0% |
| 2006 | 9.4% |
| 2007 | 8.5% |
| 2008 | 8.2% |
| 2009 | 13.1% |
| 2010 | 23.3% |
| 2012 | 14.4% |
| **AVERAGE (\*)** | **11.1%** |

Note: \*Own calculations

## Assumptions Associated with the District Education Centers’ Cost Savings (Component II)

* 1. The calculation of the cost savings from decreased staff time devoted to information gathering and data entry depends on the optimization of the working time from the human resources in the MOEYS District Education Centers. Table 10 presents the District Education Center staff and pay scale data on which the cost saving calculation was based.

Table 10. District Education Office Staff and Pay Scale (US$)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **EDUCATION OFFICERS II** | | | |  | **PRINCIPAL EDUCATION OFFICERS** | | | |
| **#** | **Post** | **Pay scale** | **Average**  **Annual Wage (\*)** |  | **#** | **Post** | **Pay scale** | **Average**  **Annual Wage (\*)** |
| 1 | EO II | 17 | 19,692 |  | 1 | PEO | 24 | 26,154 |
| 1 | EO II | 17 | 19,692 |  | 1 | PEO | 24 | 26,154 |
| 1 | EO II | 17 | 19,692 |  | 1 | PEO | 24 | 26,154 |
| 1 | EO II | 17 | 19,692 |  | 1 | PEO | 24 | 26,154 |
| 1 | EO II | 17 | 19,692 |  | 1 | PEO | 24 | 26,154 |
| 1 | EO II | 17 | 19,692 |  | 1 | PEO | 24 | 26,154 |
| 1 | EO II | 17 | 19,692 |  |  |  |  |  |
| 1 | EO II | 17 | 19,692 |  | **SECOND CLASS CLERK/SECRETARY** | | | |
| 1 | EO II | 17 | 19,692 |  | **#** | **Post** | **Pay scale** | **Average**  **Annual Wage (\*)** |
| 1 | EO II | 17 | 19,692 |  | 1 | SCC | 4 | 5,520 |
| 1 | EO II | 17 | 19,692 |  | 1 | SCC | 4 | 5,520 |
| 1 | EO II | 17 | 19,692 |  | 1 | Secretary I | 10 | 9,267 |
| 1 | EO II | 17 | 19,692 |  | 1 | SCC | 4 | 5,520 |
| 1 | EO II | 17 | 19,692 |  | 1 | SCC | 4 | 5,520 |
| 1 | EO II | 17 | 19,692 |  | 1 | SCC | 4 | 5,520 |

Note: \*Own calculations

Source: MOEYS administrative records (2014)

* 1. The average annual wage has been calculated as the average between the minimum and the maximum value associated with each pay scale. The Principal Education Officers neither collect school administrative data from schools, nor do data entry. Therefore, the model does not contemplate any time savings as a result of Component II. Although no formal study of time use have been conducted, interviews with two of the six education district offices, as well as with central MOEYS officers, indicate that data collection is currently the task that consumes most of the working hours of Education Officers, Clerks and Secretaries. The model considers three different time use scenarios for these three groups of MOEYS employees: 70% in the conservative scenario; 75% in the neutral scenario; and up to 80% in the optimist scenario.

## Assumptions about Non-recurrent and Recurrent Expenditures

* 1. Non-recurrent or investment costs are the incremental costs generated with the program. The principal investment cost is the training budget (42% of total investment costs). The second cost in magnitude is the cost of the EMIS (35% of total investment costs).
  2. Recurrent costs are comprised of teacher salaries and the recurrent cost per student. The following table presents the cost amounts for the recurrent costs of the project (see annex I sheet Rec.Spend).[[2]](#footnote-2) During the years in which the beneficiary cohorts are enrolled in primary and or secondary education, the model calculates the recurrent expenditure as the average per student cost of education. Once a cohort has graduated, the model estimates the recurrent expenditure based on the value of the wages for beneficiary teachers.

Table 11. Base for recurrent cost calculation while cohorts are enrolled in school (US$)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Level** | **2006-07** | **2007-08** | **2008-09** | **2009-10** | **2011-12** | **2012-13** |
| **Primary** | 560 | 583 | 604 | 644 | 670 | 674 |
| **Secondary** | 986 | 1,053 | 1,174 | 1,183 | 1,229 | 1,253 |

Source: Calculations based on MOEYS administrative data 2012/13

Table 12. Base for recurrent cost calculation for the investment stage and the period in which the analyzed cohorts are not enrolled (US$)

| **QUALIFICATIONS** | **PAY SCALE** | **MIN** | **MAX** | **AVERAGE** |
| --- | --- | --- | --- | --- |
| Primary School Certificate | 2 | 4,122 | 4,878 | 4,500 |
| Second Class Certificate | 4 | 5,052 | 5,988 | 5,520 |
| High School Diploma | 5 | 5,574 | 6,582 | 6,078 |
| First Class Certificate | 6 | 6,402 | 13,356 | 9,879 |
| Certificate in Teaching Level 1 | 7 | 7,494 | 14,790 | 11,142 |
| Associate Degree (Not in Education) | 8 | 8,322 | 9,528 | 8,925 |
| Certificate in Teaching Level 2 | 8 | 8,322 | 15,960 | 12,141 |
| Associate Degree (Not in Education), plus 1 A-Level or 1- 2 unit CAPE | 9 | 8,490 | 9,714 | 9,102 |
| Associate Degree Primary Education | 9 | 8,490 | 16,242 | 12,366 |
| Associate Degree (Not in Education) | 10 | 8,646 | 9,888 | 9,267 |
| Associate Degree Primary Education with Induction | 12 | 9,558 | 17,766 | 13,662 |
| Bachelor’s Degree (Not in Education) | 14 | 11,610 | 20,730 | 16,170 |
| Bachelor’s Degree in Education | 16 | 12,792 | 23,280 | 18,036 |
| Master’s Degree in Education | 16 | 13,896 | 23,280 | 18,588 |
| PHD | 16 | 15,552 | 23,280 | 19,416 |

|  |  |
| --- | --- |
| Teacher average wage | 11,653 |

Source: Calculations based on MOEYS administrative data 2014

# Economic Benefits

* 1. The calculated benefits consist of savings in recurrent costs by reducing repetition rates, higher income due to greater schooling, and savings as a result of the EMIS. Based on our assumption about program benefits (Chapter II), the NPV of the benefits are presented below. Under our conservative scenario, the NPV of program benefits would be US$37 million (Table 13), rising to US$158 million under the optimistic scenario (Table 15).

Table 13. Benefits Conservative Scenario (US$)

|  |  |
| --- | --- |
| **CONCEPT** | **NPV** |
| **INCOME** |  |
| Savings in recurrent costs by reducing repetition rates | 828,811 |
| Higher income due to greater schooling | 35,019,516 |
| EMIS savings | 1,229,981 |
| **TOTAL BENEFITS** | **37,078,308** |

Source: Projections based on model

Table 14. Benefits Neutral Scenario (US$)

|  |  |
| --- | --- |
| **CONCEPT** | **NPV** |
| **INCOME** |  |
| Savings in recurrent costs by reducing repetition rates | 1,657,623 |
| Higher income due to greater schooling | 96,249,279 |
| EMIS’s savings | 1,317,837 |
| **TOTAL BENEFITS** | **99,224,738** |

Source: Projections based on model

Table 15. Benefits Optimistic Scenario (US$)

|  |  |
| --- | --- |
| **CONCEPT** | **NPV** |
| **INCOME** |  |
| Savings in recurrent costs by reducing repetition rates | 2,486,434 |
| Higher income due to greater schooling | 154,182,545 |
| EMIS’s savings | 1,405,693 |
| **TOTAL BENEFITS** | **158,074,672** |

Source: Projections based on model

# Economic Costs

* 1. The investment cost of the program is US$10,573,373, including interest and US$100,000 provided in kind by the MOEYS (Table 16). More detail of these costs can be found in the spreadsheet attached (see Annex 1 sheet INVEST):

Table 16. Program Investment (US$)

|  |  |  |  |
| --- | --- | --- | --- |
| **Component/Subcomponent** | **IDB** | **Local** | **Total** |
| **Component I: Improving the Quality of Teachers.** | **4,391,000** |  | **4,391,000** |
| 1.1 System for attracting and accepting higher Quality Teacher Training Candidates. | 1,501,000 |  | 1,501,000 |
| 1.2  Capacity building of the TEIs in the training of primary education teachers. | 595,000 |  | 595,000 |
| 1.3  On-site Practical Professional Development. | 2,296,000 |  | 2.296,000 |
| **Component II: Governance of the Education System.** | **3,578,000** |  | **3,578,000** |
| 2.1  Strengthening of Quality Assurance Role of TEIs. | 1,156,000 |  | 1,156,000 |
| 2.2  School Quality Assurance System. | 2,422,000 |  | 2.422,000 |
| **Component III: Evaluation** | **748,000** |  | **748,000** |
| 3.1  Evaluation of the pre-service teacher training. | 348,000 |  | 348,000 |
| 3.2  Randomized control trial of the on-site practical professional development in primary schools. | 400,000 |  | 400,000 |
| **Project Management** | **757,000** | **100,000** | **857,000** |
| 4.1  Executing Unit/Project Execution Support | 597,000 | 100,000 | 697,000 |
| 4.2  Midterm and Final Review, including ex-post economic analysis | 60,000 |  | 60,000 |
| 4.3  Audit | 100,000 |  | 100,000 |
| **Contingency** | **526,000** |  | **526,000** |
| **Interest paid on the loan** |  | **473,373** |  |
| **Total** | **10,000,000** | **573,373** | **10,573,373** |

Source: Calculations based on IDB project data

* 1. The NPV of the US$10.5 million, at the 12% annual discount rate typically used for IDB projects, is US$8.1 million (Table 17).

Table 17. NPV Investment (US$)

|  |  |
| --- | --- |
| **CONCEPT** | **NPV** |
| **INVESTMENT** |  |
| IDB + LOCAL | 7,645,091 |
| Financial cost | 473,373 |
| **TOTAL INVESTMENT** | **8,118,464** |

Source: Calculations based on IDB project data

* 1. Based on our assumption about recurrent costs (Chapter II), the NPV of the recurrent costs are laid out below. Under the conservative scenario, the NPV of the recurrent costs would be US$25.8 million (Table 18), raising to US$70.3 million under the optimistic scenario.

Table18. Expenses Conservative Scenario (US$)

|  |  |
| --- | --- |
| **CONCEPT** | **NPV** |
| **EXPENSES** |  |
| Operating Expenses – Recurrent Costs | 25,846,609 |
| **TOTAL EXPENSES** | **25,846,609** |

Source: Projections based on model

Table 19. Expenses Neutral Scenario (US$)

|  |  |
| --- | --- |
| **CONCEPT** | **NPV** |
| **EXPENSES** |  |
| Operating Expenses – Recurrent costs | 52,711,401 |
| **TOTAL EXPENSES** | **52,711,401** |

Source: Projections based on model

Table 20. Expenses Optimistic Scenario (US$)

|  |  |
| --- | --- |
| **CONCEPT** | **NPV** |
| **EXPENSES** |  |
| Operating Expenses – Recurrent Costs | 70,341,625 |
| **TOTAL EXPENSES** | **70,341,625** |

Source: Projections based on model

# Economic Returns

* 1. Once we have calculated the economic benefits and costs of the project under a conservative scenario, we find that the NPV discounted at a rate of 12% is positive and over US$3 million. This allows us to conclude that the project is viable. The internal rate of return is 12.5% and the benefit to cost ratio is 1.09 (Table 21a). Under a neutral scenario (Table 22a), the NPV is over US$38 million with a benefit to cost ratio of 1.63.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Table 21a. Economic Indicators  Conservative Scenario | |  | Table 21b. Execution term | |
|  |
|  |  |  |  |  |
| **ECONOMIC INDICATOR** | **VALUE** |  | | |
| **NPV (Benefits)** | 37,078,101 |
| **NPV (Investment / Cost)** | 33,965,073 |
| **NPV 12,0%** | 3,112,923 |  | | |
| **IRR (%)** | 12.5% |
| **COST/BENEFIT** | 1.09 |
| **Payback Period** | 20 |
|  |  |  |  |  |
| Table 22a. Economic Indicators  Neutral Scenario | |  | Table 22b. Execution term | |
|  |
|  |  |  |  |  |
| **ECONOMIC INDICATOR** | **VALUE** |  | | |
| **NPV (Benefits)** | 99,224,738 |
| **NPV (Investment / Cost)** | 60,829,864 |
| **NPV 12,0%** | 38,394,874 |  | | |
| **IRR (%)** | 15.4% |
| **COST/BENEFIT** | 1.63 |
| **Payback Period** | 17 |
|  |  |
| Table 23a. Economic Indicators  Optimistic Scenario | |  | Table 23b Execution term | |
|  |
|  |  |  |  |  |
| **ECONOMIC INDICATOR** | **VALUE** |  | | |
| **NPV (Benefits)** | 158,074,672 |
| **NPV (Investment / Cost)** | 70,814,997 |  | | |
| **NPV 12,0%** | 79,614,584 |
| **IRR (%)** | 17.5% |
| **COST/BENEFIT** | 2.01 |
| **Payback Period** | 16 |

# Sensitivity Analysis

6.1 The sensitivity analysis that has been described and referred to throughout this document is described in further detail in the spreadsheet ([Annex I](http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=38691161)). The most relevant effects associated with our three program scenarios are summarized in the table below.

Table 24. Sensitivity of the Program effects by scenario

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **DATA** | **WITH PROGRAM** | | |
| **CONSERVATIVE** | **NEUTRAL** | **OPTIMISTIC** |
| **General** | # of benefited cohorts | 13 | 15 | 18 |
| Projection Period | 62 | 62 | 62 |
| **Impacts** | % of graduated from Standard 6 (cohort that does all the cycle) | 26% | 30% | 34% |
| Savings in recurrent costs by reducing repetition rates (US$ NPV) | 828,811 | 1,657,623 | 2,486,434 |
| Higher income due to greater schooling (US$ NPV) | 35,019,516 | 96,249,279 | 154,182,525 |
| EMIS’s savings (US$ NPV) | 1,229,981 | 1,317,837 | 1,405,693 |

Source: Projections based on model

1. Conclusions
   1. The cost-benefit analysis allows us to conclude that the project is viable. Under a conservative scenario, we find that the NPV discounted at a rate of 12% is positive and over US$3 million. The internal rate of return is 12.5% and the benefit to cost ratio is 1.09. Under a neutral scenario, the NPV is close to US$38 million with a benefit to cost ratio of 1.63. The ex-post cost-benefit analysis will show what scenario is achieved *de facto*. This, of course, depends entirely on the success of the program implementation.
   2. If we break the analysis down by component, we see that Component I, representing 43% of the investment, under the conservative scenario accounts for 96.68% of total program benefits (2.24 percentage points come from savings in recurrent costs by reducing repetition rates and 94.45 percentage points come from higher income due to greater schooling). The ex-ante evaluation of the benefits of Component I indicates that the NPV is positive and reaches 109.26% of its costs.

Table 27. NPV Benefits Component I

|  |  |  |
| --- | --- | --- |
| **BENEFITS COMPONENT I** | **US$** | **%** |
| Savings in recurrent costs by reducing repetition rates | 828,811 | 2.24 |
| Higher income due to greater schooling | 37,019,516 | 94.45 |
| **TOTAL PROGRAM BENEFITS** | **37,078,308** |  |

Source: Projections based on model

* 1. Under our conservative scenario, the benefits of Component II represent 3.32% of total program benefits. The ex-ante evaluation of the benefits of Component II indicates that the NPV is positive and reaches 106.4% of its costs.

Table 28. NPV Benefits Component II

|  |  |  |
| --- | --- | --- |
| **BENEFITS COMPONENT II** | **US$** | **%** |
| EMIS’s savings | 1,229,981 | 3.32 |
| **TOTAL PROGRAM BENEFITS** | **37,078,308** |  |

Annex:

* Annex I: [Economic Evaluation Spreadsheet](http://idbdocs.iadb.org/wsdocs/getDocument.aspx?DOCNUM=38691161)

1. The students related to the special education segment are not included within this group. [↑](#footnote-ref-1)
2. Information provided by MOEYS. [↑](#footnote-ref-2)