This User Guide is designed to be used in conjunction with the Education Needs Assessment model available at

http://www.unmillenniumproject.org/policy/index.htm

This User Guide was prepared by Albert Cho
Comments and suggestions are welcome and should be sent to the author at albert.cho@unmillenniumproject.org
# TABLE OF CONTENTS

I. NEEDS ASSESSMENT OVERVIEW ................................................................. 1

II. EDUCATION MODEL BASICS ....................................................................... 4
   Objective ........................................................................................................ 4
   Scope ............................................................................................................. 4
   Data Requirements ....................................................................................... 5

III. USING THE EDUCATION MODEL ............................................................... 7
   Modeling Methodology ................................................................................ 7
   The Worksheets .......................................................................................... 8
      Overview .................................................................................................. 8
      Interventions .......................................................................................... 8
      Population Data Entry .......................................................................... 8
      Coverage ................................................................................................ 8
      Costs ........................................................................................................ 11
      Organizing Data ..................................................................................... 15
      Resource Needs ....................................................................................... 15
      Summary Sheet ....................................................................................... 21
      Region Aggregator .................................................................................. 21

IV. ADAPTING THE MODEL ............................................................................. 22
V. CHECKING RESULTS AND TROUBLE-SHOOTING ...................................... 24
   Checking Results ....................................................................................... 24
   Trouble-shooting ...................................................................................... 24
   Unrealistically high or low resource estimates .............................................. 25

VI. OTHER RESOURCES AND FURTHER READING ........................................ 27
I. NEEDS ASSESSMENT OVERVIEW

This user guide is a step-by-step introduction to the UN Millennium Project’s education needs assessment tool. It assumes that users have read the *Handbook* and have a basic familiarity with the fundamentals of an MDG Needs Assessment, but does not presume any prior technical knowledge of MDG needs assessment tools. The guide should be used concurrently with the education needs assessment tool, available at [www.unmillenniumproject.org/policy](http://www.unmillenniumproject.org/policy). In conjunction with the *Handbook*, it aims to help users embark on an MDG-based education needs assessment.

Based on data input by the user, the education needs assessment tool estimates the resources needed to support education interventions as part of a strategy for meeting the MDGs at the national level. It yields aggregate financial costs, as well as quantitative estimates of necessary infrastructure, such as classrooms, and specialized human resources, such as primary and secondary school teachers. These estimates, along with estimates from other thematic areas (health, gender, rural and urban development, etc.) will help provide the basis for a national investment strategy for meeting the Millennium Development Goals.

**MDG Needs Assessments**

MDG needs assessments are the analytical building blocks for developing MDG-based poverty reduction strategies. They aim at helping governments to answer the question, “What investments will it take to meet the MDGs by 2015?” This approach marks a fundamental shift from current practice to strategy design, which asks the question: “How can governments best allocate existing resources?” Traditional sectoral work is thus based on forming annual budget allocations in a resource-constrained setting. An MDG Needs Assessment aims instead to help countries identify what resources are needed each year over a 10-year period to meet the MDGs by 2015. The resulting estimates can then be core inputs to an MDG investment strategy, including sequencing and capacity building, which, along with a policy and implementation outline, comprise a 10-year framework for meeting the MDGs.

The *Handbook* specifies an approach to creating an MDG-based PRS, and describes in detail the steps required to conduct an MDG needs assessment. This introduction will briefly outline these steps, and the role that the education model plays in the overall MDG needs assessment process.

First and foremost, the MDGs need to be interpreted at the country level. This entails defining quantitative *outcome* targets that are meaningful at the national level, and defining the areas of intervention that are needed to meet each of the MDGs. For education, the MDG target of universal primary education is relatively clear, but countries may wish to alter the target in various ways. For example, countries may wish to achieve UPE before 2015 or add targets for secondary education. Once outcome targets have been set, there are four steps in conducting a needs assessment, illustrated in Figure 1 and described below.
Figure 1: Steps in an MDG Needs Assessment

1. Develop list of interventions
2. Specify targets for each set of interventions
3. Estimate resource needs
4. Check results

1 – Develop list of interventions

Users first need to define the critical interventions required to meet the MDGs. As outlined in the Handbook, interventions are defined broadly here as goods, services and infrastructure that need to be provided to generate outcomes. In education, interventions include, for example, provision of primary school teachers, classrooms, and textbooks. The UN Millennium Project recommends that thematic working groups be organized as part of the MDG-based planning process. These groups will help to guide the selection of a comprehensive set of interventions that comprise each investment cluster [see Step 2 of the Handbook]. In many cases countries will have already elaborated such interventions in their national and sectoral planning documents. These documents should be a starting place for defining MDG interventions. The UN Millennium Project has drawn up sample lists of interventions to reach the MDGs that can also be an input into thematic working group discussions. This list will then have to be modified and adapted to national needs. The education-related interventions from these lists are the basis of the interventions outlined in this model.

2 – Specify targets for each set of interventions

Once national outcome targets have been set and interventions have been identified, countries need to determine who the interventions should reach, what proportion of this population will need to be covered by 2015, and how many units of each intervention are needed to reach them. This requires setting targets for each intervention and input quantity ratios that relate interventions to the people they reach. For example, primary school interventions aim to reach all children of school going age. To know the number of classrooms that need to be built to meet this goal, countries need to also set a target student-to-classroom ratio. These quantified coverage targets and ratios are the basis for determining “how much” of each intervention will be necessary over the 10-year period. Countries should also establish interim milestones to measure progress.

Where relevant, targets and their corresponding interventions can be disaggregated by age and gender as well as by urban and rural areas. For example, urban and rural areas often
require distinct interventions and technologies or face very different unit costs.\(^1\) Disaggregation by gender and age will help countries better target services to populations in need and to adjust their service delivery to a changing demographic profile. You will find advice on using the models to reflect additional disaggregation in Part Four of this guide: Adapting the Model.

3 - Estimate resource needs

The next step is to estimate the financial, human and other resources needed to achieve the identified targets. The UN Millennium Project’s education model is designed to assist countries in making these estimates. This Excel-based needs assessment tool integrates the information input by the user to generate these estimates. It uses outcome targets, coverage targets and ratios, and unit costs to develop aggregate as well as intervention-by-intervention estimates of resource requirements. Similarly, simple ratios between beneficiaries, HR parameters, and infrastructure yield the non-monetary results. A simple ten-year scale up path allows users to maps out the yearly investments needed to meet 2015 targets. The model aims to be transparent and adaptable to national needs. This user guide focuses largely on explaining how to use and adapt this model.

4 - Check Results

With any needs assessment, the results should be carefully reviewed to make sure that they are accurate and adequate to reach the MDGs. While every country will obtain different results based on local circumstances, the UN Millennium Project has carried out preliminary needs assessments in several countries that can serve as a basis for comparison. These results provide some guidance on the order of magnitude of the costs for reaching the MDGs in a subset of low income countries. See the Handbook for sample results across areas and countries.

The education sectoral needs assessment is part of a broad MDG strategy that covers all investment areas. Once needs assessments are completed for all investment clusters, they need to be aggregated and integrated as a first step in creating a ten-year MDG framework. As part of this consolidation process, countries should produce one summary budget outlining the projected expenditures for meeting the MDGs. In practice, this means that each model should contain a summary output page that can be easily summed and manipulated across clusters. This model has a [“summary outputs page”] that is formatted for incorporation in the UN Millennium Project’s “financing model”\(^2\).

This user guide is designed to explain the use of the needs assessment tool as clearly and simply as possible. As you work through it, please feel free to contact the UN Millennium Project with any comments, questions, or suggestions for improvement. We look forward to hearing from you and wish you good luck in the needs assessment process.

\(^1\) A clear distinction between urban and rural needs is particularly warranted for the following categories: water supply and sanitation, transport infrastructure and energy services.

\(^2\) In addition to aggregation, this model allows countries to calculate the investments that can be financed by households and domestic government, and the remaining needs that will have to be financed by other sources such as ODA.
II. EDUCATION MODEL BASICS

Objective

The objective of the Education model is to estimate the resources required for a country to achieve Millennium Development Goal #2: Universal Primary Education (UPE). The model identifies the interventions needed to scale up school enrollment and completion to 100% by 2015 and costs the associated resource requirements from the bottom up.

Scope

MDG 2 calls for countries to achieve universal primary education by 2015. To reflect the complexity of factors that influence school enrollment and completion, this model includes interventions that deal with several levels of education.

Pre-primary education is an important – but optional – investment in achieving UPE. Research indicates that children who complete a course of pre-primary education are more likely to enroll in and complete primary school. Though it is not strictly necessary, we include pre-primary education for countries where this is a priority set of interventions.

We define primary education to include a full course, typically six years, of schooling for children between five and twelve years of age. The Millennium Development Goals call for universal primary education, and in various international agreements, governments have called for free and compulsory education for all children, boys and girls alike. The model can easily be adapted for countries with basic education systems (typically eight years).

Secondary education is not explicitly part of the Millennium Development Goals, but it is included in our model for at least three important reasons. First, secondary graduates are needed for many tasks associated with achieving the Millennium Development Goals, including teaching primary school. Next, secondary education generates incentives for parents to send their children, particularly their girl children, to primary school. Without the prospect of access to secondary education, which produces greater returns to education, enrollments may not increase sufficiently to meet the Goals. Finally, access to secondary education may be especially important for marginalized populations where more years of schooling may be needed to acquire basic competence.

Adult literacy is one of the indicators associated with achieving MDG 2. Adult literacy is also an important input into the achievement of other MDGs. We include it so that countries that wish to make adult literacy part of their investment programs can estimate the resources that will be required to meet this objective. The definition in the model is adults 15-59 years of age; this can be changed by users to fit local circumstances.

Limitations of the model. This model provides a framework for modeling direct costs of achieving universal primary education. It does not include the systemic costs associated with running school systems. Systemic expenses include outlays for services such as district administration, operations of the Ministry of Education, school assessment and quality
control, and sector strategic planning, to name but a few. These services are crucial to the proper functioning of a school system and should not be neglected. Nevertheless, they do not form part of this costing model. Some suggestions for including systemic costs are provided in Part Four of this user guide: Adapting the model.

Data Requirements

The education model will require users to supply a number of data inputs and parameters. These inputs fall into five basic categories: demographic data, outcome and coverage targets, input quantity ratios, and unit costs.

- **Demographic data** are needed to establish basic population parameters. Required inputs include per capita GDP and urban and rural populations, disaggregated by age. This data are typically found in national population censuses and statistical databases.

- **Outcome targets** define the outcome objectives of the model. In other words, they represent the state of the world the model is trying to achieve. In the case of education, these outcome objectives include a 100% primary completion rate (PCR) by 2015, as well the achievement of 107% gross and 100% net enrollment rates quickly enough to make a 100% PCR possible by 2015.

- **Coverage targets** define the proportion of the population that will be reached by a given intervention. In most cases in the education model, this is 100%, but in cases where the intervention reaches only a proportion of the target population, this ratio will be lower. For example, the demand-side intervention of subsidies for girl children has a coverage target of 50% by 2015.

- **Input quantity ratios** define the ratios of inputs needed to deliver interventions, e.g. textbooks per pupil or students per classroom. They are necessary to calculate how many units of each intervention will be needed. Many input quantity ratios have both a current and a target value; e.g. 80 students per classroom in 2005 and 40 students per classroom by 2015. Target input quantity ratios are important because they permit users to control aspects of educational quality (i.e. on balance, a lower pupil-to-teacher ratio results in higher quality than a high ratio).

- **Unit costs** describe the cost of a single intervention. Some examples include the cost of a single textbook, the cost of constructing a single classroom, or the cost of school meals for a single child. These costs should be based on average unit costs for the selected intervention. These data can be derived from a number of sources, including past procurement contracts or current market rates.

---

3 Needs assessments could in theory use marginal costing to estimate resource requirements, but in practice this involves making quite demanding assumptions about the pattern of marginal costs, for which there is frequently insufficient empirical evidence. We account for differential marginal costs in two ways. First, we permit disaggregation of target populations based on relative unit costs (e.g. urban needs can be modeled separately from rural needs). Second, the model includes specific interventions that target hard-to-reach populations, such as subsidies for girls education.
Because the model deals in constant dollars, some costs are treated as static, i.e. a textbook costs as much in real terms in 2005 as it does in 2015. However, other costs evolve over time in real terms. Teacher salaries, for example, may need to increase in real terms between the present and 2015, and so we include places to input current and 2015 target unit costs.

**Key points:**

1. This model calculates the full cost of achieving MDG2 as well as the educational investments required to meet the other MDGs.

2. The model covers pre-primary education (an optional set of interventions), primary education, secondary education, and adult literacy, which are important components of achieving the MDGs.

3. Required inputs include demographic data, outcome and coverage targets, input quantity ratios, and unit costs. These can be derived from research, the experience of well-performing countries, national statistics, and records from the Ministry of Education.
III. USING THE EDUCATION MODEL

Modeling Methodology

The model follows the general needs assessment methodology outlined in the Handbook. As you will remember, this methodology asks users to define the interventions that are required to meet the Millennium Development Goals, define targets associated with these interventions, then determine the resources that will be required to implement them fully. In the Education model, each of the four components – pre-primary education, primary education, secondary education, and adult literacy – is treated separately, and each component is then costed using this needs assessment methodology.

- **Interventions** are the specific inputs that are needed to deliver services effectively. They include classroom construction, teacher salaries, demand side interventions, and textbooks, among many others. In this model, interventions are broken up into several sub-categories, including infrastructure, teachers, and facilities.

- **Outcome targets, coverage targets, input quantity ratios, and unit costs** are all described above.

- **Resource requirements** are calculated using simple multiplication. The total population is multiplied by coverage targets to get the population covered by a particular intervention, which is then multiplied or divided by input quantity ratios as appropriate to get the number of units required of each intervention. Finally, the required interventions are multiplied by unit costs, providing the total resource requirements for each year.

**Methodology for calculating resource requirements**

\[
\text{Population size} \times \text{Coverage ratio} = \text{Covered population} \times \text{Input quantity ratio} = \# \text{ of units of interventions required} \times \text{Unit costs} = \text{Resources required}
\]
The Worksheets

Overview

The Overview sheet provides a general overview to the model.

Interventions

The Interventions page allows the user to define interventions and associated intervention targets. The page is divided into four sections that correspond to the four general areas of the educational system addressed by the model: pre-primary education, primary education, secondary education and adult literacy. In each area, the Interventions page lists categories of specific interventions that form the basis of the needs assessment exercise.

The cells on this page are linked to relevant fields on the other worksheets, so changing intervention names on this page will change them throughout the model. We will return to this feature in Part Four: Adapting the Model.

Population Data Entry

On this page, the user enters country-level population and demographic data. Required data include total population, broken up into pre-primary school age population, primary school age population, secondary school age population, and adult population. If the user wishes to calculate separate estimates for rural and urban areas, data can also be disaggregated along urban-rural lines. See Part Four for more details on regional assessments. Data need to be entered for the base year, and growth projections need to be made for subsequent years until 2015. The population data page also requires data on per capita GDP in 2005, as well as projections through 2015.

It is important that these data are as recent and as accurate as possible, and that growth projections are based on reasonable assumptions. These data underpin the entire costing model, so it is essential to verify their accuracy. Population data and projections can be obtained from national census data, as well as from the UN Population Division.

NB: When conducting needs assessments that cover more than one sector, users should check to make sure that the same population data are used across different models to ensure consistency of results.

Coverage

The Coverage section permits users to enter the coverage targets and input quantity ratios defining the reach of education interventions. Coverage targets work similarly for each of the four education areas (pre-primary, primary, secondary, adult literacy), so we illustrate their use with examples from primary education.
The targets on this worksheet have two input cells: one for 2005 values, and one for 2015 targets. Users should input current data in the first (2005) cells to provide a baseline value, and then specify 2015 coverage and input quantity ratio targets in the second cell.

For example, under Primary Education, the first input variable is “Gross Enrollment Rate (GER).” In the first input cell, the user should enter the current gross enrollment rate, which in the example below is 92%. The second cell is where users should enter the 2015 target GER. In this case, a value of 107% is entered, suggesting that by 2015, the country aims to have a 107% gross enrollment rate.4

The procedure is the same for input quantity ratios. In the example above, the user enters the current pupil-teacher ratio in the first input cell in line 30, then enters the target pupil-teacher ratio in the second. In this example, the entries suggest that there are currently 38 pupils per teacher in the primary education system, but that in 2015 there will need to be enough teachers to bring the ratio down to 40 pupils per student.

Under “infrastructure,” the entries follow the same logic, with two exceptions. Under

---

4 UPE corresponds to a primary completion rate of 100%, which is the 2015 outcome target. This in turn implies a target net primary enrollment rate (NER) of 100% prior to 2015. Specifically, where $x$ is the number of years in a full course of primary education, NER needs to reach 100% in $x$ years before 2015. Research suggests that a 100% net enrollment rate requires, on average, a 107% gross enrollment rate (GER). Hence we suggest the following outcome targets: 100% PCR by 2015 and 107% GER, 100% NER by $x$ years prior to 2015. Furthermore, this model estimates costs based primarily on the PCR, but it is in principle possible to derive cost estimates using targets for net enrollment rates by building in targets for repetition rates. The user would need to frame the resource estimation model around the NER and also include a scaled-down path to a 7% repetition rate from whatever rate currently prevails.
“classrooms,” users should input the total number of classrooms currently extant in the country. The spreadsheet will automatically calculate the current pupil-classroom ratio. Users can input the 2015 target pupil-classroom ratio in the second entry cell on line 41.

The “classroom reconstruction” target may also require some clarification. In some countries, a certain share of existing classrooms may be in such poor condition that these rooms require significant rehabilitation before they are usable. The reconstruction intervention asks countries to identify what percent of existing classrooms are unusable. This is translated into a numerical estimate of how many classrooms need to be reconstructed, which becomes the outcome target for classroom reconstruction in the Resource Needs page. It is recommended that classroom reconstruction be completed as a matter of priority and scaled up before 2015, typically in the first five years of the investment program.

<table>
<thead>
<tr>
<th></th>
<th>% of existing classrooms requiring reconstruction</th>
<th>5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
<td># of existing classrooms requiring reconstruction</td>
<td>12,187</td>
</tr>
</tbody>
</table>

Many cells require both 2005 coverage data and 2015 targets, but there some variables require only a single, static input quantity ratio. These cells ask users to enter values for parameters that remain stable over time, such as the number of years in primary education (in this case, 5).

<table>
<thead>
<tr>
<th></th>
<th>Primary Education</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>Primary Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Gross Enrollment Rate (GER)</td>
<td>92%</td>
<td>107%</td>
</tr>
<tr>
<td>25</td>
<td>Net Enrollment Rate (NER)</td>
<td>84%</td>
<td>100%</td>
</tr>
<tr>
<td>26</td>
<td>Primary Completion Rate (PCR)</td>
<td>30%</td>
<td>100%</td>
</tr>
<tr>
<td>27</td>
<td>Years of Primary Education</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

The user should proceed by filling in all of the input cells in the model. Once this task is complete, move to the “costs” page.
How are targets derived?

Outcome targets are derived directly from the MDGs. If universal primary education is to be achieved by 2015, primary completion rates need to reach 100% by 2015, which implies that net and gross enrollments need to reach 100% prior to 2015.

Coverage targets are based on national assessments what proportion of the population will need to receive a given intervention for the outcome targets to be achieved. For example, a subsidy for girls’ education is an important demand-side intervention, but it may be the case that only half of the girls in a country require subsidization. In this case a coverage target less than 100% may be warranted.

Input quantity ratio targets are determined on the basis of evidence from well-performing education systems. Studying well-performing countries suggests that supplying textbooks and a uniform free to each child eliminates one of the most important barriers to access, which is why an input quantity ratio of 1:1 is recommended. While targets will naturally differ from country to country according to variations in local circumstances, there is a general rule of thumb: all targets should be derived from the existing evidence base and the government’s best available understanding of what it will take to achieve the MDGs. In turn, this implies an inclusive and participatory national process that will enable stakeholders from various groups to contribute their expertise and knowledge to the identification of targets and interventions. See Step One in the UN Millennium Project Handbook for more information on the process of target setting.

Costs

The Costs page asks users to input the unit costs of each of the interventions specified in the model. Again, costs are divided among the four areas: pre-primary education, primary education, secondary education, and adult literacy. In each of these areas, costs are divided into various pools, which generally correspond to infrastructure, human resources, and other expenses such as demand side interventions, textbooks and uniforms. Many of these expenses have both one-time (capital) and ongoing (recurrent) costs, which the model treats separately for the purposes of determining the pattern of resource needs. In this model, we provide illustrative costs; actual costs will naturally differ by country.

Pre-Primary Education

Pre-primary education costs are divided into infrastructure, human resources (e.g. teachers), and administrative expenses.

Infrastructure

Under infrastructure, users need to input the capital cost of constructing a pre-primary educational centre, as well as an estimate of recurrent (e.g. operations and maintenance) costs as a percentage of capital costs. In the example below, the infrastructure capital cost is $2500 and the recurrent cost percentage is 10%, yielding an annual recurrent cost of $250.
Recurrent and operating costs of pre-primary education infrastructure

<table>
<thead>
<tr>
<th></th>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Infrastructure</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Capital Costs</td>
<td>2500</td>
</tr>
<tr>
<td>8</td>
<td>O&amp;M Cost (as % of Capital Cost)</td>
<td>10%</td>
</tr>
<tr>
<td>9</td>
<td>Recurrent Costs</td>
<td>250</td>
</tr>
</tbody>
</table>

**Teachers**

Under “teachers,” users input any capital or one-time costs for teachers, such as pre-service training. Next, they input the current (2005) salary for teachers, and the spreadsheet automatically calculates the implied salary-to-GDP ratio. Users then input the target salary-to-GDP ratio for 2015, and the spreadsheet automatically calculates the implied salary for 2015. If users would rather input a salary figure directly into the spreadsheet, they can simply overwrite the formula in the “implied recurrent cost” box with a constant value.

<table>
<thead>
<tr>
<th></th>
<th>Teachers</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>110</td>
<td>Salary Expense</td>
<td></td>
</tr>
<tr>
<td>111</td>
<td>Female Teachers</td>
<td></td>
</tr>
<tr>
<td>112</td>
<td>Capital Costs</td>
<td></td>
</tr>
<tr>
<td>113</td>
<td>Salary - GDP Multiple</td>
<td></td>
</tr>
<tr>
<td>114</td>
<td>Implied Recurrent Costs</td>
<td></td>
</tr>
<tr>
<td>115</td>
<td>Male Teachers</td>
<td></td>
</tr>
<tr>
<td>116</td>
<td>Capital Costs</td>
<td></td>
</tr>
<tr>
<td>117</td>
<td>Salary - GDP Multiple</td>
<td></td>
</tr>
<tr>
<td>118</td>
<td>Implied Recurrent Costs</td>
<td></td>
</tr>
</tbody>
</table>

Note that teacher costs are entered separately for male and female teachers to allow for different starting and ending salary points, which may be useful if extra incentives are necessary to achieve gender balance in the workforce, which is important to encourage girls to attend school.

**Administrative expenses**

Under administrative expenses, users input an estimate of administrative costs as a proportion of total direct costs (infrastructure and salaries). The sample entry is 35%, but this can be adapted to fit country experiences.

<table>
<thead>
<tr>
<th></th>
<th>Administrative Costs</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>As % of total direct costs</td>
<td>35%</td>
</tr>
</tbody>
</table>

**Primary education**

Primary education costs are divided into infrastructure, teachers, demand-side interventions, and other recurrent expenses.

**Infrastructure**

Infrastructure costs include classrooms and other equipment, such as latrines, and transportation facilities if provided. Classroom costs cover costs for new and rehabilitated classrooms, and include both capital and recurrent (O&M) costs. As before, recurrent costs are calculated as a fixed percentage of capital costs.
Under New Classrooms, users enter the construction cost of a new classroom. Next, they input a reasonable estimate of classroom recurrent costs as a percentage of construction cost; our sample figure is 3%, but this will vary locally. The “Implied O&M Cost” cell automatically calculates the implied annual recurrent cost per classroom.

<table>
<thead>
<tr>
<th></th>
<th>Infrastructure</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>124</td>
<td>Classrooms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>125</td>
<td>New Classroom Construction</td>
<td>1,950</td>
<td></td>
</tr>
<tr>
<td>126</td>
<td>Capital Cost</td>
<td>3%</td>
<td></td>
</tr>
<tr>
<td>127</td>
<td>O&amp;M Cost (as % of Capital Cost)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>128</td>
<td>Implied O&amp;M Cost per Annum</td>
<td>58.5</td>
<td></td>
</tr>
</tbody>
</table>

Classroom reconstruction costs are also included in this model. Note that classroom reconstruction costs are entered as capital costs only, since their O&M costs are captured in the aggregate classroom O&M calculations.

The other infrastructure categories – desks, chairs and blackboards – follow the same logic. Users need to input the cost of purchasing one unit and develop an appropriate estimate for recurrent costs as a percentage of purchase costs. The same procedure is applied to equipment, such as latrines and transportation.

**Sample cost calculation for equipment**

<table>
<thead>
<tr>
<th></th>
<th>Desks</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>135</td>
<td>Capital Cost</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>136</td>
<td>O&amp;M Cost (as % of Capital Cost)</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td>137</td>
<td>Implied O&amp;M Cost per Annum</td>
<td>0.4</td>
<td></td>
</tr>
</tbody>
</table>

**Teachers**

Teacher costs are divided into salaries, housing, and pre-service and in-service training. Salaries are treated just as they were under pre-primary education (see above). Teacher housing costs are treated just like other infrastructure interventions.

Pre-service training is treated as a capital cost with no recurrent costs; in-service training is generally treated as a recurrent cost, though it may involve some capital costs as well.

<table>
<thead>
<tr>
<th></th>
<th>Teacher pre-service training (per teacher)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>170</td>
<td>Capital Cost</td>
<td>54</td>
<td></td>
</tr>
<tr>
<td>171</td>
<td>Recurrent Cost (as % of Capital Cost)</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>172</td>
<td>Implied O&amp;M Cost per Annum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>173</td>
<td>Teacher in-service training (per teacher)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>174</td>
<td>Capital Cost</td>
<td></td>
<td></td>
</tr>
<tr>
<td>175</td>
<td>Recurrent Cost (as % of Capital Cost)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>176</td>
<td>Implied O&amp;M Cost per Annum</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

Demand-side interventions may be entered where these are necessary to encourage school attendance. The model includes input fields for two of the most common: subsidies for girls
and school meals. In both cases, the user can either enter a capital cost and a recurrent cost percentage, or directly enter the capital cost and recurrent cost.5

<table>
<thead>
<tr>
<th>Demand-side interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>178</td>
</tr>
<tr>
<td>179</td>
</tr>
<tr>
<td>180</td>
</tr>
<tr>
<td>181</td>
</tr>
<tr>
<td>182</td>
</tr>
<tr>
<td>183</td>
</tr>
<tr>
<td>184</td>
</tr>
<tr>
<td>185</td>
</tr>
<tr>
<td>186</td>
</tr>
</tbody>
</table>

The ‘other recurrent’ expenses include textbooks, uniforms, and exam-related costs. Cost data can be entered by the user as described above. One special category is “school management costs,” which include the administrative, operational and maintenance costs of running a school. Estimates of per-student costs for administration and O&M can be derived from the budgets of well-functioning schools in the country and input into the model.

Secondary education costs are entered identically to primary educational costs, though the magnitude of the costs may differ. The only area of difference is the facilities costs. The model permits users to input costs for special secondary education facilities, such as libraries, laboratories and sports facilities. These are entered just like other infrastructure interventions, with capital and recurrent costs.

<table>
<thead>
<tr>
<th>Libraries</th>
</tr>
</thead>
<tbody>
<tr>
<td>261</td>
</tr>
<tr>
<td>262</td>
</tr>
<tr>
<td>263</td>
</tr>
<tr>
<td>264</td>
</tr>
<tr>
<td>265</td>
</tr>
</tbody>
</table>

Adult literacy costs are calculated differently from the other three categories. Per learner costs are entered for each of the required interventions, and these are summed up at the bottom. Each intervention’s percentage contribution to total cost is automatically calculated in the model.

<table>
<thead>
<tr>
<th>Instructional Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>305</td>
</tr>
<tr>
<td>306</td>
</tr>
<tr>
<td>307</td>
</tr>
<tr>
<td>308</td>
</tr>
<tr>
<td>309</td>
</tr>
<tr>
<td>310</td>
</tr>
<tr>
<td>311</td>
</tr>
<tr>
<td>312</td>
</tr>
<tr>
<td>313</td>
</tr>
<tr>
<td>314</td>
</tr>
</tbody>
</table>

5 Cost and coverage data for the ‘school meals’ intervention are entered in the Education model, but the calculation of resource needs takes place in the Hunger model because ‘school meals’ are classified as a Hunger intervention. If users wish to include them in the Education model instead, they can add fields to the Resource Needs page and update total cost calculations accordingly.
Organizing Data

The Organizing Data organizes all data into a tabular format that makes it easy for users to check whether their entries and assumptions are reasonable or correct. It does not require the user to input any new data. If the Organizing Data page reveals errors, corrections should be entered in the underlying page (e.g. Cost, Coverage, or Population Data); this will automatically update the Organizing Data page.

It is crucial to correct data in the underlying pages rather than in the Organizing Data page because the Resource Needs page draws all data inputs from the Organizing Data page. If users enter data directly into the Organizing Data page instead of the underlying data entry pages, they will break the link between the Resource Needs page and the underlying data entry pages, making future changes and analysis more difficult and error-prone. Therefore, users should ensure that they use the Organizing Data page only to check the validity of their entries and make all changes on the underlying data input pages.

Resource Needs

The Resource Needs page uses all of the input data entered thus far to estimate the resources needed to achieve the education targets. Users do not need to input new data into this page; the only input that may be required is the choice of a scale-up assumption (discussed below). The Resource Needs page takes the current coverage data and 2015 coverage targets and extrapolates a scale-up path between them to determine resource requirements for each year. The following figure demonstrates the basic approach of the Resource Needs calculator.

CALCULATING RESOURCE REQUIREMENTS

(Levels defined by scale-up assumption)

For any given coverage target, the model takes 2005 data and 2015 data and interpolates values for 2006, 2007, … 2014, 2015 based on scale-up assumptions that chart out a scale-up path.
The intervention units implied in the scale-up path are then multiplied by unit costs (which may or may not vary with time) to determine annual resource requirements for each intervention.

An important distinction to make is between the way total capital and total recurrent costs are estimated. For interventions with both capital and recurrent costs, capital costs accrue only to the incremental units of interventions delivered, while recurrent costs accrue to the total stock of interventions delivered. In the latrine example below, total construction costs are calculated by multiplying the number of incremental units constructed each year by the unit construction cost. Recurrent (O&M) expenditures are calculated by multiplying the O&M unit cost by the total stock of latrines.

<table>
<thead>
<tr>
<th>Year</th>
<th>Blackboards</th>
<th>Equipment Construction</th>
<th>Latrines</th>
<th>Latrine classroom coverage</th>
<th>Implied # of latrines</th>
<th>% of incremental latrines constructed</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>112</td>
<td>116</td>
<td>117</td>
<td>118</td>
<td>70,262</td>
<td>28,140</td>
</tr>
<tr>
<td>2006</td>
<td>116</td>
<td>117</td>
<td>118</td>
<td>119</td>
<td>98,402</td>
<td>29,848</td>
</tr>
<tr>
<td>2007</td>
<td>117</td>
<td>118</td>
<td>119</td>
<td>120</td>
<td>128,250</td>
<td>34,336</td>
</tr>
<tr>
<td>2008</td>
<td>118</td>
<td>119</td>
<td>120</td>
<td>121</td>
<td>162,586</td>
<td>39,419</td>
</tr>
<tr>
<td>2009</td>
<td>119</td>
<td>120</td>
<td>121</td>
<td>122</td>
<td>202,004</td>
<td>45,233</td>
</tr>
<tr>
<td>2010</td>
<td>120</td>
<td>121</td>
<td>122</td>
<td>123</td>
<td>247,237</td>
<td>43,990</td>
</tr>
<tr>
<td>2011</td>
<td>121</td>
<td>122</td>
<td>123</td>
<td>124</td>
<td>291,228</td>
<td>41,990</td>
</tr>
</tbody>
</table>

The scale-up assumptions that charts out the scale-up path may vary from intervention to intervention. A common assumption is that coverage increases linearly each year between 2005 and 2015. This is the scale-up assumption that is currently embedded in the model. However, many different scale-up functions are feasible so long as they are increasing and use 2005 and 2015 as endpoints.

These diagrams depict linear, back-loaded and front-loaded scale-up paths. Linear scale-up paths roll out interventions at an even pace between 2006 and 2015. Back-loaded paths start the roll-out more slowly, but accelerate in the later years of the program. Front-loaded paths start out quickly to achieve rapid scale-up, then grow more slowly as 2015 approaches. Many other paths are possible. Classroom reconstruction, as mentioned above, should be completed in the first five years of the investment program, implying a rapid scale-up to 100% between 2005-2010; the scale-up path would be kinked.
Areas that require scale-up functions are highlighted in pink; users can change the scale-up paths by entering an appropriate formula in the 2006 column and extending it to 2014.

The diagram below (which omits years 2007-11 for space reasons) illustrates how scale-up functions are used to derive year-by-year estimates for resource needs.

This diagram demonstrates the scale-up path of an input quantity ratio for a single infrastructure intervention. It shows a scale-up path (line 20) from 40 students per education centre in 2005 to 50 students per education centre in 2015. Line 21 uses population projections (not shown) and the evolving input quantity ratio (40 in 2005 to 50 in 2015) to calculate the total number of education centres needed (line 21) and the incremental number of centres to be added each year (line 22). This information is combined with cost data for capital (line 46) and recurrent (line 47) costs to generate estimates for total capital (line 48) and recurrent (line 49) costs, as well as total costs (line 50).

All of the input data has already been entered in the Cost, Coverage, and Population Data sheets. The only decision the user needs to make on the Resource Needs page is the choice of an appropriate scale-up path.

Which scale-up path should the user choose? The optimal scale-up path is the one that best reflects planners’ strategies for scaling up the delivery of interventions. Planners should ask themselves what scale-up pattern makes the most sense. A linear scale-up function will make sense for some interventions, but perhaps not for others. For example, planners might want to front-load the expansion of some priority interventions, with the result that 2015 targets are reached much sooner, perhaps as soon as 2010. Another front-loaded scale-up path
might be one that increases rapidly in the first five years, then increase at a much slower rate in the last five years.

A third possibility is demonstrated in the case of classroom reconstruction, where we have assumed that all classrooms are reconstructed in the first five years of the investment program:

By contrast, planners might need to back-load the expansion of interventions that are not yet ready to be scaled up, such that scale-up is convex to the origin, resembling exponential growth. Whatever the case, it is clear that planners will need to adapt scale-up paths to specific situations.

The Resource Needs page follows the same format as the Costs and Coverage pages, separating pre-primary education, primary education, secondary education and adult literacy. In addition, it calculates resource sub-totals for a number of categories, including infrastructure, human resources, and demand-side interventions. At the bottom of the page, these sub-totals are aggregated into a summary table that calculates the aggregate sum of resources required.

**Special Cases and Complicated Formulas**

Most of the resource estimation cells follow exactly the same pattern, but there are several variables and formulas that require special attention:

**Primary Education**

Net Enrollment Rate (line 92)
The “net enrollment rate” scale-up formula is structured so that the NER reaches 100% in $x$ years before 2015, where $x$ is the number of years in a full course of primary education. Scale-up to 100% net enrollment rates $x$ years prior to 2015 is necessary to ensure a 100% primary completion rate by 2015.
To be more concrete, a country with a five-year course of primary education will need to achieve an NER of 100% by 2010 to ensure a primary completion rate of 100% in 2015. The current formula, which is slightly complicated, uses the OFFSET function to allow for variation in the total number of years of primary education. However, because a user will know a constant duration for the course of primary education, the formula can be simplified immensely by inputting 100% as the target for whatever year corresponds to 2015 – 𝑥 (in our example, 2010), and then inserting a linear scale-up function between 2005 levels and the 2010 target.

Secondary Education

Modeling outcomes (enrollment and graduation) in secondary education is slightly complex because it depends on several variables, including primary completion rates, transition rates, and dropout rates. The logic behind the model is intuitive but the formulas can be tricky, so this section explains the calculations at a fairly high level of detail.

The “General” input section (lines 360-365) asks for direct inputs that are provided from the Organizing Data page: primary school age population, secondary school age population, and the secondary drop-out rate. The spreadsheet scales up the drop-out rate from 2005 levels to 2015 (though this should perhaps be called “scaling down” as the drop-out rates are generally targeted to decrease). The ‘implied secondary retention rate’ is simply one minus the drop-out rate – a simple identity that says that students who have not dropped out are retained. The “implied secondary graduation rate” is the only complicated formula in this section. It suggests that in the first years of the model, where 𝑦 is the duration in years of secondary school, the graduation rate is zero because all of the cohorts are still in school. After 𝑦 years, the graduation rate is calculated by multiplying the retention rates for the previous 𝑦 years together. The intuition is simply that each year, a certain proportion of the class drops out, so by the end of the 𝑦 years, the survivors can be calculated by multiplying the 𝑦 annual retention rates together.

---

6 =IF(Z1_PrimaryYears<$Y$7-R$7,$O91*(($Y$7-Z1_PrimaryYears-R$7)/(1+$Y$7-$O$7-Z1_PrimaryYears))+$Y91*((1+$Y$7-$O$7-Z1_PrimaryYears))),IF(Z1_PrimaryYears=$Y$7-R$7,OFFSET(Zone_1_Point,'Organizing Data'!$A50-RowIndexDelta,TargetCoverage,1,1),IF(Z1_PrimaryYears>$Y$7-R$7,Q91)))

7 From O365: =IF(O7<Z1_SecondaryYears,0,PRODUCT(OFFSET(O364,0,-Z1_SecondaryYears-1,1,Z1_SecondaryYears+1,1,Z1_SecondaryYears)))
The “incoming students” section (lines 366-371) estimates how many students enter the secondary education system each year. Using the primary school age population (line 361) and average years in school (line 367), the model calculates the average population in each grade (line 368). The target primary completion rate (line 369) and the target transition rates (line 370) are taken from inputs from the Coverage (and Organizing Data) page, and scaled up linearly to the 2015 targets. The “implied total incoming students” (line 371) is simply the product of the “average population in each year” (line 368), the target primary completion rate (line 369) and the target transition rate (line 370). The intuition is that not all the students in each grade go on to high school. Some do not finish primary school (reflected in low primary completion rates); others finish primary school but do not continue on to secondary school (low transition rate). Hence the product of these ratios reflects the surviving cohort that enters secondary school each year.

Finally, the “outgoing students” section (lines 372-378) estimates outcomes for secondary education. The “beginning of year cohorts” (line 373) is the same as “total incoming students” (line 371). By multiplying this number by the drop-out rate (line 363), we get the total number of dropouts (line 374).

In line 375, the formula is set up so that there are no graduates until \( y \) years have passed. In year \( y \), the total number of graduates is given by the number of incoming students from \( y-1 \) years ago, multiplied by the implied secondary graduation rate (line 365). The “end of year cohorts” (line 376) is the total number of students enrolled in secondary school, and is given by the “beginning of year cohorts” (line 373) minus dropouts (line 374) minus graduates (line 375). The total number of secondary school students, in other words, is the number you started with, minus graduates, minus dropouts. The incremental number of cohorts (line 377) is derived by subtracting last year’s number of secondary school students from this year’s number of secondary students (both line 376). Finally, the implied net enrollment rate for secondary education is simply the total number of students enrolled in secondary school (line 376) divided by the number of children of secondary school age (line 362).

Note: The purpose of this section (lines 360-378) is twofold: to calculate the number of students enrolled in secondary education for the purpose of estimating resource requirements, and to estimate the total number of graduates to help users identify the availability of human resources. It permits countries to model secondary enrollments and graduates based on assumptions about primary enrollment, completion, and transition rates.

However, some countries may already have good data and projections for – or alternate ways of estimating – secondary enrollment and completion. Users may input these data directly by adapting lines 358-378 and changing the dependent links in the Resource Needs page. Any changes should be consistent with two principles: that secondary NERs need to be consistent with primary completion rates (i.e. the country cannot have more students enrolled in secondary school than have completed primary school); and second, there needs to be a way to calculate annual graduates so that planners can assess the availability of human resources for tasks that require secondary education.

---

8 For the initial four years, the user can directly input anticipated graduates derived from current enrollment data
**Summary Sheet**

The Summary sheet takes these sub-totals and organizes them into a table that provides information on total capital and recurrent resource requirements needed for each area (pre-primary, primary, etc) for each year between 2005 and 2015. It also provides a 10-year average as well as per-student and per-capita cost calculations for total resource requirements. Note that these resource estimates include financial as well as human and infrastructure requirements. The Summary sheet works automatically and does not require inputs from the user.

The Summary sheet is organized specifically to permit the results to be entered directly into a financing model alongside the outputs of other needs assessment models.

**Region Aggregator**

The Region Aggregator sheet is used only when the user wishes to conduct needs assessments for different regions. The Region Aggregator page is discussed in greater detail in Part Four: Adapting the Model.

**KEY POINTS:**

1. This model **defines interventions, sets coverage targets, identifies unit costs, and calculates resource requirements** for achieving universal primary education.

2. The sheets of this model break up these tasks into separate steps. There are three input sheets. “Population data” collects basic demographic information. “Interventions” assembles the list of interventions to be costed. “Coverage” allows users to set targets for the interventions. “Costs” is a sheet for all unit costs to be input.

3. There are also three output sheets. “Organizing data” is an automatically generated sheet that tabularizes all of the data. “Resource Needs” calculates a scale-up path for resource requirements. “Summary” brings all of the calculations together into a sheet that displays aggregate capital and recurrent expenditures for each of the various areas for investment.
IV. ADAPTING THE MODEL

The education model is designed to be generally applicable to a broad range of countries and systems, but countries may wish to adapt it further to local circumstances. Here, we discuss four adaptations that countries may wish to make to the model: dropping interventions, changing interventions, adding interventions, and adding regions.

**Dropping interventions**

In some cases, countries may wish not to use one or more of the interventions built into the model. For example, a country may decide that some of the demand-side interventions are not needed. There are many ways to reflect this in the model, but the easiest is to zero out coverage and costs. To do this, users enter zeros for all coverage targets associated with the intervention. This will eliminate the intervention from resource estimates. In the example below, for example, subsidies for girls have been eliminated.

<table>
<thead>
<tr>
<th>47</th>
<th>Demand-side interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td>Girl-boy ratio</td>
</tr>
<tr>
<td>49</td>
<td>% of girls with subsidies</td>
</tr>
</tbody>
</table>

**Changing interventions**

To modify an intervention by changing it to a different kind of intervention, users should go to the “Interventions” page and change the name of the intervention. Then, in each row where the intervention appears on the other worksheets (costs, coverage, resource needs), the user should alter the spreadsheet accordingly to reflect the costing of the intervention. If the costing methodology for the intervention remains the same as the one it is replacing, then changing the names of the cells in the “Interventions” page should be sufficient. Otherwise, the user will need to ensure that appropriate costing fields and formulas are entered for the new intervention.

**Adding interventions**

There are many ways to add interventions to the model, and advanced users should find it relatively easy to add rows and link them throughout the model to the relevant worksheets. The simplest, most modular, and most intuitive way to add an intervention to the model, however, is to add a worksheet to the model to account for all of the new interventions.

Users should enter any new population data, coverage targets, input quantity ratios, and unit costs associated with the new intervention. The new worksheet should follow the same general methodology as the rest of the model, scaling up coverage targets and multiplying them by unit costs to derive resource estimates. Once resource estimates have been calculated, formulas on the Summary page should be updated to include them. In particular, the formulas for capital, recurrent and total costs in each area (pre-primary, primary, etc.) should be revised to include the capital, recurrent, and total costs of the new interventions.
One example of an intervention that users may wish to add is systemic costs, which are not currently included in the model because they are so country-specific. To add this set of interventions, users should create a new worksheet, then decide how best to estimate the systemic costs of educational administration. There is no single right way to model these costs; instead, there are many plausible methods. Systemic costs could be calculated as a straight proportion of total direct costs, the simplest method. Or, at the other end of the spectrum, users could identify a comprehensive list of specific systemic roles (e.g. district administrators, assessment experts, procurement and budgeting specialists) and use input quantity ratios such as experts per student or per school to derive the total number of people needed. Then unit costs can be used to derive a total resource estimate. Whatever method is chosen, it should distinguish costs for each of the four areas (pre-primary, primary, secondary, adult literacy) and also disaggregate capital from recurrent expenditures.

Adding regions

To calculate results for additional regions (e.g. provinces, or separate urban/rural models), the user should create one copy of the model for each region to be assessed. One of these copies should be designated a master copy. The master copy is used to aggregate investment needs across all of the regions. Each of the models should correspond to a single region and named accordingly (e.g. education_rural.xls, education_urban.xls).

In each model, the user should enter population data, coverage targets, input quantity ratios, and unit costs specific to the region. Each region’s model will then generate an individual estimate of total resource needs.

Next, the user needs to add up the resource needs across regions. This is done in the master copy’s Region Aggregator page, where the user should copy and paste “as values” the capital, recurrent and total costs for pre-primary, primary, secondary, and adult literacy into the corresponding line in the summary page. It is important to paste “as values” so that the actual numerical values get pasted rather than formulas, avoiding broken links. The Region Aggregator page then helps the user calculate the total resource requirements across all regions.

NB: When working with multiple regions, the user will need to take special precautions to ensure that changes to the model architecture of one region are reflected appropriately in the others.

**KEY POINTS:**

1. Interventions can be dropped, changed, or added. Each of these operations is simple, but will require careful attention to make sure that adjustments are reflected accurately in worksheet calculations.
2. Regions can be added in order to permit users to create separate cost estimates for different parts of the country, e.g. rural vs. urban, or different sub-regions. These calculations can be aggregated by pasting them into the Region Aggregator page of the master copy.

---

9 The “Paste Special” is under the “Edit” menu. Choose the function of “paste as values” to transfer resource requirements from the region-specific models to the master copy.
V. CHECKING RESULTS AND TROUBLE-SHOOTING

Checking Results

Once the user has derived results from the needs assessment model, how can s/he tell whether the results are realistic?

One way is to check the per capita resource needs against other countries where needs assessments have been conducted. Results from five low-income countries can be found in Chapter 3 of the Millennium Project *Handbook* and on page 244 of *Investing in Development*. In general, these findings suggest that annual per capita expenditures should fall within the range of $11 to $25 each year between 2005 and 2015. Of course, the actual number will depend on how far away the country is from achieving universal primary education, what target secondary transition rate is chosen, etc; but this range provides a reasonably robust basis for comparison.

Other ways to check results include reviewing per student costs, examining the path of per capita expenditures between 2006 and 2015, and running internal checks on cost drivers:

- **Per student costs.** For primary education, international comparisons suggest that per student costs typically fall within the range of $30 - $70. For secondary education, per student costs are much higher, typically no less than $120 and frequently even greater.

- **Path of per capita expenditures.** One way to check for major errors is to study the 2006-2015 path of per capita expenditures. If there are any unusual spikes or troughs, or other patterns, users may need to re-examine scale-up paths.

- **Internal checks on cost drivers.** Another way to assess results is to analyze the major drivers of total resource needs. Cross-country comparisons suggest that teacher salaries typically contribute between 30% and 45% of total costs. Capital costs typically account for between 15% and 40% of total costs, and non-salary recurrent costs typically make up between 25% and 45% of total costs. If the user finds large variances in one or more of these costs, s/he may wish to re-examine some of the unit costs, the outcome/coverage targets, or input quantity ratios and compare them to international standards to identify the source of variance.

Trouble-shooting

During the course of the needs assessment, users may also encounter a number of modeling issues and problems. Here, we discuss some of the most common and identify simple tools that may help resolve them.
Unrealistically high or low resource estimates

After comparing results to comparable estimates, the user may find that the model has produced unrealistically high or low values. A bit of detective work will be in order, moving from general to specific issues.

- Are any of the cost drivers significantly higher or lower than cross-country benchmarks?
- Are there any large spikes or troughs in the pattern of resource needs? (this might indicate a typographical error in a single year’s entry).
- Are all of the coverage and input quantity ratio targets accurate?
- Are the unit costs reasonable?
- Are recurrent and capital costs calculated correctly? (if the calculations are mixed up, based incorrectly on incremental vs. total figures, results may be unrealistically high or low).
- Are results highly sensitive to small changes in variables? If so, users should be very careful in interpreting results.

#VALUE

If the phrase “#VALUE” appears in a cell, the problem is most likely that the user has entered an inappropriate value for the variable, e.g. text in a cell that only accepts numbers. If inappropriate values are entered into cells that are used to calculate values in other cells, all the dependent cells will also display the #VALUE symbol. If confronted with this problem, the user should click on a cell where the #VALUE symbol is displayed and go to the “Tools” menu, select “Auditing,” and click on “Trace Precedents.” By following the arrows backward to the cell with the original error, the user should be able to identify and correct the problem.

#REF

If the phrase “#REF” appears, a link has been broken, most likely by deleting a precedent cell. If the #REF symbol has just appeared, go to the “Edit” menu and select “Undo,” which may bring back the deleted cell and solve the problem. If this does not help, select a cell where the #REF symbol appears and try to assess what cell might have been deleted or moved. If, for example, the cell is the sum of various infrastructure costs and there is one #REF symbol in the summation formula, it is likely that the missing cell is also an infrastructure entry. Going through this process may help the user identify and rectify the problem.

Many #REF problems can be avoided by following two simple rules. First, before deleting any cell, select it and use the Auditing function (under the “Tools” menu) to “Trace dependents.” If there are any dependents, make sure that their formulas are appropriately modified before deleting the cell.
Second, when moving cells or rows from place to place, always CUT (from the “Edit” menu) and then PASTE (also from the “Edit” menu). Never “COPY” and paste. Cutting and pasting updates all of the links; copying and pasting does not.

#DIV/0!

The “#DIV/0” symbol means that a formula involves division where the denominator is zero, yielding an undefined result. When this occurs, examine the formula and check the precedent cells to ensure that the values are correct. More often than not, the “#DIV/0” symbol appears when an entry has been accidentally deleted and used as the denominator of in a quotient formula, yielding this readily resolvable problem.

KEY POINTS:

1. Results can be checked against assessments from other countries. A reasonable range for annual per capita investment needs between 2006 and 2015 is around $11 to $25.

2. There are a number of common spreadsheet mistakes that result in error messages. Using the “Trace Precedents” auditing function can help identify and resolve some problems. Proper Excel technique can help prevent others from occurring in the first place.

3. When results appear unrealistic, backtrack and check the accuracy and plausibility of assumptions and inputs; check for technical errors; and assess the overall sensitivity of the model to small changes in key variables.
VI. OTHER RESOURCES AND FURTHER READING

There are a number of different models and resources available to inform work on modeling education costs, and we encourage users to study and absorb as many of them as possible.

Models

On the UN Millennium Project web site, users will find copies of models completed by other country teams. In particular, the modeling tools developed by the Tajikistan team are useful to understand how different countries have adapted models to local systems and circumstances. The page for needs assessment tools can be located at the following URL: http://www.unmillenniumproject.org/policy/needs03.htm

The UN Educational, Scientific and Cultural Organization (UNESCO) has also developed needs assessment tools for the Education for All (EFA) initiative. These models may also be useful to countries planning to undertake a needs assessment. Visit the UNESCO site at http://www.unesco.org

Education resources

The book A Chance for Every Child: Achieving Universal Primary Education by 2015 by Barbara Bruns et al. is a useful resource that explains some of the major issues and challenges surrounding the achievement of UPE. It is also a useful source of cross-national comparative data and information that may be helpful in determining input quantity ratios and other targets.

Toward Universal Primary Education: Investments, Incentives and Institutions, the report of the UN Millennium Project's Task Force on Education and Gender Equality, identifies cases and quality parameters from a variety of policy contexts that may be useful in determining input quantity ratios and other targets.

Needs Assessment and MDG-Based PRS Resources

The UN Millennium Project Handbook features extensive information on the process of developing MDG-based poverty reduction strategies, including needs assessments. In particular, Chapter 3 focuses on needs assessment tools and discusses education sector assessments in detail.

Investing in Development: the report of the UN Millennium Project to the UN Secretary-General, provides a general overview of MDG-based planning.