



global e-schools and communities initiative

transforming education, empowering communities, promoting development

Instruction manual for GeSCI TCO Tool V4.0.6

A framework for identifying and assessing technology options, their benefits, feasibility and total cost of ownership

VERSION 4.0.6 - JUNE 2009

Authors:

Alex Twinomugisha Alex.Twinomugisha@gesci.org and

Roxana Bassi Roxana.Bassi@gesci.org

Copyright notice



This document is provided under a Creative Commons License of Attribution-NonCommercial-ShareAlike. For more information on this license, please visit the Creative Commons website at <http://creativecommons.org/licenses/by-nc-sa/3.0/>

The latest version of this document can be found at <http://www.gesci.org>

We welcome your feedback and questions to tco.tool@gesci.org

TABLE OF CONTENTS

ABOUT THE GESCI TCO TOOLS	4
Audience of the tools	4
When to use the tools	5
Feedback.....	5
BEFORE YOU BEGIN	6
Framework for Identifying & Assessing Available ICT Options	7
Consider and choose your education objectives.....	8
Gather cost data	9
KEY FEATURES OF THE ELECTRONIC TOOL	11
USING THE GESCI TCO TOOL	13
Tool Basics	13
Structure of the tool.....	13
Introduction Sheet.....	14
Overview Sheet.....	15
Step 1	17
Step 2.....	18
Part A- ICT Platform components and deployment	20
Part B- Content and Applications	21
Part C- User Training and Support	22
Part D- Maintenance and Technical Support.....	23
Part E- Usage approach and users.....	23
Step 3.....	23
Step 4.....	26
Assumptions sheet	33
Calculations sheet	33
TCO Summary sheet.....	33
TCO Details sheet.....	34



The Grand Total Page	34
CONCLUSION	35

ABOUT THE GESCI TCO TOOLS

The electronic tools, for which this manual has been developed, are derived from a framework for identifying and assessing technology options, their benefits, feasibility and total cost of ownership (TCO) for schools.

The framework provides guidance to the user on the range of possible usage approaches, technology platform functionalities and numbers of devices required. For more information please refer to the manual “Assessing technology options for schools” published by GeSCI and available for download at <http://www.gesci.org/ict-infrastructure-connectivity-and-accessibility.html>.

The electronic TCO tool, which is the focus of this manual, comprises of the detailed TCO calculator information. It should be used to calculate the total cost of owner at the school level. A regional or national level TCO module is available as a separate tool at our website. You can download the calculator TOOL from GeSCI as well.

Audience of the tools

The electronic tools are meant to assist the decision-making process faced by local, state or national governments, individuals, and agencies that are considering the implementation of technology in schools.

The data needed for the toolkit will depend on the inputs of more than one person. We suggest that at least the following persons participate in providing the required information:

- ❖ School administrator: to define specific use of ICT in school, which educational objectives, decision on teacher training, etc.
- ❖ ICT coordinator / Network manager / IT Professional: For equipment inventory, needs, estimating costs, etc.
- ❖ School accountant: To provide data for inflation and discount rates, compare estimate cost with school budget

GeSCI makes the tools available to any educational institution, school or government planning agency that may be interested in deploying ICTs for education.

When to use the tools

GeSCI recognizes that every region or country has its own unique accounting or costing approaches. The tools are therefore not meant as a “one size fits all”, but rather as a starting point to consider alternatives among technology platforms and to develop a reasonable cost estimate.

The electronic Tool is only available offline as an excel spreadsheet. Use it if you want to calculate an accurate TCO, if you are preparing a funding proposal or if you are developing your school budget.

What this tool can not do

This electronic tool can only calculate direct costs of deploying and using ICTs in a classroom. It does not calculate indirect or opportunity costs such as costs associated with increased teacher preparation time. It also does not calculate cost increases or reductions as a result of improved or reduced efficiency. In other words, this electronic tool is an econometric model for ICTs in Education.

Feedback

If you come across a bug or want to suggest a feature refinement, please email us at tco.tool@gesci.org

BEFORE YOU BEGIN

There are three pre-requisites to using the electronic tools:

1. Read the report “A framework for identifying and assessing technology options, their benefits, feasibility and total cost of ownership” to gain an understanding of the framework used in the development of these tools (available from <http://www.gesci.org/ict-infrastructure-connectivity-and-accessibility.html>)
2. Carefully consider and decide on your desired educational objectives and subsequent deployment approaches. If you are using this electronic tool, you will also need to consider an implementation or roll out schedule that details the quantities of equipment, software and amount of training and support you will offer as part of the deployment approach.
3. Download the Excel spreadsheet that contains the tool. To fill in the spreadsheet, gather cost data necessary for the TCO calculator to work.

Framework for Identifying & Assessing Available ICT Options

As educational planners and school administrators increasingly consider ICTs for schools, they often face several problems including having to choose from a myriad of technology options. GeSCI has developed a framework that can help them in identifying and assessing the available ICT options.

The framework is based on three pillars:

1. Focus on education objectives - what you want to do with ICTs
2. Consider all the elements of the system-wide approach. ICTs do not equate to computers or hardware and software only
3. Consider short term as well as long term costs or the Total Cost of Ownership (TCO). The GeSCI TCO Tool is meant to support the development of the TCO.

The framework advocates for a systematic and iterative process to help you make the right choices, as shown in Figure 1.

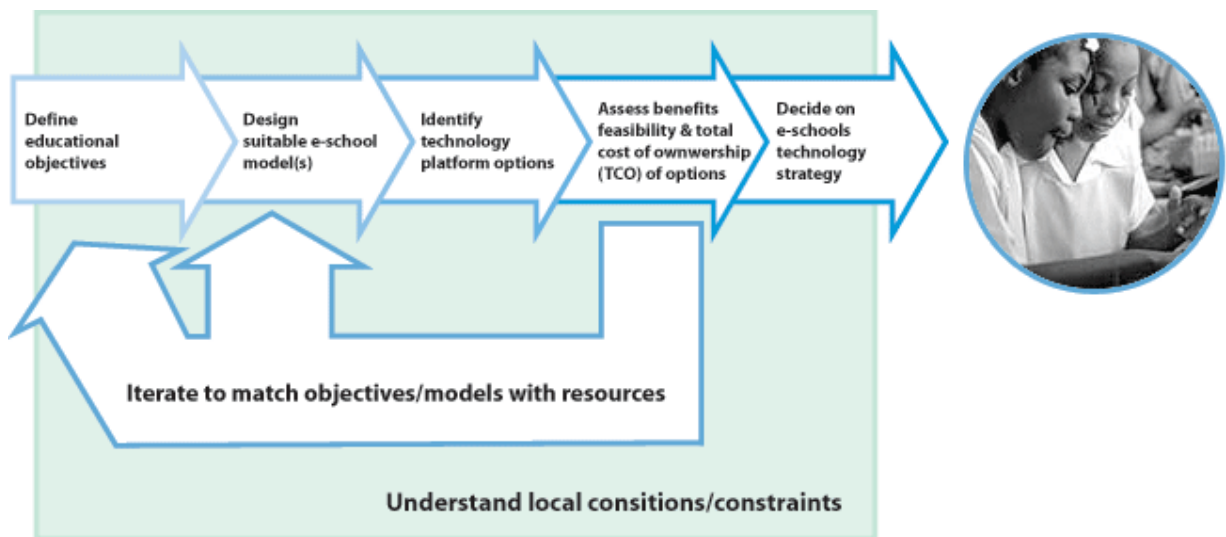


Figure 1- Framework for selecting ICT options

Consider and choose your education objectives

Educational objectives are what (should) drive any technology deployment in schools. Choosing your educational objectives is therefore the first step in forging an ICT strategy for your school(s). We have analysed many possible reasons, or objectives, that schools might want to purchase technology and arrived at 11 main educational objectives broadly classified under four main categories:

1. For administration and school management
 - Enhancing School Productivity
 - Enhancing Data Flow for Policy Making
2. For improving teaching skills
 - Developing Teacher Skills and Knowledge
 - Assisting Effective Lesson Planning
3. As a student resource
 - Accessing Information by Students
 - Improving Conceptual Understanding
 - Developing Constructivist Skills
 - Facilitating Collaboration
 - Providing Testing and Feedback
4. For developing ICT skills
 - Developing Basic ICT Skills
 - Developing Advanced ICT Skills

These educational objectives are explained in further detail in Chapter 2 of the full Report.

Once you have identified your educational objectives, the next step is to determine your deployment approach. The deployment approach is a combination of who will use the ICT and where the ICT will be used. There are 6 main deployment approaches, listed below, with more in depth explanations in Chapter 2 of the Report.

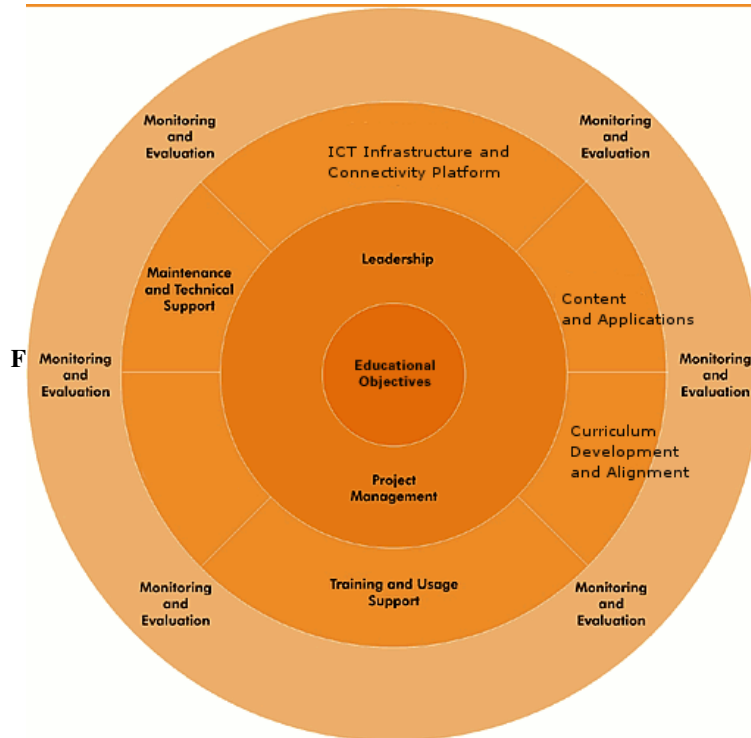
1. Teacher/Admin Office Use
2. Mobile Device Assigned to Teacher
3. A Single Device in a Classroom
4. Multiple Computers in a Classroom
5. Setup a Computer Lab
6. Multiple Computers in an open, easily accessible area

Another factor to consider when deploying ICTs is functionality- whether the ICT is interactive or not and whether it is connected to the Internet. You need

to consider the appropriate functionality in order to gain the most benefit from the deployed ICTs for any given educational objective.

GeSCI’s System wide approach

Purchasing and installing computers is not the end of the story; it is only a relatively small part of an integrated system wide analysis that requires a holistic approach to ICT planning in order to achieve the desired educational outcomes.



GeSCI has identified 5 key elements (see Figure 2) that must be considered if the deployment of ICTs is to have meaningful impact.

These components must all co-exist; none is optional and together form a system. This system involves purchasing and installing ICTs, conducting training, providing user support, technical

support and maintenance and conducting continuous assessments to ensure the educational objectives are being met. In Figure 3 below the relationship between each of the components and the educational objectives is highlighted. The system wide approach is discussed in more detail in Chapter 1 of the report.

Gather cost data

Total Cost of Ownership or TCO is the **cost of a complete system-wide analysis over the useful life of the system**. A True Total Cost of Ownership or TCO must take into account all system components.

The cost categories that comprise the calculation backbone of the software tool correspond to the different parts of this system—deployment of ICT

platform, content, user training, technical support and monitoring and reporting. The sum of each of these over a selected timeframe, usually the useful life of the ICT platform, becomes the TCO value. Furthermore, the TCO value can be divided into initial cost and ongoing cost. A detailed review of cost data is provided in the succeeding sections.

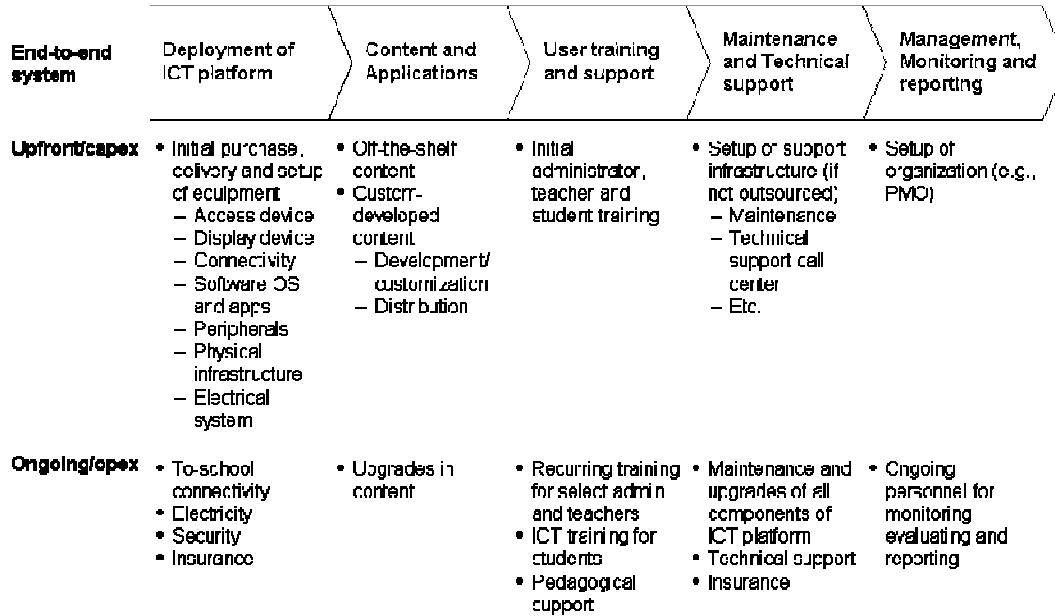


Figure 3- Initial and Ongoing costs

KEY FEATURES OF THE ELECTRONIC TOOL

The tool was built with several features in mind, which are captured below:

Considers the user's school context

- In calculating the TCO, the tool takes account of the school situation and specifically the size of the school in terms of numbers of teachers, administrators and students. This school context is important as it can influence the numbers of devices required by the school.

Provides the user with different technology and system-wide component options

- This tool asks the user to make the choice of technology bundles including choosing access devices, operating systems, peripherals, in-school connection, to-school connection and electricity backup devices.
- The tool also requires users to make choices among various options for accompanying the system-wide components such as those for content and applications, user training and support and maintenance and technical support.
- After customizing a bundle of technology options and determining the total cost of ownership, the user can change parts of the technology bundle to see if the TCO can be reduced (e.g. running the tool to determine the cost of a bundle with DSL connectivity and then running another version with dial-up connectivity for the sake of comparison).

Considers the implementation plan that the school might take

- This tool can calculate the total cost of ownership even when the implementation of the technology is done in phases—for example, when schools choose to spread their technology purchases over a number of years in order to make them more affordable. The tool achieves this by asking users to provide their planned roll-out schedule.

Allows the user to determine the device lifecycle

- The user can customize equipment replacement costs by stating how long the school intends to keep certain devices (e.g., choosing to use the same laptop for five years versus choosing to replace after three years).

Allows for inflation and discounting

- Users can input inflation and discounts rates and determine what effect this is likely to have on their TCO over a period of time.

Allows the user to change their choices

- After using the tool to determine the TCO of a particular e-school model, the user can go back to earlier steps to change variables and see how different choices can impact the total cost.

Allows the user to input additional or unique ICT options

- The tool has been developed to allow for a moderate level of customization by the user by inputting their own ICT options.

The next section discusses the data required in order to run the tool.

USING THE GESCI TCO TOOL

Tool Basics

The GeSCI TCO Tool is provided as an excel spreadsheet with protected sheets and different coloured tabs.

The tool is divided into an input and output section. You will need to collect or careful consider all the information you require for the input section before using the tools. In addition to the input and output sections, the tool has two information sheets (introduction and overview) and two hidden processing sheets (used for calculations).

Users are encouraged to use the tool by following the different sections in order of their presentation.

The tool will require you to collect and insert certain specific information about your school and project. You don't have to have this information all at once since you can start using the spreadsheet to realize exactly what you need to collect. However, the tool will not give proper results until all the required information has been inserted. And even then you can try changing certain parameters to see the results under different scenarios.

The data needed for the toolkit will depend on the inputs of more than one person. We suggest that at least the following persons participate in providing the required information:

School administrator	Specific use of ICT in school, which educational objectives, decision on teacher training, etc.
ICT coordinator	For equipment inventory, needs, estimating costs, etc.
School accountant	To provide data for inflation and discount rates, compare estimate cost with school budget

Structure of the tool

The GeSCI TCO Tool is provided as an excel spreadsheet with protected sheets and different coloured tabs.



Figure 4- GeSCI tool showing Tabs

The **information** sheets are marked by **light green tabs**:

1. **Introduction**: provides general information on the tool and a table of contents of the various sheets contained in the tool.
2. **Overview**: provides an overview of the framework used in the tool.

The **input** sheets are represented by **blue tabs** and are:

1. **Step 1**: School and context information.
2. **Step 2**: Choices of ICT platforms, types of content, training, user support and maintenance- chosen by selecting “yes” if used or leaving blank for “no” if unused.
3. **Step 3**: Deployment or roll out schedule- number of devices bought or installed and the years in which this is done.
4. **Step 4**: Costs. Information on how much different ICT, content, training, support and maintenance components cost.
5. **Assumptions**: basic assumptions based on best practices to guide the user. These values are normally left as they are, but they can be adjusted by the user.

The **output** sheets are represented by **grey tabs** and are:

1. A detailed TCO result
2. A summary TCO result
3. A qualitative benefits summary

There are also two hidden processing sheets:

1. A calculations sheet
2. A benefits data bank

Introduction Sheet

When the user first opens the tool, they will come to the Introduction Sheet . The Introduction Sheet simply provides general information on the tool and a table of contents of the various sheets contained in the tool. From the Introduction, users are strongly encouraged to read the Overview.

Overview Sheet

After the Introduction, users are strongly encouraged to read the Overview and follow the link to download the Report. When this is done you need to click the “Step 1” button to continue, which is highlighted in red in Figure 5.

Overview of Framework

Identifying & Assessing Available ICT Options

As educational planners and school administrators increasingly consider ICTs for schools, they often face several problems including having to choose from a myriad of technology options. GeSCI has developed a framework that can help them in identifying and assessing the available ICT options.

The framework is based on three pillars:

1. Focus on education objectives - what you want to do with ICTs
2. Consider all the elements of the end-to-end system. ICTs don't equate to computers only
3. Consider short term as well as long term costs

The framework advocates for a systematic and iterative process to help you make the right choices, as shown in the figure below. This electronic tool is meant to help in using the framework.

[Read Report »](#)

You are strongly encouraged to read the full report that details the framework and tool.

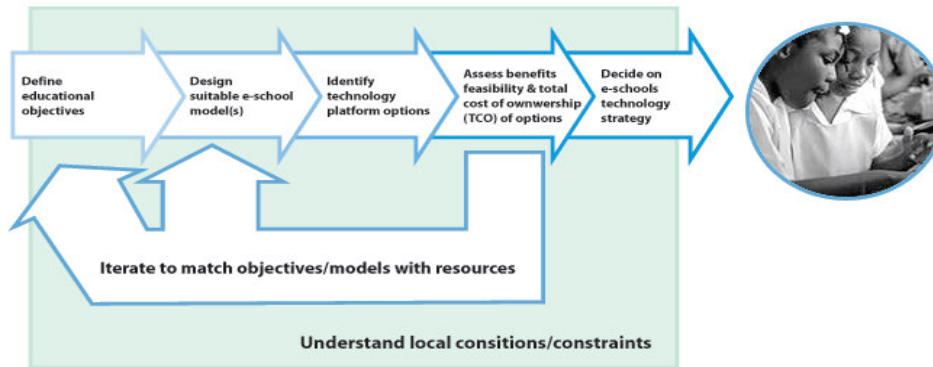


Figure 1- framework for choosing ICT options

The GeSCI end-to-end System

GeSCI has identified 5 key elements (see Figure 1) that must be considered if the deployment of ICTs is to have meaningful impact. These components must all co-exist; none is optional and together form an "end-to-end" system.

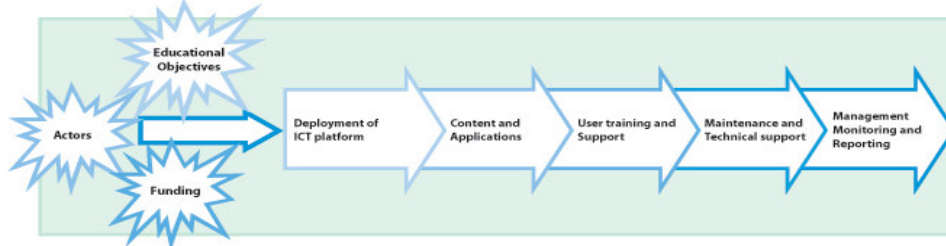


Figure 2- the end-to-end system

In order to maximize the use of this tool, it is strongly recommended that you obtain and read the report describing the framework.

[« Back to Introduction](#)

[Go to Step 1 »](#)

Proceed to Step 1 of 2

Figure 5- Overview

Step 1

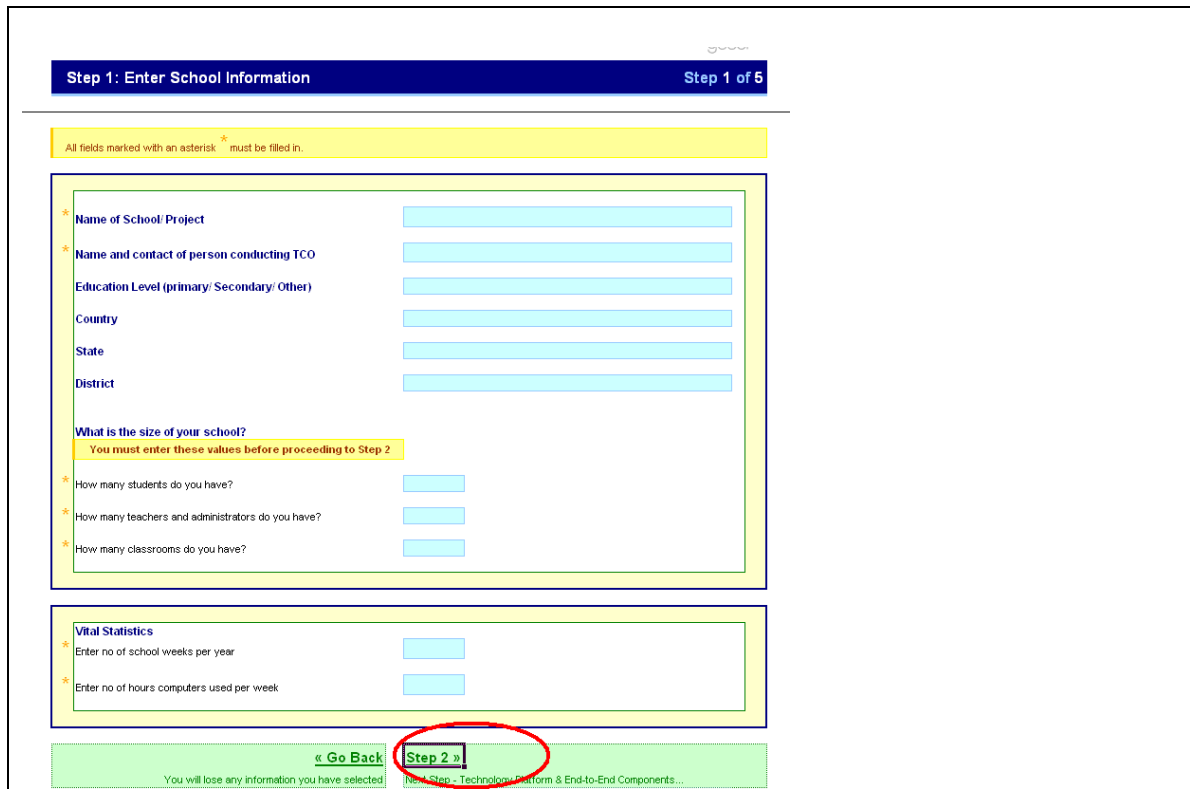
In Step 1, the user is encouraged to enter the basic information about the Educational Institution. All fields marked with an asterisk (*) must be filled in. The fields with no (*) are not mandatory and are required for general information, though they are not used in any calculations.

The institutional information needs to be entered in the spaces provided. **Information regarding the size of the school must be entered before proceeding. School size information is absolutely critical and must be entered in order for the tool to work.**

The user must complete:

- Number of students, teachers and administrators. This information will determine Access Devices and Consumables in Step 3, and calculate the average cost per student and per teacher in TCO summary
- Number of classrooms,
- Number of school weeks per year.
- Number of hours computers used per week: refers to the average number of hours in a week that a single PC is going to be used by the students and staff. For example if each machine is used 4 hours a day it is going to be 20 hours a week. Together with the previous information, this is used to calculate the amount of electricity consumed by the ICT devices.

Once this step has been completed the user needs to click on the link with “Step 2” on it, as highlighted in Figure 6.



Step 1: Enter School Information Step 1 of 5

All fields marked with an asterisk * must be filled in.

* Name of School Project

* Name and contact of person conducting TCO

Education Level (primary/ Secondary/ Other)

Country

State

District

What is the size of your school?
You must enter these values before proceeding to Step 2

* How many students do you have?

* How many teachers and administrators do you have?

* How many classrooms do you have?

Vital Statistics

* Enter no of school weeks per year

* Enter no of hours computers used per week

[« Go Back](#) [Step 2 »](#)

You will lose any information you have selected. (Next Step - Technology Platform & End-to-End Components...)

Figure 6- Step 1

Step 2

In this screen the user must select a deployment platform along with all the associated system-wide components. This section is divided into discrete parts to guide the user, as shown in Figure 7.


- Part A: Deployment of ICT Platform
- Part B: Content and Applications
- Part C: User Training and Support
- Part D: Maintenance and Technical Support
- Part E: Usage Approach and users

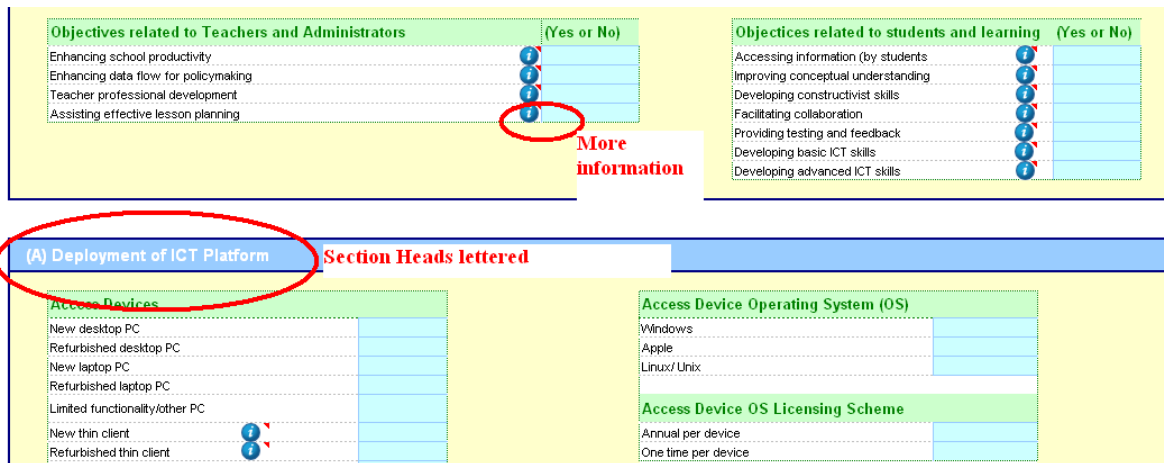
This section will require the user to choose all the components by making selections and filling cells as needed:

- **Light blue cells** allow the user to select that option. For making selections, the user has to **fill the cell with a “Yes”, or leave it blank for “No”**.

- Pre-filled cells are denoted by a **light purple color**, and cannot be changed.

Please note: Steps 3 and 4 are also organized along the same ways to allow for consistency.

Additional information available: Please note that beside some of the boxes is a “more info” tab with this small icon  (see Figure 7) which, if the pointer is hovered over it and **slightly to the left**, more information on that particular item will be displayed.



The screenshot shows two tables of objectives and a section header. The first table, 'Objectives related to Teachers and Administrators', has four rows with 'Yes or No' columns. The second table, 'Objectives related to students and learning', has six rows with 'Yes or No' columns. A red circle highlights an 'i' icon in the first table, with a red arrow pointing to a 'More information' label. Below the tables, a blue header bar contains '(A) Deployment of ICT Platform' and 'Section Heads lettered'. Below this are two more tables: 'Access Devices' and 'Access Device Operating System (OS)'. The 'Access Devices' table has rows for 'New desktop PC', 'Refurbished desktop PC', 'New laptop PC', 'Refurbished laptop PC', and 'Limited functionality/other PC'. The 'Access Device Operating System (OS)' table has rows for 'Windows', 'Apple', and 'Linux/Unix'. Below this is another table for 'Access Device OS Licensing Scheme' with rows for 'Annual per device' and 'One time per device'.

Figure 7- Step 2

Automatically completed cells

In step 2, the only automatically completed cells are for devices to be maintained under Part D. This is done to assist the user since they will have already selected whether they will use a particular device earlier (from Part A) and whether they will use external contract for maintenance.

Note also that selections under “Usage Approach and users” are used in automatic calculations in Step 3 for access device consumables.

- Access devices consumables- to determine whether to make this calculation using an IF statement in conjunction with whether the consumable is selected in Step 2 (e.g. IF diskettes selected in Step 2 AND Teachers are the primary users, THEN calculate number of consumables based on appropriate assumptions made and number of teachers who are the users in Step 1)

Choices made in Step 2 determine three events

- **Highlight input cells in following steps:** Whether the corresponding item is highlighted for input in step 3 and 4. If an item is selected by typing “yes” in step 2, then a corresponding input cell is shaded light blue in Steps 3 and 4 using a conditional format command
- **Automatic calculations in following steps:** Whether automatic calculations will be made in Step 3 for operating system licenses, consumables, network points, software licenses under content, etc. (e.g. IF Microsoft Windows were selected in Step 2 THEN automatically calculate number of Windows licenses required in Step 3)
- **Include items in the Calculation sheet:** Whether the TCO of any item will be calculated in the Calculations sheet. This avoids situations where somebody earlier entered costs and deployment schedules but forgot to delete these for a new TCO.

Part A- ICT Platform components and deployment

This involves choosing the **access devices**, **servers**, the **operating system** for both the access device and server, and whether or not **peripheral devices** or **display devices** are required.

The user is not restricted to choosing only one type of access device. Different access devices may be chosen, for example, the user may choose to give laptops to the teachers and put desktops in classes.

Along with the access device and server, the user also needs to decide on whether an **in-school and to-school network** is required. Different options are given and the user need only fill them in if they require them. The user must also consider, if an in-school network is not required, if other offline tools required, if an in-school network is not. The user also needs to **how this network will be priced** and whether a **school-wide network** is needed. If the user requires a to school network he/she needs to know how it is intended to be purchased.

The user also needs to fill in information about the **electricity infrastructure** available at the school and whether any **electrical modifications** need to be made. Finally, within the deployment section, the user needs to indicate whether any **changes to the building infrastructure** needs to be made and what security will be required.

Part B- Content and Applications

In the next section of Step 2, the user needs to enter information regarding the **type of content required**, as shown in Figure 8.

The user should take into account that the main users of the technology will be when deciding on the appropriate content, for example, if the technology is for administrative use only, then it will be necessary to acquire specialist applications, such as an accounting package. Again, more information about each of the types of content is available by placing the pointer over the “more info” button.

With regards to the **licensing scheme**, the user must decide which one is appropriate for each of the software tools:

- Option 1 if you are paying a one time fee per each one of the devices where the software is installed on.
- Option 2 if you are paying an annual fee per each one of the devices where the software is installed on.
- Option 3 if you are paying a single amount per school, independently of the number of users and devices.
- Option 4 if you are paying an annual fee per school, independently of the number of users and devices.
- In some cases licensing schemes require you to pay an initial amount and then also a yearly maintenance amount. In this case select YES in all the relevant columns.
- If you are using free software /open source you do not need to include a licensing cost, unless you want to consider some amount to be invested in adapting and maintaining the tools with your own resources.

(B) Content & Applications

Please select the educational applications and content you intend to use AS WELL AS appropriate licensing scheme. Enter yes to make selection

Content and Applications	Licensing Scheme - please choose only one licensing scheme per content or application type			
	Option 1 One time per Device	Option 2 Annual per Device	Option 3 One time per School	Option 4 Annual per School
Type of Content and Applications				
Basic Software e.g. Office				
Microsoft Office	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Apple	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Open Office	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Server Based Applications				
Email server	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<Enter name of application>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<Enter name of application>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
School Administration Applications				
Timetabling software	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Financial management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EMIS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<Enter name of application>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<Enter name of application>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Educational Applications				
Virtual labs or simulations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Assessment (test or quiz) application	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Figure 8- Part B- content and applications

Part C- User Training and Support

Under the section entitled “User Training and Support”, the user must decide how best **training** should be administered, whether it is residential and whether training is done by one person.

In relation to **user support**, the user must decide who will provide this. This is highlighted in Figure 9.

(C) User Training & Support

Please select the type of training you intend to offer AS WELL AS the appropriate approach to training you intend to take. Enter yes to make selection

User Training	Approach to Training- please choose only one approach per type of training			
	Option 1 - In School		Option 2 - Out of School	
	School or Central Education Authority contracts with individual trainer	School or Central Education Authority contracts with external firm	School or Central Education Authority contracts with external firm	Teachers pay external firm or individual trainer privately
Type of training				
Introduction to Computers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Productivity plus Internet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Specialist Applications	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pedagogical training	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

User support	(Yes or No)
Please indicate what type of user support you provide	
A regular teacher trained to provide support part time (on-site)	<input type="checkbox"/>
A special ICT teacher hired to provide support (On-site)	<input type="checkbox"/>

Figure 9- Part C- User Training and Support

Part D- Maintenance and Technical Support

Under “Maintenance and Technical Support”, the user must decide on **how maintenance will be provided** and **what type of technical support will be required** as shown in Figure 10.

(D) Maintenance & Technical Support

Maintenance and repairs <small>(Yes or No)</small>		
I have a contract with external company for all repairs	<input type="checkbox"/>	
Annual maintenance cost is assumed to set as a fixed percentage of initial purchase cost	<input type="checkbox"/>	
I have my broken equipment repaired on case by case basis by any one	<input type="checkbox"/>	

Devices to be maintained (Automatic. Change if you are absolutely sure)	External Contract <small>(Yes or No)</small>	Case by Case <small>(Yes or No)</small>
Desktop PCs, Laptops, Limited functionality PCs, thin client	<input type="checkbox"/>	<input type="checkbox"/>
Servers	<input type="checkbox"/>	<input type="checkbox"/>
PDA	<input type="checkbox"/>	<input type="checkbox"/>
Printers, Scanners	<input type="checkbox"/>	<input type="checkbox"/>
Television, DVD/VCD/VHS player, Radio	<input type="checkbox"/>	<input type="checkbox"/>
Projectors, Interactive whiteboards	<input type="checkbox"/>	<input type="checkbox"/>
Video camera, digital camera	<input type="checkbox"/>	<input type="checkbox"/>
Photocopier	<input type="checkbox"/>	<input type="checkbox"/>

Technical Support <small>(Yes or No)</small>	
A regular teacher trained to provide support part time (on-site)	<input type="checkbox"/>
A special ICT teacher hired to provide support (On-site)	<input type="checkbox"/>
A computer technician hired to provide support (On-site/ Off-site)	<input type="checkbox"/>

Figure 10- Part D- Maintenance and Technical Support

Part E- Usage approach and users

Finally, at the end of the page, the user should enter the **expected usage approach**. The user can then either click on the “Step 3” button and enter the roll out schedule or go back to the start as shown in Figure 11.

Usage Approach and users

Expected Usage Approach	Primary Users
Where do you intend to use the equipment selected? For teachers only	Who are you targeting to use the ICT?
A mobile device is assigned to the teacher	Administrators
In the classroom	Teachers
In a computer Laboratory	Students
In an open or free access space like a library	

« Go Back You will lose any information you have selected
Step 3 » Next Step - Rollout Schedule

Figure 11- End of step 2

Step 3

This sheet is used to enter the number of devices or other system-wide component items bought per year.

CONSUMABLES						
Access device consumables (Automatically calculated. You may change assumptions)						
	Year 1	Year 2	Year 3	Year 4	Year 5	
	0	0	0	0	0	
	0	0	0	0	0	
	0	0	0	0	0	
	0	0	0	0	0	
Peripheral consumables- Automatically calculated. Change from assumptions only						
Printer ink Cartridges	4	4	4	4	4	
Printer paper	12	12	12	12	12	
	0	0	0	0	0	
	0	0	0	0	0	
Display device consumables- Automatically calculated. Change from assumptions only						
	0	0	0	0	0	
	0	0	0	0	0	

Figure 13- Step 3- purple cells

Automatic calculations

Some quantities are automatically calculated especially those that are dependant on other quantities or where standard assumptions based on best practice are known. This helps the user who is not very ICT savvy. Remember that automatic calculations are only undertaken if the item is selected (“yes entered”) in Step 2. The following automatic calculations are made:

- Number of servers required:** The number of servers is the SUM of servers required for thin-clients and for fat clients. Each server type quantity is determined by dividing the total number of devices purchased (thin clients and all PC and laptop fat clients whether new or refurbished) by the number of clients to server ratio (server capacity) from the Assumptions Sheet.
- Operating system licenses:** Remember there are two types of licensing schemes: annual per device akin to an annual subscription and a one time per device license. In the former case, the number of licenses required is the SUM of all PC type devices bought or to be rolled out in Step 3 and are required every year. In the latter case, the number of licenses required is still SUM of all PC type devices bought or to be rolled out in Step 3 but are only required once whenever new devices are purchased.
- Consumables:** Consumables required are automatically calculated based on pre-defined inputs in the Assumptions Sheet which can all be changed. See above and refer to comments in the excel sheet for access device consumables. There is a special consumable here that warrants more explanation- that is the **projector lamp**. The number of projector lumps required is the SUM of any spare lamps bought with any new projector from the Assumptions Sheet and replacement lamps for projectors already

bought. The replacement lamps are calculated based on the lifecycle of a projector lamp as provided for in the Assumptions Sheet. Note carefully that the projector lifecycle in cell L53 in the Assumptions sheets can not be changed here and simply equals cell G29 from whence it can be changed. Cell L53 is simply used in the calculation of replacement rate but draws its values from cell G29.

- **In School network:** Number of network points is automatically calculated and equals the total number of devices plus number of servers plus number of printers (essentially all devices which require network connectivity)
- **Amount of electricity:** The amount of electricity consumed is given in Kilo Watt hours or KWh and is obtained from the Calculations page. The total amount of electricity consumed is the SUM of electricity consumed by each device. Consumption by each device is the PRODUCT of the power rating of the device and the amount of time the device is used.
- **Electrical modifications:** If you require to modify your electricity system, for example to add plug points or modify Circuit Breakers (CB), then the modifications are calculated for the number of devices you require to power on a per connected device basis. The total number of modifications required therefore equals the SUM of all active or devices to be powered.
- **Furniture:** The number of tables purchased equals the corresponding number of appropriate devices. For example, the number of tables for PCs equals the number of PC devices purchased.
- **Security:** The number of security guards required per school is extracted from the Assumptions Sheet and assumes 1 guard per school
- **Replacement of devices:** All devices are replaced based on their lifecycle as defined in the Assumption sheets. Lifecycle values in the Assumption sheet can be changed. The actual replacement calculations are hidden from the user (since all the user does is change lifecycle values in the assumptions) from row 336. Select “unhide rows” from the format menu to see the replacement calculations. These replacement calculations are extremely complex and should be changed unless you know exactly what you are doing.

Step 4

Step 4 is simply **cost inputs** by the user. Cells are highlighted light blue for entry of data depending on selection made in Step 2.

You can enter cost data in any currency you wish provided that you consistently use the same currency base.

The user needs go through all of Step 4 and fill in all the relevant boxes. For example, within the Technology Deployment section, along with the purchase price, the user also has to enter the delivery cost, installation cost and cost of disposal at the end of the devices life, as shown in Figure 14.

Since cost data is the most critical piece of data that the Schools or user will have to obtain prior to using the tool, a little more information is provided for each item.

(A) Technology Deployment						
unit	Capital/ One time Costs			Disposal Costs		
	Purchase price for devices	Delivery cost	Installation	Cost of disposal at end of life		
Access Device						
New desktop PC						
Refurbished desktop PC						
New laptop PC						
Refurbished laptop PC						
Limited functionality/other PC						
New thin client						
Refurbished thin client						
PDA						
Television						
Radio						
DVD/VCD/VHS player						
Servers						
New Server						
Refurbished Server						

Figure 14- Step 4- example

(A) Deployment of ICT Platforms

Access devices (e.g., Desktop PC, thin client)

- **Hardware:** The cost of access devices is the sum of the purchase price, delivery cost, installation cost and disposal cost. These are one-time costs.
- **Access devices consumables:** There are items consumed with access devices such as diskettes/CDs and even batteries for TVs and radios. These fall under access devices consumables. The consumable cost per year is calculated by estimating the number of items consumed in one year, from some basic assumptions, multiplied by the cost of one unit of the item.

Server (e.g., new server, refurbished server)

- **Hardware:** Servers are optional unless the access device chosen is a thin client.

Disposal cost is the cost of destroying the equipment once its useful life span ends. Many countries now regulate this as a cost that has to be paid either when acquiring the equipment or when throwing it away.

The cost for servers is the sum of purchase price, delivery cost, installation cost and disposal cost multiplied by the number of servers needed. In order for this tool to be dynamic, it does not ask the user the number of servers to purchase but its capacity in terms of the maximum number of PCs that can be connected to it which is entered in the Assumptions Sheet. The tool automatically determines the number of servers needed given the number of PCs in the user's technology platform, provided that the user inputs a capacity greater than zero.

Note: Server hardware is a one-time cost. The number of servers will increase as the number of PCs increases beyond the server's capacity.

Display devices (e.g., projectors, whiteboards, and televisions used for video or DVD content)

- **Hardware:** The cost of a display device is calculated in the same method as access device hardware, it is the sum of the purchase price, delivery cost and set-up cost. This is then multiplied by the number of display devices the user indicated. These are also one-time costs.
- **Display devices consumables:** Each display device consumes items when used—the bulb for the projector, batteries for TVs and marker pens for the interactive white board. The cost of the bulb for the projector is the sum of the purchase price and installation cost. This is incurred every two years, which is the estimated lifetime of a bulb (or whatever the life time you enter in the Assumptions Sheet). The consumable cost per TV or interactive whiteboard is calculated by estimating the number of items consumed for every device in one year multiplied by the cost of one unit of the item.

Peripheral devices (e.g., Printer, scanner, digital camera)

- **Hardware:** The cost of a display device is calculated in the same method as access device hardware, it is the sum of the purchase price, delivery cost and set-up cost multiplied by the quantity that the user indicated. These are also one-time costs but the equipment needs to be replaced after the lifecycle. Also it is assumed that peripheral devices are bought during the first year that the user starts to buy the access devices.
- **Peripheral devices consumables:** Peripheral consumables are calculated similar to access device consumables—estimated quantity consumed in one year per device multiplied by purchase price.

Software and applications (e.g., Windows, Linux, Microsoft office, Open office)

- **Operating system:** All interactive access devices and servers need operating systems. To compute this cost, the user should input the per PC price of the different operating systems depending on whether it is a onetime cost or if it an annual recurring cost, or both. If it is an annual cost, then the total cost for Operating System is shown under Recurring Costs in the TCO Details Sheet. One time Operating System licenses will need to be replaced as determined by their lifecycle in the Assumptions Sheet.

To-school Connection (e.g., Dial-up, broadband, VSAT)

- **Connectivity set-up:** The cost of setting up the connectivity option is the sum of the cost of all the devices needed, for example mobile phones for the mobile connectivity option, the delivery cost and installation cost. All these are on a per school basis and it is assumed that this cost will be incurred in the first year.
- **Connectivity charges:** The connectivity charge is an ongoing cost and is billed monthly.

In-Institution networking (LAN+WAN)

- **Set up Costs:** There are two approaches to determining networking costs, which apply to both WIFI and Wired LANs, and users can choose between the two methods:
 - **Cost per connected device-** the tool calculates the total cost of setting up the network as the product of cost per connected device and the total number of connected devices (assumed to be access devices plus servers plus printers).
 - **Total cost of networking equipment-** the user is asked to input the total estimated cost of setting up the network which can be based on an internal budget or estimates from providers.
- For the WAN just enter the estimated cost per room or building connected.

Utility charges

- **Electricity charges:** This is an ongoing cost that is the sum of the electricity usage of major devices (access, server, display and peripheral devices) in KWh multiplied by the price of electricity per kWh. The tool has default values for the kW consumption per device but the user can opt to modify them as needed in the Assumptions Sheet.
- **Alternate electricity source:** For areas that are not connected to the national power grid, or have an unreliable connection, the software tool allows the user to opt for generators or solar power. The cost of buying

this equipment is computed as the sum of the purchase price, delivery cost and set-up cost.

- **The price of electricity per kW** is computed differently depending on the power source. For the national power grid it is simply the price that electricity providers charge per kW. For generators the user must input the cost of fuel per litre and the number of kW that each generator can supply per litre of fuel, entered in the Assumptions Sheet. The tool automatically calculates the amount of fuel needed to provide energy for all the devices and multiplies this to the cost of fuel per litre.
- In addition to this, since the number of hours that devices run is the product of the number of school weeks and the numbers of hours the devices are used per week, it is important that the user inputs this information adequately in Step 1.
- The cost to **modify the electrical system** is the product of the cost per connected device and total number of connected devices (sum of all equipment). You can obtain the cost per device by obtaining the estimate from an engineer or the company tasked to carry out the upgrades.

Infrastructure (e.g. builds new rooms, add security, add air conditioners)

- **Construction and renovation:** Costs associated with building new computer labs, adding security measures, and upgrading the electrical system fall under this category. For new construction, the user is asked to input an average building cost per square meter. The number of square meters required is estimated from the number of square meters required per access device as entered in the Assumptions Sheet.

For renovating buildings or adding security, the user is asked to input the total cost for each room and this is multiplied by the number of rooms that the user indicated in the first step to have the total cost calculated.

- If the user would like to add an **alarm system**, this cost should also be inputted in the software tool. This is calculated as the sum of the purchase price of devices needed, the delivery cost and the set-up cost.
- **Security personnel:** The cost of hiring security personnel is an annual expense computed by multiplying the total annual compensation per person by the number of people needed.
- **Room fixtures:** The cost of putting air conditioning or curtains/blinds in the rooms is computed as the sum of purchase price, delivery cost and set-up cost multiplied by the number of units required.

- **Furniture:** The cost of buying furniture for the PCs, TVs, and other devices is included in the TCO calculation. This number is computed as the cost of purchase per unit multiplied by the number of units required.

(B) Content & Applications

Educational content is often licensed per PC or device or per school. There are four ways of costing content and applications:

- Annual cost of subscription per device where users get the latest updates at no additional cost every year but has to pay an annual fee per device
- One time license fee per device, in which case there is the issue of replacing software licenses every few years
- Annual cost of subscription per school in which a school pays a lump sum fee every year for all the licenses required
- One time license fee per school in which a school pays a one time lump sum fee for all licenses required.

(C) User training and support

Teacher and administrator training: There are four broad types of training required when deploying ICTs. These are:

- Introduction to computers- a basic beginners training course
- Productivity plus Internet- training to cover productivity applications such as word processing, spreadsheets, presentations tools and using the Internet
- Specialist Applications- training to cover special applications such as testing and assessment tools, database applications, programming tools and multimedia development tools.
- Pedagogical training- training to cover how teachers can use ICTs in teaching and learning across any subject area in the curriculum

Irrespective of the training type, you will need to consider providing initial training, which is assumed to be incurred during the first year and ongoing or refresher training. There are four approaches to conducting and costing for any one of the training types, broadly divided into training conducted within the school (In-school) and training conducted outside the school say at a hired hall or external

training centre. In all cases, the total cost of training is the cost per trainee per course multiplied by the number of trainees and the number of courses taken per trainee.

User support: The cost of having user support personnel is calculated by multiplying the total compensation of a support person by the number of people needed. Users are expected to input the number of support personnel required. The tool is also flexible enough to incorporate the possibility of having part-time user support personnel by asking users to input the percentage of time personnel offer support. It is important that the user understands this process, however, and indicates the percentages correctly.

(D) Maintenance and Technical support

If your maintenance contract is based on cost per year as percentage of total device cost, you only need to enter this value in the first cell.

Maintenance: The user can choose between having a yearly contract fee for hardware maintenance or paying as each breakdown occurs. With the first option, the user simply inputs the cost of the contract per device per year. With the second option, the user has to provide the average cost per device.

(E) Inflation Rates

Step 4 also has input for inflation rates which can be positive or negative in the case of say falling computer prices in later years. These values will be used to adjust the values of the expected costs of acquisitions, upgrades, repairs and maintenance.

After entering all the required cost information for all the system-wide components, the user can decide to either review all the assumptions used or to proceed and view a summary TCO by clicking on the appropriate links as shown in Figure 15.

Maintenance opex	Labor	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Technical support opex	Labor	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Content and applications capex	Software	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Content and applications Opex	Software	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
User training opex	Labor	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Labor inflation	Labor	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

[Review Assumptions »](#)

[Proceed to TCO Summary »](#)

Figure 15- Step 4- the end

Assumptions sheet

In order to make life easy for the user, some assumptions are made based on best practices or industry standards. These assumptions are usually about information that is highly technical or not easily found e.g. electricity consumptions rates of access devices or number of clients per server.

All assumptions can be changed by the user, but it is advised that the user not change these unless they know exactly what they are doing.

Calculations sheet

All input data from Step 1 to Step 4 is collated and captured in the Calculations sheet and it here that the TCO is actually calculated. This calculation sheet is hidden from users.

The underlying calculation of TCO is that it is PRODUCT of Total Cost of an item and quantity of items purchased.

Syntax of calculations:

IF item has been selected in Step 2, THEN calculate TCO ELSE return 0.

TCO = Quantity or amount of item purchased from Step 3 X Total cost of item from Step 4 X Inflation rate factor

TCO Summary sheet

This sheet presents a compact summary of the data in the TCO details sheet and graphs this data using a bar and pie chart.

In the TCO Summary, the TCO is broken down into the system-wide components and start up, capital expenses, replacement costs and ongoing costs. It is also displayed by system-wide component and by each year for

which the TCO is calculated. It gives the costs per student and per teacher per year and displays the TCO graphically.

To view the TCO in more detail the user should click the button at the end of TCO Summary sheet entitled “TCO details” to see more detailed information of the TCO over the period the TCO is being calculated.

TCO Details sheet

The TCO Details Sheet is a summary of the TCO for each system-wide sub component for each year as calculated in the Calculations sheet.

It draws all its data from the Calculations sheet only.

The Grand Total Page

In the case where you are satisfied with the results and want to analyze the cost of deploying a similar solution to several schools in the region, this sheet gives you the opportunity to do so very easily.

Just insert the number of schools planning to install per year under section (B) Institutional Roll out or deployment schedule.

Section (C) will show you the grand total for all institutions.

CONCLUSION

This tool has been developed to assist decision makers in estimating the Total Cost of Ownership. The tool should assist you in the decision making process along with other tools such as the GeSCI report on the framework for the selection of technology options. The tool on its own may be used for budgeting and costing but it will not, on its own assist you to make the choice between two technology options. For this the tool must be used in conjunction with the GeSCI report on the framework for the selection of technology options. We hope that you find the tool useful and productive.

We also encourage you to share you findings, cost models and of course any errors and bugs you may come across with us by sending an email to tco.tool@gesci.org. You may also modify the tool to suit your own purposes provided you acknowledge GeSCI.