A practical guide to conducting economic and financial analyses for compulsory education projects

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The aim of this practical guide is to provide task teams in the Education Global Practice with resources to write a clear economic and financial analysis (EFA). Specifically, this document describes the steps of conducting an EFA for compulsory education projects with an example from China (P154261 Guangdong Compulsory Education Project). An excel spreadsheet ("*Guangdong Project EFA_NN_April 2016.xlsx*") accompanies this document to show the raw data and equations used to calculate the figures presented below.

What this practical guide offers

Before reading this guide, there are a few recommended readings. The OPCS Economic Analysis Guidance Note for Investment Project Financing (IPF) provides an overview of basic concepts and the role of economic and financial analyses in IPF projects. The guidance note also provides details of the specific questions that must be answered in the EFA sections of the Project Concept Note (PCN) and Project Appraisal Document (PAD) for an IPF. Specific to education projects, there are several resources that provide excellent overviews of concepts and guidance for economic and financial analyses:

- An overview of the objectives of conducting an economic and financial analyses for education projects
- A selection of World Bank resources on economic analysis of education projects
- Boardman, A.B., D.H. Greenberg, A.R. Vining, and D.L. Weimer (2010). *Cost Benefit Analysis*. See section on "Education" in their selected cost-benefit analysis bibliography at the end of the book.

This practical guide differs from and contributes to the resources above in the following ways. First, this guide (along with the accompanying excel spreadsheet) gives a detailed description of the procedures involved, exact data sources and calculations for project impact estimates. Second, this guide offers an example of how to conduct an EFA for education projects that focus on improving the *quality* of education rather than increasing access to education, as projects today increasingly focus on quality improvement. Finally, the example in this guide shows how to conduct an EFA when teams have to work with limited data (i.e., how to make the best use of alternative data sources). The guide is geared directly towards members of task teams in the Education GP to ensure that there is clear documentation of the EFA section for peer review processes—particularly during project appraisal, implementation, and the ICR stage.

Background: Guangdong Compulsory Education Project

The project development objective of the Guangdong Compulsory Education Project (P154261) is to improve learning facilities and teaching quality in selected schools in 16 project counties. The project has four components:

Component 1 is to improve school equipment and facilities, which includes construction and rehabilitation of classrooms, installation of Information and Communications Technology (ICT) equipment in classrooms, provision of learning equipment to students, and accommodations for teachers in rural locations. This component is designed to address the inadequate infrastructure at the school level in the project counties. The theory of change is that the improved learning environment will contribute to increasing student learning outcomes, which subsequently will result in improved labor market outcomes in the long term.

Component 2 is to strengthen the training and assessment system for teachers and principals, which includes improving existing training content and developing new training content for teachers and principals, improving the delivery of training, and strengthening the quality assurance, monitoring and evaluation system for teacher continuous professional development.

Assessments of the training system in the province reveal a need to not only improve the content of training that is delivered but also to improve the mechanism for delivery and subsequent mentoring of teachers. While substantial numbers of teachers in a variety of disciplines are trained, the province lacks an objective mechanism to assure the quality of the training or whether teachers are able to translate training into improved teaching practices in the classroom. As a result, the project activities under Component 2 are aimed to improve teaching practices in the classroom, which will contribute to improved student learning outcomes in the medium term and later lead to improved labor market outcomes in the long run.

Component 3 of the project is to pilot and evaluate reforms. Under this component, the government will pilot several initiatives aimed at modernizing the basic education system such as enabling inclusive education (emphasis on left-behind children and children with disabilities), promoting children's overall development, and providing mobile laboratories to hard-to-serve schools. Each activity under this component of the project will be evaluated for its impact, efficiency and cost-effectiveness. Finally, component 4 includes project management and monitoring and evaluation.

A step-by-step guide to conducting an economic analysis

For compulsory education projects that aim to improve education quality, the following steps offer a general guideline of how to organize an economic analysis that uses cost-benefit analysis (CBA)[1].

- Step 1. **Conduct a literature review & draw a framework of benefits.** The objective is to figure out which components or activities can be reasonably appraised from the existing international evidence.
- Step 2. **Create a table of project beneficiaries**. The objective is to determine how many cohorts of students will benefit from the project.
- Step 3. **Calculate the number of project beneficiaries**. The objective is to estimate the approximate number of students that will benefit from the project.

[1] Cost-benefit analysis is a method of economic analysis that monetizes (i.e., puts into dollar terms) all of the benefits and costs associated with the project. However, every education project is unique – with different project development objectives, components, and degrees of access to data. As a result, some task teams may opt to use cost-effectiveness analysis instead of cost-benefit analysis.

- Step 4. **Calculate project costs**. The objective is to calculate the investment and recurrent costs of the project.
- Step 5. **Estimate project impacts on student test scores**. The objective is to estimate a reasonable range of the project's impact on student test scores.
- Step 6. **Convert gains in student test scores to additional years of education**. The objective is to convert the project's impact from test scores to years of education.
- Step 7. **Find or estimate the rate of returns to education in the project's country context**. The objective is to determine the association between education and wages in the project's country context (Mincer wage equation).
- Step 8. **Monetize project benefits**. The objective is to estimate increases in wages among project beneficiaries resulting from the project.
- Step 9. **Calculate net present values and internal rate of return**. The objective is to determine whether the benefits of the project outweigh the costs.
- Step 10. **Conduct sensitivity analysis**. The objective is to show alternative scenarios of the project and how they will change the cost-benefit analysis.

The accompanying spreadsheet shows each of the steps listed above for the Guangdong Compulsory Education Project. Below, we explain each step in greater detail and make references to the tables in the accompanying spreadsheet.

NOTE:

The procedures used in this guidance note and additional tools/resources offered in the spreadsheet may not be appropriate for all compulsory education projects across the Global Practice. It is merely an example of one way to conduct a high quality economic and financial analysis – task teams should decide the methods most appropriate for their specific project based on the project objective, scope, and available data sources.

Step 1. Conduct a literature review & draw a framework of benefits [*Spreadsheet: "Step 1. Lit review & framework"*]

First, conduct a literature review of education interventions that are similar to the components and/or activities in the project. Gather studies that show how these similar education interventions impact student learning outcomes.

Table 1a in the spreadsheet shows some key literature that supports components of the Guangdong Compulsory Education Project (a non-exhaustive list of studies). Notice that they are all quasi-experimental or experimental studies; rigorous evaluations will provide the most convincing arguments in favor of the project's activities. In addition, several impact evaluations from China are included in the literature. If possible, studies from the project's country context or from similar developing countries will provide stronger evidence to support the project's success in similar types of settings.

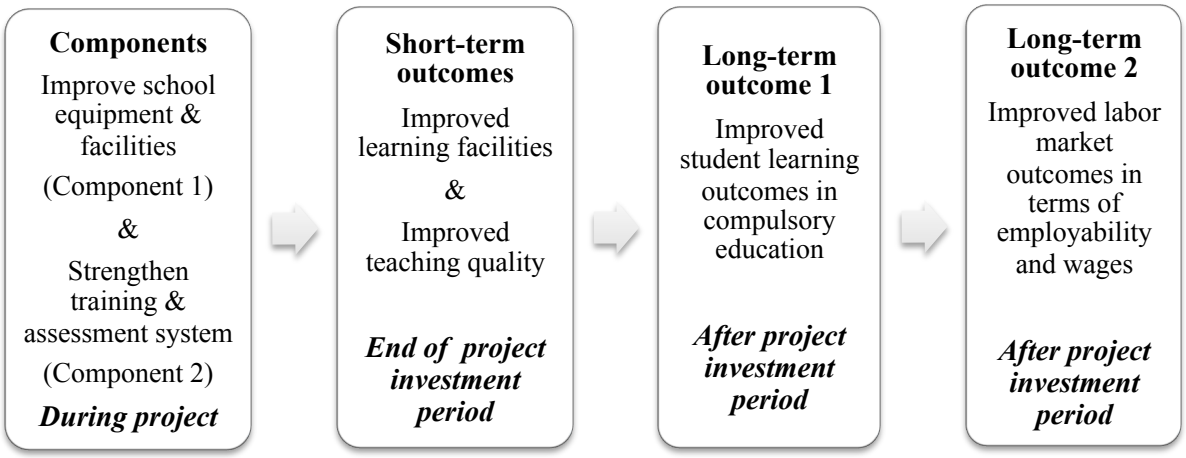
To help task teams get started, a list of recent systematic reviews of education interventions (from both developing and developed countries) are listed in the excel spreadsheet (Table 1b). These reviews will provide (i) a general overview of education interventions that have and have

not been successful in improving educational outcomes, and (ii) references to specific studies that are relevant to the project.

Based on the literature review, teams can determine which components in their project can be reasonably appraised from the existing international evidence. It is helpful to draw a framework of benefits to illustrate how the components of the project will lead to quantifiable benefits. For the vast number of compulsory education projects that focus on improving education quality, the outcome of interests are likely to be: (1) raise student learning outcomes as measured by test scores, which in turn will lead to (2) improve subsequent labor market outcomes.

** Excerpt of Step 1 from the Guangdong Compulsory Education Project PAD:
By improving school equipment and facilities (Component 1) as well as strengthening the training and assessment system for teacher and principals (Component 2), we expect improvements in student learning outcomes, which in turn will raise future employability and wages of these students (see Figure 1). In this analysis, we focus on monetary private returns. The total benefit of the project is likely to be much higher if we account for non-monetary returns for beneficiaries as well as social returns, such as increased aggregate productivity (over and above the direct effect on individual productivity), reduced crime, and improved political participation (for more on social returns to education, see Acemoglu and Angrist 2000, Moretti 2004). Specifically, components 1 and 2 of the Guangdong Compulsory Education Project are amenable to a cost-benefit analysis since the benefits of activities under these two components can be reasonably appraised from existing evidence. In all instances, we attempted to be conservative in our estimates.

Figure 1. A framework of benefits from the Guangdong Compulsory Education Project



Step 2. Create a table of project beneficiaries [*Spreadsheet: "Step 2. Table of beneficiaries"*]
The next step is to create a table to illustrate how the project will roll out to reach its intended beneficiaries. The table will help determine how far into the future to calculate project costs and benefits.

In the spreadsheet, Table 2a illustrates the number of student cohorts that will benefit from the Guangdong Compulsory Education Project. In 2016, the project will be preparing activities. In

2017, nine cohorts of students can be expected to benefit from project activities. For example, cohort 1 (those who are in grade 9 in 2017) is expected to benefit from one year of the project; some of these students will enter the labor market at the end of that academic year while others will continue on to senior secondary (grades 10-12) and higher education. In contrast, cohort 9 (those who are in grade 1 in 2017) will benefit from the project until 2025, which is the year they complete grade 9. The last cohort of students that will directly benefit from the project are those who are grade 1 in the final year of the project investment period (2020) and they will graduate from compulsory education in 2028. Thus, this table helps determine that project costs and benefits will need to be calculated into 2028.

Depending on the project, teams may also need to create a table for intermediate beneficiaries as this will determine how project costs are calculated. For example, in the Guangdong Compulsory Education Project, component 2 includes activities for pre-service teacher training that are five and six years in duration. As a result, costs associated with this activity are expected to continue beyond the project investment period. Table 2b in the spreadsheet illustrates how the pre-service teacher training costs will continue into 2025.

Step 3. Calculate the number of project beneficiaries [*Spreadsheet: "Step 3. Calc.beneficiaries"*]
Next, we calculate the expected number of project beneficiaries. For some projects, the number of beneficiaries may be clearly defined by the project design. For others, such as the Guangdong Compulsory Education Project, teams may need to make assumptions about how many students will benefit from the project based on the project's provision of specific activities. Teams should clearly describe any assumptions made to calculate project beneficiaries and make reference to data sources.

For example, the economic analysis of the Guangdong Compulsory Education Project focuses on component 1 and 2. As a result, the project beneficiaries are estimated based on the number of students that will benefit from these two components. Under component 1, the project aims to provide ICT equipment to 15,300 classrooms. While there are other activities in component 1, they are much smaller in scale compared to the provision of ICT equipment. Thus, we assume that the vast majority of beneficiaries from component 1 will come from the activity on ICT equipment. Under component 2, the project aims to provide training to teachers and principals (30400 on ICT, 3000 in-service, 300 principals and 500 backbone). We use the number of teachers trained in component 2 to estimate the number of project beneficiaries.

Table 3a shows four scenarios of project beneficiaries per year: (1) components 1 & 2 reach intended beneficiaries, (2) only component 1 reaches intended beneficiaries (none from component 2), (3) only component 2 reaches intended beneficiaries (none from component 1), and (4) component 2 reaches only half of intended beneficiaries (none from component 1). The number of beneficiaries in each scenario are calculated based on assumptions that are presented in Table 3b, which in turn were estimated from education statistics on the project counties presented in Table 3c. The education statistics presented in Table 3c are some key indicators to help calculate project beneficiaries. The full range of data that teams will need varies depending on the objective and scope of the project; however, at the very least, teams will need data on

basic indicators such as student and teacher populations, number of schools, and distribution of highest completed education level.

The last calculation in this step involves estimating the number of beneficiaries by final level of education. Table 3d shows the results for each scenario. The ratios of students by final level of education (35%, 37% and 28%) derive from the average distribution of education across the population of the 16 project counties.

**Excerpt of Step 3 from the Guangdong Compulsory Education Project PAD:
Based on data provided by the Guangdong Department of Education (2015) on the 16 project counties, we used the following assumptions in our calculations:

Table 1. Assumptions used to estimate project beneficiaries

Variable	Values	Notes
Number of students per school	564	
Number of students per classroom	47.5	Government regulation
Number of classrooms per school	12	
Number of teachers per school	35	
Number of principals per school	2	
Number of backbone teachers per school	6	
High number of beneficiaries: students benefiting from the project that will be graduating from compulsory education each year	99,894	Assumptions: Component 1 & 2 reaches (a conservative estimate of) intended beneficiaries
Medium number of beneficiaries: students benefiting from the project that will be graduating from compulsory education each year	79,900	Assumption: Only component 1 reaches (a conservative estimate of) intended beneficiaries
Low number of beneficiaries: students benefiting from the project that will be graduating from compulsory education each year	74,424	Assumption: Only component 2 reaches (a conservative estimate of) intended beneficiaries
Worst-case scenario number of beneficiaries: students benefiting from the project that will be graduating from compulsory education each year	37,212	Assumption: Only half of the intended beneficiaries in the "low beneficiaries" scenario.

Source: Author's calculations using data from Guangdong Department of Education 2015

The size of each graduating cohort that will benefit from the project is about 99,894 students ("high beneficiaries" scenario). This is computed using conservative assumptions about some key activities under Component 1 and 2 of the project. Specifically, we use the activities on:

- *Providing ICT equipment to classrooms: 15,300 classrooms will be reached (15,200 rural classrooms and 100 teaching station classrooms). Given that this activity will give preference to poor, rural schools that currently have no or very little ICT equipment, we expect these to be concentrated in specific schools. Thus, this activity alone will reach*

$15{,}300\ classrooms \times \frac{1\ school}{12\ classrooms} \times \frac{564\ students}{1\ school} \times \frac{1}{9} = 79{,}900\ students$. *The assumptions of 12 classrooms per school and 564 students per school are derived from data provided by the Guangdong Department of Education (2015) and made available in the accompanying excel spreadsheet. We divide the total number of students by 9 years of compulsory education to calculate the number of students graduating each year who will have benefited from the ICT activity.*

- *Teacher training (in-service): 3,000 teachers will receive in-service teacher training under Component 2. Here, we expect the following number of graduating students to benefit each year from this in-service teacher training:* $3{,}000\ teachers \times \frac{1\ school}{35\ teachers} \times \frac{564\ students}{1\ school} \times \frac{1}{9} = 5{,}371\ students$. *Here again, the ratios used are based on data provided by the Guangdong Department of Education (2015).*
- *Principal training: 300 principals will be trained under Component 2. Similar to the calculation above, we expect:* $300\ principals \times \frac{1\ school}{2\ principals} \times \frac{564\ students}{1\ school} \times \frac{1}{9} = 9{,}400\ students$ *to graduate each year that have benefited from this activity of the project.*
- *Backbone teacher training: 500 backbone teachers will be trained. Thus, we expect the following number of graduating students to benefit each year from the backbone teacher training:* $500\ backbone \times \frac{1\ school}{6\ backbone} \times \frac{564\ students}{1\ school} \times \frac{1}{9} = 5{,}222\ students$

We also calculate an even more conservative estimate of project beneficiaries. In the "medium beneficiaries" scenario, we assume a scenario where all of the project activities are concentrated in only the few schools that receive the key activity in Component 1 (ICT equipment). This yields an estimate of 79,900 beneficiaries in a given cohort of students graduating from compulsory education each year. In the "low beneficiaries", we assume a scenario where only the key teacher training activities in Component 2 reach its intended beneficiaries. This yields an estimate of 74,424 beneficiaries. Finally, we also test a "worst-case scenario" in which only half of the intended beneficiaries (37,212 students) benefit from the key activities in Component 2.

To put our estimates of project beneficiaries into perspective, we are expecting to reach between 37% in the high beneficiaries (but nonetheless very conservative number of beneficiaries) to 17% in the low beneficiaries of students in the 16 project counties.

Next, we assume that of the students that graduate from compulsory education each year, 35% will enter the labor market immediately upon graduation, 37% will progress to senior secondary education and enter the labor market 3 years later, and the remaining 28% will go on to senior secondary education followed by higher education and enter the labor market 7 years later. This distribution is derived from the completed levels of education among the young adult population (age 25-35) in the 16 project counties in 2014. Table 2 below shows the number of beneficiaries we estimate in a given cohort of students who graduate from compulsory education each year:

Table 2. Expected number of beneficiaries in a graduating cohort each year

HIGH: Number of beneficiaries per year	
Total (100%)	99,894

Compulsory graduates (35%)	34,963
Senior secondary graduates (37%)	36,961
Higher education graduates (28%)	27,970
MEDIUM: Number of beneficiaries per year	
Total (100%)	79,900
Compulsory graduates (35%)	27,965
Senior secondary graduates (37%)	29,563
Higher education graduates (28%)	22,372
LOW: Number of beneficiaries per year	
Total (100%)	74,424
Compulsory graduates (35%)	26,048
Senior secondary graduates (37%)	27,537
Higher education graduates (28%)	20,839
WORST-CASE: Number of beneficiaries per year	
Total (100%)	37,212
Compulsory graduates (35%)	13,024
Senior secondary graduates (37%)	13,768
Higher education graduates (28%)	10,419

Source: Author's calculations using data from Guangdong Department of Education 2015

Step 4. Calculate project costs [*Spreadsheet: "Step 4. Costs"*]

To calculate project costs, details of both investment and recurrent costs will need to be determined. To do so, the team needs a cost breakdown for each activity in the project that will be included in the economic analysis.

Table 4b shows the detailed investment costs of each activity in component 1 and component 2 of the Guangdong Compulsory Education Project. Table 4c includes the detailed recurrent costs associated with operation & maintenance and pre-service teacher training activities, as these activities will continue to require additional costs even after project investment in 2020 (recall table of beneficiaries for teachers in Step 2). Table 4a in the spreadsheet summarizes the results of the investment and recurrent cost calculations from Tables 4b and 4c.

**Excerpt of Step 4 from the Guangdong Compulsory Education Project PAD:
Program costs discounted at 5% are shown in Table 3 below.[2] Both investment and incremental recurrent costs are calculated based on data received from the Guangdong Department of Education in December 2015. With a 5% discount rate, the present value of investment costs are about USD 210 million and the recurrent costs are about USD 16 million, for a combined total cost of USD 226 million.

Table 3. Discounted costs (USD) of the Guangdong Compulsory Education Project

Year	Investment costs	Recurrent costs	Total costs
2016	11,958,599		11,958,599

[2] 5% is the set discount rate used in external debt analysis by the IMF and World Bank (set by the IMF executive board on October 2013)

2017	22,778,283		22,778,283
2018	54,234,008		54,234,008
2019	61,981,723		61,981,723
2020	59,030,213		59,030,213
2021		5,963,782	5,963,782
2022		4,539,081	4,539,081
2023		2,566,601	2,566,601
2024		1,392,478	1,392,478
2025		472,166	472,166
2026		293,271	293,271
2027		279,305	279,305
2028		266,005	266,005
Total	209,982,826	15,772,689	225,755,515

Source: Author's calculations using data from Guangdong Department of Education 2015

The project investment and recurrent costs were calculated using the following assumptions:

Overall cost projections

- *1 USD = 6.28 Yuan (2015 yearly average exchange rate)*
- *5% discount rate*
- *Cost projections are made until 2028, when the last cohort of students who will benefit directly from the project activities are expected to graduate from compulsory education. (See "1.b Beneficiaries" sheet in the excel spreadsheet for details).*

Investment costs

- *Project investment costs will be disbursed at 5% in Year 1, 10% in Year 2, 25% in Year 3, 30% in Year 4 and 5.*

Recurrent costs

- *Derived from operation and maintenance (O&M) costs for infrastructure and equipment, and incremental recurrent costs from on-going teacher training.*

Step 5. Estimate impact [*Spreadsheet: "Step 5. Estimate impact"*]

Now that project costs have been determined we turn to estimating project benefits, which will require a series of procedures. The first is to refer back to the studies reviewed in Step 1 and gather the impact estimates of similar types of education interventions to the proposed project. Table 5a shows how evidence was gathered for the Guangdong Compulsory Education Project and the types of interventions that the task team decided was most relevant to the project.

**Excerpt of Step 5 from the Guangdong Compulsory Education PAD:

The estimated impact of components 1 and 2 are based on existing evidence on education interventions from developing countries and from China. In recent years, several systematic reviews of education interventions in developing countries have been written. While there is some heterogeneity in methods and findings across these reviews, there is broad support for pedagogical interventions that match teaching to students' learning and individualized teacher training (Evans and Popova 2015).

For the purpose of estimating the impact of activities under the Guangdong Compulsory Education Project, we focus on evidence gathered from two recent systematic reviews (Krishnartne, White, and Carpenter 2013 and McEwan 2015), which have (i) evidence from developing countries broadly (i.e., not region-specific) and (ii) conduct meta-analyses to report effect sizes of various categories of education interventions.[3] *The effect sizes allow us to reasonably predict the estimated effect of the Guangdong Compulsory Education Project on student learning outcomes. In addition to the evidence from Krishnaratne, White, and Carpenter (2013) and McEwan (2015), we also draw on evidence from China, where rigorous evaluations have estimated the impact of increased access to educational resources (in the form of ICT) on student learning outcomes. Table 4 presents a summary of estimated impacts for selected interventions that are relevant to the activities in Components 1 and 2 of the Guangdong Compulsory Education Project.*

Table 4. Impact of education interventions on student test scores (in low and middle-income countries & China)

Authors (Year)	Category of intervention (as defined by the authors)	Effect Size (SD)	Context
Krishnaratne, White and Carpenter (2013)	Buildings	0.383**	Low and middle-income countries
	Materials	0.160***	
	Teacher resources	0.284**	
McEwan (2014)	Computers or technology	0.150***	Low and middle-income countries
	Teacher training	0.123***	
	Class size or composition	0.117**	
Lai et al. (2015)	Computer assisted learning[4]	0.15***	China (Beijing)
Lai et al. (2012)	Computer assisted learning	0.20***	China (Qinghai)
Mo et al. (2013)	Computer assisted learning	0.16***	China (Shaanxi)

*p<.10, **p<.05, ***p<.01

The estimated impacts of interventions that focus on improving learning facilities and teaching quality range from 0.117 to 0.383 standard deviations in increasing student test scores. Based on these existing evidence and careful design of the project, we can reasonably expect that the Guangdong Compulsory Education Project will have a similar range of positive impact on student learning.

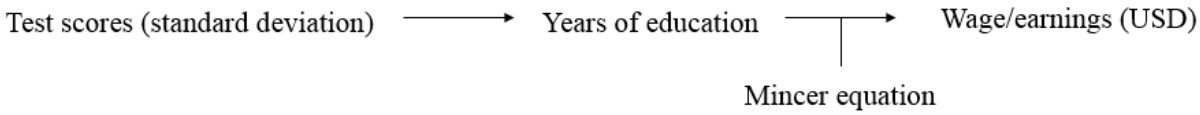
Step 6. Convert gains in student test scores to additional years of education [*Spreadsheet: "Step 6. Converting to years"*]

[3] A note on some of the other recent systematic reviews: Conn (2014) focuses on sub-Saharan Africa; Kremer, Brannen and Glennerster (2013) and Murnane and Ganimian (2014) are narrative reviews; and Glewwe et al. (2013) and Glewwe and Muralidharan (2015) use vote-counting.

[4] These interventions provided ICT directly to students, which make it slightly different from the activities envisioned under this project. Nonetheless, the estimates provide context in relation to the estimates from other developing countries.

The next step involves interpreting the impact estimates gathered in the previous step and converting them into equivalent years of additional education. This conversion is a crucial step because the final benefits in a cost-benefit analysis must be monetized and the Mincer equation (which models earnings as a function of years of education) is the most commonly applied tool to monetize the returns to educational investments (see the logic chain below):

Figure 2. Logic chain of the steps in monetizing project benefits



First, Table 6a includes a simple tool to help teams interpret the expected project impacts in test scores (e.g., what does it mean for an intervention to improve test scores by 0.117 standard deviations?) Second, teams need to benchmark the impacts on test scores to the natural growth in test scores that occurs during one academic year for an average student. This will help convert from units of test scores to years of education. Ideally, normed, longitudinally scaled achievement tests are available in the project context; however, many teams are likely to prepare projects for clients that do not collect such data. In the absence of such data, teams may want to refer to Table 6c, which provides a way to convert project impacts from improvements in test scores (standard deviation units) to equivalent years of additional education. The details of table 6c are described in the excerpt from the PAD below. The results of the conversion for the Guangdong Compulsory Education Project are shown in Table 6d.

**Excerpt of Step 6 from the Guangdong Compulsory Education Project PAD:
Next, we estimate how improvements in learning will translate into increased earnings for students benefiting from the project. Studies on the returns to education have shown that skills acquired through schooling account for a large part of the returns to schooling (Fasih, Patrinos and Sakellariou 2013). We expect that the Guangdong Compulsory Education Project will help students improve the skills that are fundamental to success in school and in the labor market.

First, we translate what it means to expect an increase in learning outcomes by 0.117 to 0.383 standard deviations under Components 1 and 2 of the Guangdong Compulsory Education Project. Effect size is the standardized mean difference between the treatment group (those that received the intervention) and control group (those that did not receive the intervention). Thus, when there is no effect of an intervention, the effect size is zero. In the case of the Guangdong Compulsory Education Project, the project is expected to increase learning outcomes by 0.117 to 0.383 standard deviations, which is equivalent to a 5% to 15% improvement on student achievement outcomes over students who never received the Project.[5]

[5] In addition to the excel spreadsheet, this can also be calculated manually by using a Standard Normal Distribution Table (or Z-score table) to look up the area under the normal curve falling under a given *z*-score (the effect size) minus 50% (the mean when there is no difference between control and treatment).

Moreover, we can convert the estimated project impact of 0.117 to 0.383 standard deviations into equivalent years of education. This can be done by benchmarking the effect sizes to the natural growth in academic achievement that occurs during a year for an average student. Ideally, we would compute this year-to-year growth in academic achievement from standardized tests in the 16 project counties or in Guangdong province among compulsory school students. However, in the absence of such data we use estimates from Bloom et al. (2008), which reports the mean effect sizes for annual grade-to-grade gains based on information from several normed, longitudinally scaled achievement tests.[6] Table 5 reports the equivalent effect size values for annual student growth.

Table 5. Effect sizes of annual achievement gains by grade

Grade transition	Reading	Math	Science	Across all three subjects
Grade 1 - 2	0.97	1.03	0.58	0.86
Grade 2 - 3	0.60	0.89	0.48	0.66
Grade 3 - 4	0.36	0.52	0.37	0.42
Grade 4 - 5	0.40	0.56	0.4	0.45
Grade 5 - 6	0.32	0.41	0.27	0.33
Grade 6 - 7	0.23	0.3	0.28	0.27
Grade 7 - 8	0.26	0.32	0.26	0.28
Grade 8 - 9	0.24	0.22	0.22	0.23
Median for Grades 1-9	0.34	0.47	0.33	0.38

Source: Adapted from Bloom et al. 2008 using data from the United States.

Note that annual student growth is very large in the first two years of compulsory education and declines down thereafter. Given these outliers, we compute the median annual achievement gains for Grades 1 to 9. Across all subjects, one year of education is equivalent to about 0.38 standard deviations increase in student learning outcomes (Bloom et al. 2008). Thus, the estimated project impact of 0.117 to 0.383 standard deviations per year is equivalent to increasing compulsory education by 0.31 years to 1.02 years.[7] This is calculated by:

$$Effect\ size \times \frac{1\ year\ of\ schooling}{0.38\ standard\ deviation\ improvement\ in\ test\ score}$$

[6] Estimates from Bloom et al. (2008) are computed using data on seven different normed, standardized tests in the United States. Although we would have preferred to use estimates directly from the 16 project counties, using estimates from Bloom et al. (2008) is the next best alternative for the purpose of the economic analysis.

[7] Using the estimates from Bloom et al. (2008) allows us to compute very conservative estimates of the project impact. Table 4 tells us that an annual gain in academic achievement in the United States is about 0.38 standard deviations. However, in the project counties where education quality is much lower than that found in a typical U.S. classroom, the annual gain in academic achievement is likely to be much less than 0.38 standard deviations. Thus, the actual benefit of the project as converted into years of schooling in the project counties is probably much more than what we have estimated using annual student growth data from Bloom et al. (2008).

For students who benefit from the Guangdong Compulsory Education Project in its entirety during their 9 years of compulsory education, we assume the higher-end estimate of the project impact—equivalent to 1.02 additional years of schooling overall. We assume the lower-end estimate of the project impact—equivalent to 0.31 additional years schooling overall—for all students who benefit less than 9 years of the project in order to estimate conservative impacts of the project.

Step 7. Find or estimate the rate of returns to education in the project's country context. [*Spreadsheet: "Step 7. ROR"*]

The next step is to find or estimate the relationship between market wages and education. The most commonly used equation is the Mincer wage function. For teams that have access to census or labor data that includes (at the very minimum) variables for years of education, years of experience, and wage/earnings, they may want to estimate the Mincer wage function for their specific project context. For projects that target specific student populations, it may also be useful for teams to estimate the Mincer wage function for that target population as it may be significantly different from the average. Alternatively, teams can look to the existing literature on rate of returns to education since the topic has been studies quite extensively (e.g., Psacharopoulos and Patrnios 2004, Montenegro and Patrinos 2014).

In China, there is a wealth of literature on the returns to education using the Mincer equation. For the Guangdong Compulsory Education Project, the team opted to use these existing studies to estimate the rate of return to education given that the team could not gain access to county level census or labor data that would allow for estimating a Mincer wage function specific to the project counties. Table 7a shows the studies from China and table 7b presents the result of a meta-regression that estimates the returns to education from all of the studies in table 7a.

**Excerpt of Step 7 from the Guangdong Compulsory Education PAD:

Next, we estimate how much 0.31 to 1.02 additional years of schooling will increase future earnings for the project beneficiaries. To do so, we looked at existing studies that have calculated the rates of return to education in China using the standard labor economics model of estimating returns to education – the Mincer (1974) wage function:

$$ln(y_i) = \alpha + \beta_0 Edu_i + \beta_1 Exp + \beta_2 Exp^2 + \gamma X_i' + \mu_i$$

where y_i is the earnings of individual i, Edu_i is years of schooling, Exp is years of work experience, Exp^2 is the quadratic term of work experience, X_i' is a vector of other controls, and μ_i is an error term. The main outcome of interest for us is β_0, the coefficient on years of education.

A recent meta-analysis of returns to education in China (Awaworyi and Mishra 2014) gathered 469 Mincer estimates. Table 6 shows the full list of studies with the simple mean effect (the coefficient β_0) as well as the weighted mean for studies that calculated multiple Mincer estimates. From these studies, the authors conducted a meta-regression, controlling for moderating variables (i.e., time, rural/urban, datasets used, estimation methodology, etc.). The meta-regression analysis yields a β estimate of 0.1025, which means that on average one additional year of schooling in China is associated with a 10.25% increase in income (Awaworyi

and Mishra 2014). This is comparable to the 10% rate of return to education found in other countries around the world (Montenegro and Patrinos 2014).

Table 6. Returns to education in China (1980s-Present)

Author	Year	No. of estimates	Simple Mean Effect	Weighted Mean (Fixed Effect)	95% CI of Weighted Mean
Bishop and Chiou	2004	2	0.1559	0.1688	(-0.4979, 0.8355)
Brauw and Rozelle	2008	13	0.0007	0.0003	(0.0001, 0.0006)
Byron and Manloto	1990	5	0.0007	0.0007	(-0.0009, 0.0023)
Chen and Hamori	2009	8	0.2958	0.3058	(0.2502, 0.3614)
Cheng and Feng	2011	9	0.07	0.0664	(0.0240, 0.1088)
Fan	2009	1	0.1506	0.1506	
Fan et al.	2012	20	0.0692	0.0682	(0.0414, 0.0949)
Fu and Ren	2010	2	0.1236	0.1236	(-0.1827, 0.4300)
Giles et al.	2008	4	0.3541	0.3544	(0.3205, 0.3883)
Hannum et al.	2013	16	0.0283	0.0333	(-0.0078, 0.0743)
Ho et al.	2002	14	0.1748	0.1699	(0.1401, 0.1997)
Huang et al.	2002	12	0.4757	0.5292	(0.4034, 0.6549)
Johnson and Chow	1997	8	0.1711	0.1836	(0.1270, 0.2402)
Kang and Peng	2012	56	0.1284	0.0977	(0.0840, 0.1113)
Kim	2010	5	0.2397	0.2418	(0.1511, 0.3324)
Li	2003	4	0.1572	0.1555	(0.1348, 0.1763)
Li and Luo	2004	9	0.1728	0.1798	(0.1360, 0.2236)
Li et al.	2005	4	0.1518	0.1543	(0.0826, 0.2260)
Li et al.	2012	16	0.1722	0.2039	(0.1245, 0.2834)
Liu	1998	10	0.176	0.179	(0.1554, 0.2025)
Luo	2008	8	0.1218	0.1221	(0.0900, 0.1542)
Maurer-Fazio	1999	4	0.2325	0.2354	(0.1930, 0.2778)
Meng	1995	6	0.0844	0.0765	(-0.0232, 0.1762)
Mishra and Smyth	2013	26	0.3025	0.3071	(0.2872, 0.3270)
Ning	2010	8	0.2989	0.3135	(0.2355, 0.3915)
Qian and Smiyth	2008	5	0.2921	0.2878	(0.2197, 0.3559)
Qin et al.	2013	1	0.017	0.017	
Qiu and Hudson	2010	16	0.1001	0.0737	(0.0397, 0.1077)
Ren and Miller	2012	4	0.2111	0.1971	(0.0940, 0.3003)
Ren and Miller	2012b	18	0.2296	0.2182	(0.1602, 0.2762)
Wang	2013	28	0.1543	0.1549	(0.1170, 0.1929)
Wu and Xie	2003	11	0.089	0.099	(0.0210, 0.1769)
Xiu and Gunderson	2013	20	0.1496	0.1539	(0.0949, 0.2129)
Zhang et al.	2002	1	-0.0132	-0.0132	
Zhang et al.	2005	14	0.3451	0.6293	(0.4289, 0.8298)
Zhang et al.	2007	8	0.2674	0.2966	(0.1714, 0.4218)
Zhang et al.	2008	3	0.1348	0.1354	(-0.0103, 0.2811)
Zhao	2007	12	0.126	0.1331	(0.0931, 0.1730)
Zhao and Qu	2013	4	0.0925	0.0956	(0.0342, 0.1570)
Zhong	2011	7	0.2667	0.2714	(0.1846, 0.3582)
Zhu	2011	36	0.2652	0.2611	(0.2350, 0.2872)
Yang	2005	6	0.222	0.226	(0.1982, 0.2537)
Jamison and Van Der Gaag	1987	2	0.2633	0.269	(-0.1724, 0.7104)
Gregory and Meng	1995	3	0.0371	0.0371	(-0.0539, 0.1281)

Source: Awaworyi and Mishra 2014.

Thus, in our following calculations, we assume a 10.25% rate of return to education.

Step 8. Monetize project benefits [*Spreadsheet: "Step 8. Monetizing benefits"*]
Now that we know the expected project impact in terms of additional years of education (from Step 6) and the relationship between years of education and wages (from Step 7), we can monetize the project benefits.

The main calculations for the Guangdong Compulsory Education Project are shown in Table 8a. Recall that different cohorts of students will have different exposures to the project (i.e. those who benefit from the project during all nine years of their compulsory schooling and those that will benefit for fewer than nine years). The expected impact of the project on additional years of education was estimated in Step 6. Based on a 10.25% rate of return to education from Step 7, we can estimate the expected increase in wages (percent) from the project. This is calculated by multiplying 10.25% and 0.312 years for the lower-end estimates and by multiplying 10.25% and 1.02 years for the upper-end estimates. Then, we can estimate the annual incremental increase in earnings (USD) by multiplying the percent incremental increase with the average annual earnings in the project counties (5,593.70 USD) from Table 3c.

Then, Table 8b brings together the annual incremental increase (USD) calculated in Table 8a and the project beneficiaries determined in Steps 2 and 3. Based on the student beneficiaries in Table 2a, we know the number of cohorts entering the labor market each year (this is shown in columns C, D, and E in Table 8b). We multiply these cohorts by the number of graduating beneficiaries per year (low, medium and high scenarios that were determined in Step 3), shown in columns F-N in Table 8b. Finally, we multiply the number of graduating beneficiaries by the incremental annual increase in earnings (shown in columns O-AC in Table 8b).

**Excerpt of Step 8 from the Guangdong Compulsory Education Project PAD:
Assuming a 10.25% rate of return to education, an impact of 0.31 to 1.02 additional years of schooling from the Guangdong Compulsory Education Project is equivalent to an increase of 3.20% (for those benefiting from less than 9 years of the project) to 10.47% (for those benefiting from 9 years of the project) in future earnings.

The annual income per person in the 16 project countries is 5,593.70 USD. Since earning data by level of education was unavailable, we use this average annual income per person in our earnings estimates. Table 7 provides a summary of these impacts:

Table 7. Summary of project impacts on future earnings

	Lower-end estimates (For those benefitting from less than 9 years)	Upper-end estimates (For those benefitting from 9 years)
Returns to education	10.25% per year	
Impact of project in terms of equivalent years of additional education	0.312	1.02
Percent increase in earnings as a result of	3.20%	10.47%

project		
Annual incremental increase in earnings (USD)	178.89	585.59

Source: Authors' calculations and income data from the Guangdong Department of Education (2015)

In the final step of calculating project benefits, we multiply the number of graduated students in the labor market by the incremental annual increase in salary (from Table 6). The discounted benefits for each project specification are summarized in Table 8 below.

Table 8. Discounted benefits (USD) of the Guangdong Compulsory Education Project

Year	High beneficiaries	Medium beneficiaries	Low beneficiaries	Worst-case
2016	0	0	0	0
2017	5,956,543	4,764,345	4,437,825	2,218,912
2018	11,345,796	9,074,942	8,452,999	4,226,500
2019	16,208,280	12,964,203	12,075,713	6,037,857
2020	26,021,457	20,813,279	19,386,860	9,693,430
2021	34,863,291	27,885,426	25,974,324	12,987,162
2022	42,804,041	34,236,839	31,890,449	15,945,225
2023	49,909,474	39,920,124	37,184,235	18,592,118
2024	59,627,700	47,693,254	44,424,641	22,212,320
2025	77,473,120	61,966,924	57,720,078	28,860,039
2026	93,483,765	74,773,049	69,648,547	34,824,273
2027	107,793,911	86,219,028	80,310,087	40,155,043
2028	120,529,205	103,100,357	96,034,469	48,017,235

Source: Author's calculations using data from Guangdong Department of Education 2015

Step 9. Calculate net present values and internal rate of return [*Spreadsheet: "Step 9 (& 10). NPV & IRR"*]

This step brings together all of the calculations made thus far. The net present value (NPV) of the project (using a 5 percent discount rate) is calculated in Table 9a for four scenarios—high beneficiaries, medium beneficiaries, low beneficiaries, and a worst-case scenario (benefits are half of the low beneficiaries scenario).

In addition to NPV, we calculate the internal rate of return (IRR) – also known as the economic rate of return (ERR) – which makes the discount rate that makes the net present value equal to zero. Since we assume a 5% discount rate in projects, an IRR greater than 5% will be desirable to undertake the project. The IRR for the four scenarios are calculated in Table 9b.

**Excerpt of Step 9 from the Guangdong Compulsory Education Project PAD:
The final stage of the analysis is to compare costs and benefits, which are summarized in Table 10 below (using "high beneficiaries" scenario). Discounted at the standard 5% rate, the benefits of the Guangdong Compulsory Education Project far exceed its costs, with net present value (NPV) of USD 420 million. The associated internal rate of return (IRR), which is the rate of return that brings the net present value to zero, is 28%.

Table 9. Summary of Cost-Benefit Analysis for high beneficiaries (at 5% discount rate)

Year	Cost	Benefits	Benefits - Costs
2016	11,958,599	0	-11,958,599
2017	22,778,283	5,956,543	-16,821,740
2018	54,234,008	11,345,796	-42,888,212
2019	61,981,723	16,208,280	-45,773,443
2020	59,030,213	26,021,457	-33,008,756
2021	5,963,782	34,863,291	28,899,509
2022	4,539,081	42,804,041	38,264,960
2023	2,566,601	49,909,474	47,342,873
2024	1,392,478	59,627,700	58,235,222
2025	472,166	77,473,120	77,000,954
2026	293,271	93,483,765	93,190,495
2027	279,305	107,793,911	107,514,606
2028	266,005	120,529,205	120,263,200
Totals (and **NPV**)	225,755,515	646,016,584	**420,261,069**
IRR			**28%**

Source: Author's calculations using data from Guangdong Department of Education 2015

Step 10. Conduct sensitivity analysis

For all projects, it is important to conduct a sensitivity analysis to anticipate how a project's results would be affected to changes in the values of specific variables. Depending on the project design, there are likely to be key variables in the cost-benefit analysis that will vary the results. In the case of the Guangdong Compulsory Education Project, the number of beneficiaries is likely to vary considerably depending on how well and quickly key projects are implemented. This in turn will affect the cost-benefit analysis. Thus, the economic analysis was conducted for four different model specifications by the number of project beneficiaries. While this step is included at the end, it is useful to think about the key variable for conducting a sensitivity analysis throughout Steps 1-10, as was done in the Guangdong Compulosry Education Project.

**Excerpt of Step 10 from the Guangdong Compulsory Education Project PAD:
Furthermore, we calculate the NPV and IRR for different model specifications. Specifically, we conduct sensitivity analysis for the following scenarios: (1) if the project only reaches a conservative estimate of intended beneficiaries in Component 1 ("medium beneficiaries"), (2) if the project only reaches a conservative estimate of intended beneficiaries in Component 2 ("low beneficiaries"), and (3) a worst-case scenario in which only half of the intended beneficiaries in component 2 are reached. The results are summarized in Table 11 below.

Table 10. Summary of cost-benefit analysis using different model specifications

	High	*Medium*	*Low*	*Worst-case*
NPV	420,261,069	297,656,256	261,784,712	18,014,599
IRR	28%	22%	21%	6%

Source: Author's calculations using data from Guangdong Department of Education 2015

The sensitivity analysis shows that the benefits of the Guangdong Compulsory Education Project would still clearly outweigh its costs, even with a significant decrease in the estimated impacts of

the project's activities and in the number of project beneficiaries. Even when the number of beneficiaries is very low, the rate of return is greater than the discount rate of 5%, suggesting that this project is a worthwhile investment.

Conducting a financial analysis

The financial analysis of projects can vary extensively, as projects can be very different in their lending arrangements. So instead of a step-by-step guide like the cost-benefit analysis, the financial analysis section offers broader, general advice and examples of tables that may be useful for other task teams.

That said, two key questions must be answered in the financial analysis:

(1) Financial viability: will the borrower have adequate funds to secure project investment expenditures and repay the loan?
(2) Financial sustainability: will the project counties be able to cover the project's operational costs in the future?

In general, most projects will find it useful to organize the following tables to answer the questions:

- **Create a costing table.** The objective is to show how much of the project is financed by the World Bank and counterparts, and how much will be disbursed each year. [*Spreadsheet: "Project costing"*]
- **Collect and analyze revenue data**. The objective is to see if the counterparts have adequate revenues to secure their portion of the project funds and repay the loan. [*Spreadsheet: "Revenue"*]
- **Collect and analyze expenditure data**. The objective is to determine if the project costs are within reasonable range for the government to absorb its operational costs after the project investment period. [*Spreadsheet: "Expenditure"*]

**Excerpt of the financial analysis from the Guangdong Compulsory Education Project PAD:
Financial viability
The World Bank loan agreement will be signed between the World Bank and the Ministry of Finance. The on-lending agreement will be between the Ministry of Finance and the Guangdong Provincial Government, and counterpart funds will come from government fiscal revenue provided by the Guangdong Provincial Government.

The breakdown of the financing between the IBRD loan and counterpart funding is presented in Table 12 below. Both IBRD loan and counterpart funds will support activities in all four components of the project and the front-end fee and contingency funds are allocated under the IBRD loan.

Table 11. Summary of project costs by IBRD loan and counterpart funding (Unit: Million USD)

	Total investment			Annual investment (Million USD)									
				2016 (5%)		2017 (10%)		2018 (25%)		2019 (30%)		2020 (30%)	
	Total	Bank (B)	Counterpart (C)	B	C	B	C	B	C	B	C	B	C

Comp. 1	159	62	97	3.1	4.8	6.2	9.7	15.5	24.2	18.6	29.0	18.6	29.0
Comp. 2	80	12	68	0.6	3.4	1.2	6.8	3.0	17.1	3.6	20.5	3.6	20.5
Comp.3	41	33	8	1.7	0.4	3.3	0.8	8.3	2.0	10.0	2.4	10.0	2.4
Comp. 4	11	4	7	0.2	0.4	0.4	0.7	1.0	1.8	1.2	2.1	1.2	2.1
Front-end fee	0.3	0.3	0.0	0.02	0.00	0.03	0.00	0.08	0.00	0.09	0.00	0.09	0.00
Contingency	8	8	0	0.4	0.0	0.8	0.0	2.1	0.0	2.5	0.0	2.5	0.0
Total	300	120	180	6.0	9.0	12.0	18.0	29.9	45.1	35.9	54.1	35.9	54.1

Source: Author's calculations

The Guangdong provincial government has committed to providing counterpart funding and loan repayment through the provincial government's fiscal revenue. As shown in Table 13, the provincial government has a strong record of securing revenue sources from tax and non-tax sources. The provincial government's local revenue has been steadily increasing over the last 5 years with over 13% growth in the last two years. For the most recent year for which we have a detailed financial statement, the provincial government's local revenue was 1.284 billion USD. The annual investment from counterpart funding for the Guangdong Compulsory Education Project is expected to be 9 million USD in 2016, 18 million USD in 2017, 45 million USD in 2018, and 54 million USD in 2019 and 2020 (see Table 12). Even the largest annual investment –expected at 54 million USD in 2019 and 2020–is only 4.2% of the 2014 local revenue, suggesting that the provincial government will have sufficient sources to cover the counterpart funding over the project investment period.

Table 12. Guangdong Provincial Government local revenue statement (Unit: Million USD)

	2010	2011	2012	2013	2014
Provincial government's local revenue	719.3	878.2	991.9	1127.6	1284.2
Taxes	605.6	724.3	807.9	918.5	1036.7
Value-added Tax	104.7	111.7	126.4	168.6	196.4
Business Tax	198.1	227.9	247.9	260.5	275.6
Corporate Income Tax	108.1	131.8	141.9	155.2	180.9
Individual Income Tax	45.7	54.4	51.4	55.4	65.1
City Maintenance and Construction Tax	21.7	47.0	53.9	61.1	65.9
Stamp Tax	11.1	11.9	12.9	15.2	17.8
Non-Tax Revenue	113.6	153.9	184.0	209.2	247.5
Special Program Receipts	15.5	28.6	32.3	37.1	40.7
Charge of Administrative and Units	46.7	58.9	62.4	71.7	79.2
Penalty Receipts	15.2	17.9	22.3	21.5	21.4
Operating Income from State-owned Capital	14.3	13.7	19.1	19.6	9.7
Others	8.8	18.4	25.3	29.0	51.6

Note: Exchange rate of 1 USD=6.28 RMB
Source: Statistics Bureau of Guangdong Province 2014

Financial sustainability

The share of the education budget associated with the Guangdong Compulsory Education Project is also within reasonable limits. Using education expenditure data provided by the Guangdong Department of Education of the 16 project counties, we are able to estimate the ratio

between the total costs of the Guangdong Compulsory Education Project and the total compulsory education expenditure in the 16 project counties.

The actual expenditure (and budgeted figure for 2016) is shown in table 14 below. Notice that total expenditure (2) has been rising steadily since 2010, with the most recent annual growth between 2014 and 2016 at an average of 15 percent increase each year. We assume this 15 percent growth rate in projecting total expenditures (2) for 2017 to 2028. In addition, table 12 shows that the share of education expenditure relative to total expenditure (5)/(2) ranges from 33 percent to 41 percent with an average of 36 percent. For projecting future education expenditures (5), we assume this average 36 percent between total expenditure and education expenditure each year. Moreover, the share of compulsory education relative to total education expenditure (8)/(2) is between 68 percent and 74 percent with an average of 71 percent. We use this average share of 71 percent in projecting future compulsory education figures. Based on these three key assumptions, we project the future expenditure for the 16 project counties in Table 15 below.

In this context, the share of the Guangdong Compulsory Education Project is within reasonable limits both in the project implementation period (2016-2020) as well as in the subsequent operational period (2021-2028) when students will continue to benefit directly from the project's activities. During implementation, the project will cost between 0.35 percent to 1.29 percent of the compulsory education budget of the 16 project counties. During subsequent operation, the project will cost a very small fraction of the education budget of the counties (largest figure is 0.119 percent in 2021) as costs associated with the project are only recurrent costs of infrastructure, equipment, and teacher training. Thus, investments made under this project are sustainable and can be easily absorbed by the governments of these 16 project counties.

Table 13. Actual education expenditure (USD) of 16 project counties

	2010	2012	2014	2016
Total Expenditure (2)	4,478,496,323	7,258,569,610	9,576,166,335	12,407,108,588
Total Recurrent Expenditure (3)	3,354,533,609	4,576,950,554	6,637,226,993	8,478,101,134
Total Capital Expenditure (4)	983,147,028	1,473,559,609	2,157,776,769	3,167,987,947
Total Education Expenditure (5)	1,507,436,767	2,399,645,376	3,424,695,795	5,042,148,469
Total Education Recurrent Expenditure (6)	1,269,885,834	2,044,356,324	2,843,258,068	3,820,497,364
Total Education Capital Expenditure (7)	129,779,173	316,051,503	448,642,279	709,646,533
Total Compulsory Education Expenditure (8)	1,073,518,407	1,698,889,569	2,549,288,559	3,419,228,744
Total Compulsory Education Recurrent Expenditure (9)	1,008,838,043	1,508,916,261	2,311,069,023	3,059,162,568
Total Compulsory Education Capital Expenditure (10)	63,942,523	194,970,489	247,628,741	356,241,968
Share of education expenditure relative to total expenditure (5)/(2)	34%	33%	36%	41%
Share of compulsory education expenditure relative to total education expenditure (8)/(5)	71%	71%	74%	68%
Total number of students in compulsory education (11)	3,473,610	3,040,287	2,509,382	2,459,668
Compulsory education expenditure per student (8)/(11)	309	559	1,016	1,390
GD Compulsory Education Project Total Costs (12)	-	-	-	11,958,599
GD Compulsory Education Project Total Costs / Total Compulsory Education Expenditure (12)/(8)	-	-	-	0.35%

Source: Authors' calculations from data provided by Guangdong Department of Education 2015

Key assumptions drawn from Table 13 and applied to Table 14:

- Annual growth in total expenditure (using most recent '14-'16): $\frac{12,407,108,588-9,576,166,355}{9,576,166,355} \div 2\ years = 15\%\ inc.per\ year$
- Average share of education expenditure relative to total expenditure: $\frac{34+33+36+41}{4} = 36\%$
- Average share of compulsory education expenditure relative to total education expenditure: $\frac{71+71+74+68}{4} = 71\%$

Table 14. Projected/expected education expenditure of 16 project counties, 2017-2028 (costs rounded to million USD)

	2017	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**
Total Expenditure (2)	14,268	16,408	18,870	21,700	24,955	28,698	33,003	37,954	43,647	50,194	57,723	66,381
Total Education Expenditure (5)	5,137	5,907	6,793	7,812	8,984	10,331	11,881	13,663	15,713	18,070	20,780	23,897
Total Compulsory Education Expenditure (8)	3,647	4,194	4,823	5,547	6,379	7,335	8,436	9,701	11,156	12,830	14,754	16,967
Share of education expenditure relative to total expenditure (5)/(2)	*36%*	*36%*	*36%*	*36%*	*36%*	*36%*	*36%*	*36%*	*36%*	*36%*	*36%*	*36%*
Share of compulsory education expenditure relative to total education expenditure (8)/(5)	*71%*	*71%*	*71%*	*71%*	*71%*	*71%*	*71%*	*71%*	*71%*	*71%*	*71%*	*71%*
GD Compulsory Education Project Total Costs (12)	22.8	54.2	62.0	59.0	7.6	6.1	3.6	2.1	0.73	0.48	0.48	0.48
GD Compulsory Education Project Total Costs / Total Compulsory Education Expenditure (12)/(8)	0.62%	1.29%	1.29%	1.06%	0.119%	0.083%	0.0428%	0.0212%	0.00657%	0.00372%	0.00324%	0.00282%

Source: Authors' calculations. Italicized numbers are assumptions made to project future expenditures.

As a reminder, the steps and guidelines in this guidance note are merely suggestions. The aim of this guidance note is to offer a concrete example of how teams can conduct a high-quality economic and financial analysis for compulsory education projects even with less-than-ideal data sources. While each project is unique and will likely require different approaches to their economic and financial analysis, all teams in the Education Global Practice can aspire to do the following:

- **Clearly describe assumptions.** Many assumptions must be made to conduct an economic and financial analysis. As a result, if the assumptions are not clearly described and well-defended, it is impossible for a reviewer to understand the analysis. Authors of economic and financial analyses should write and document their work so that a reviewer can easily replicate their findings.
- **Share your work**. Teams should upload spreadsheets and detailed explanations of their economic and financial analysis in the Portal. This will be particularly helpful when team compositions change and ICR happens several years after appraisal.
- **Include a detailed annex**. The project appraisal document for IPFs no longer requires a separate annex for the economic and financial analysis (but additional annexes are possible). Teams should include an annex for the economic and financial analysis so that reviewers can understand whether there is sufficient evidence to support the project.
- **Start collecting data early in the project preparation stage**. A variety of data sources are required to conduct a strong economic and financial analysis. Request for data early to get an idea of what indicators are available from counterparts. This will leave ample time to investigate alternative data if key indicators are unavailable from counterparts.