

implementation handbook for

'Innovative learning in Ethiopian primary schools'

part II – the implementation

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1 Implementation structure

In order to roll-out, maintain, support and run the concept in Ethiopia a detailed action plan is mandatory. In the following a proposal for an implementation structure is given. The overall structure follows three steps

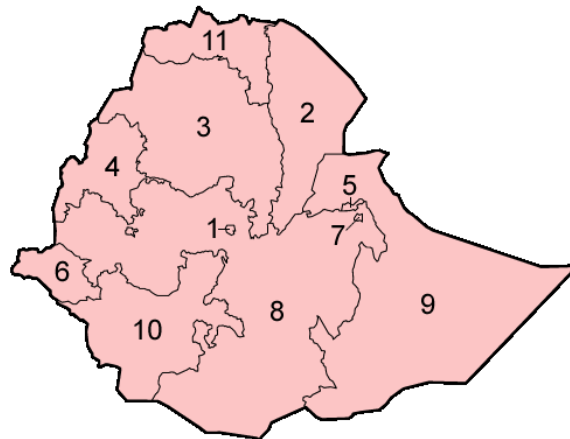
1. plan
2. build
3. run

1.1 Plan

1.1.1 Logic

According to the Ethiopian government the roll out shall consider:

- all 10 regions in Ethiopia (+2 cities)
- 1th - 8th grade in the selected schools
- 60 students per grade
- 20 teachers per school
- appr. 100 schools
- appr. 50 school Internet connections
- 1500 laptops for universities, test schools in Addis Ababa, stock



This set up is based on the assumptions that the average school has 500 pupils and that a medium sized town has 10 primary schools.

laptops will be given to 1th - 8th grade and each and every faculty members of a primary school.

With the above set up the following objectives must be achieved:

- saturation
 - the impact of saturation will be reached when all schools in one town are equipped
 - and
 - when at least 3 medium sized towns in one regions are connected
- Having said that, a minimum of 15000 laptops is needed per region to guarantee saturation
- regional, geographic and ethnic and economic diversity
- service infrastructure for future deployment
- reduced costs of connectivity
- manageable number per hub

In that context the definition for medium sized towns in Ethiopian would define Addis Abeba as a large city. Jimma, Mekelle, Bahir Dar and cities alike are defined as medium sized cities, everything smaller as a small city or village.

To achieve the above set up (10 regions) and to fulfil the objectives with the eestimated ressources at the same time, saturation in particular, it is suggested to deploy laptops to:

- 1 school in 7 regions (3500 laptops)
- 30 schools in 3 regions (45000 laptops)

The reason why saturation is so important is that

- without saturation, eLibraries can not be accessed
- without eLibraries, eBooks can not be used efficiently
- without saturation, no mesh network will be available
- without mesh network, no interaction will happen
- without interaction, no innovative learning will take place

In other words: not even the 5 Ethiopian principles can be fulfilled.

1.1.2 Testing

An initial team was formed in March 2007 in order to carry out the first olpc field-test in Ethiopia. A second test will be conducted starting in September.

1.1.2.1 Phasing

The testing is carried out in 2 phases in 2 schools (1: stand alone/technical, 2: content & context) each.

Phase 1 (B2 laptop)

- A technical test of the laptop as a stand alone solution including the Software provided with the machine
- An operational test of the laptop including content (text books, eLearning material), connectivity and optional power supply

Phase 2 (B2 & B4 laptop)

- An operational test of the laptop including teacher training and content (text books, eLearning material), connectivity and optional power supply. Test 2/Phase 2 will also include additional partners as Eduvision, GTZ, Solarkultur, bitmedia and others

Feedback from these initial tests will be used to make the laptop more child-friendly and also more considerate of any special needs in Ethiopia. Further tests can be conducted as needed.

1.1.2.2 Indicators for school environment

For the initial field test a row of indicators have been developed, which serve the goal of choosing and creating a suitable test environment. As described above, the olpc laptops are designed and should be implemented in less privileged educational and social spheres. Moreover the test period should not only reflect social and educational effects, but should

also produce feedback concerning Ethiopian specifics. This is to say, to help to identify major needs for a later roll-out in Ethiopia (software applications, hardware & network environment).

Indicators for the field test are:

- *Willingness of school director*

- *Social background of pupils*

The school has to represent pupils from less or least privileged social milieus of the city of Addis Ababa. Therefore an assessment is carried out into the number of socially deprived pupils in relation with the total number of school attendants. The school has to be socially representative (in an academic sense).

- *School size and equipment*

The school has to represent an average town school in Ethiopia. For this reason the total number of pupils (TNP) and the average number of pupils (ANP) per class has to be taken into account.

Equipment was measured through three (3) categories: *poor – limited - good*

- *School staff*

The involvement of the school staff is of an outmost importance concerning the success of the test, let alone the roll-out of the project! This is to say, that during the assessment attention should be paid to the willingness, curiosity and engagement of the staff. This regards to the safety of test environment in particular as well. This was measured at a scale of: *non-satisfactory – satisfactory - cooperative*

- *Location*

The school location should be easily accessible for the support team (see below) and for further visitors (educational experts from MoE and international organisations, etc.)

Location is depicted by the following categories: *central - remote*

The support team, composed by on.e employees (ecbp) and board members of EFOSSNET (Ethiopian Free and Open Source Network) has indicated a first set of six schools for initial visit and assessment. The schools visited were:

- Menelik II. Primary School
- Tebenja Yaji Primary School
- Kokebe Tsibah Secondary School
- Atse Naod Primary and Secondary School
- Etyiopia Tigdem Primary School (Second Cycle)
- Etsanet Berhan Primary School

The field visit to the schools took place between 15.-16.02.2007.

Menelik II. Primary and Secondary School

- TNP: no information
- ANP: 50
- social background of pupils: middle, lower class (mainly located at Arat Kilo)
- school equipment: poor
- staff: non-satisfactory
- location: central

Atse Naod Primary and Secondary School

- TNP: 1175
- ANP: 55
- social background of pupils: low/middle class (located around Arat Kilo)
- school equipment: limited
- staff: cooperative
- location: central

Tebenja Yaji Primary School

- TNP: 1393
- ANP: 55
- social background of pupils: low class (located around Debre Zeit Road)
- school equipment: poor
- staff: satisfactory
- location: remote

Etyiopia Tigdem Primary School

- TNP: 500
- ANP: 45
- social background of pupils: low class (located around Arat Kilo)
- school equipment: poor
- staff: satisfactory
- location: remote

Kokebe Tsibah Secondary School

- TNP: 2800
- ANP: 60
- social background of pupils: low class (located around Meganagna)
- school equipment: limited
- staff: satisfactory
- location: remote

Etsanet Berhan Primary School

- TNP: 1500
- ANP: 65
- social background of pupils: low class (located around Meskal Flower)
- school equipment: limited
- staff: cooperative
- location: remote

After the comparison of the above mentioned data and further discussion on according further impressions of the team members the Atse Naod Primary and Secondary School was thought to be as a good - with regards to social criteria and staff - and safe environment for a test period of six weeks. Still the final decision will be made only by the MoE or its regional office.

1.1.2.3 Field test

The first field test was implemented in a group of selected pupils. The group represented class 7 and 8 since for the moment knowledge of English is required (applications in Amharic, etc. are not yet developed). The group size is 30 pupils. The test phase is being carried out by a team consisting teachers (2) and support team members (on.e/ecbp, MoE and EFOSSNET). The entire group work will be filmed and documented.

- *Goals for the field test*
 - To create a modern learning environment (based on exploration) and foster teacher-pupil interaction
 - To test and analyze the reaction of the children
 - To test and identify needs with regard to teachers (training, additional preparation, etc.)
- *Methods*
 - Learning by doing (learning to handle basic computer applications)
 - Interactive pedagogy (focus on group work, fostering cooperation and exchange of knowledge between the pupils)
- *Hard facts about olpc B2 in support of implementation*
 - Software/Operating System
 - Installation
 - Upgrading
 - Start-up and shutdown speed
 - Tolerance of crash and malfunction
 - Types and contents of errors generated:
 - Clarity of errors
 - Appropriate errors generation
 - Application
 - Installation
 - Upgrading
 - Usability of the application within the level of the children
 - Types of available applications and their understandability and acceptance by the children
 - Level of impact on the general and specific knowledge of the children
 - Educational content
 - General knowledge
 - Internet resources
 - Graphical User Interface
 - Friendliness
 - Ease of use
 - Look and feel
 - Understandability of symbols
 - Customizability of the GUI
 - Hardware
 - Power consumption
 - Wireless communication
 - Practical ranges: direct and beyond obstacle
 - Speed of convergence: time to converge after building the mesh network
 - Visibility issues of laptops from one another and access points
 - Hardware reusability
 - Recycling
 - Maintenance

- Impact of environmental factors on hardware failure

1.1.2.4 Agenda in the operational test phase

The training agenda for in the test phase is divided in 4 steps:

1. *Teacher training*

Prior to the test period the teacher are trained in the basic applications of the olpc B2 desktop environment. The training takes 1 week and could be conducted in parallel to the student training (last week of March).

2. *Basics I (1 weeks)*

Main aim is to create an understanding for the use and opportunities offered by olpc B2 laptops among the children. Assisting staff focuses on basic applications (word processors, media creation files, networking, games, etc.) and will improve the computer literacy of the participating pupils.

3. *Advanced (2 weeks)*

This period serves the aim of systematic learning – the teachers facilitate and go through a didactic programme in order to acquire in-depth knowledge and skills concerning olpc B2.

4. *Maintenance (1 week)*

Debugging skills to maintain buttons, speakers, bunny ears, LED strip in backlight, bumpers, hinge, fuse, connectors/cables, keyboard, touchpad, battery, display, motherboard

According to the experiences out of the test schools an agenda will be developed. It will include teacher training, student training (indifferent phases: how to use the laptop, learning by learning (etoys), use of textbooks etc.).

As one of the major outcomes the agenda for the following phases would focus on teacher training mainly.

1.2 Build

Following the concept of the balanced score card the implementation of the concept in Ethiopia will focus on 4 areas which have to be managed in a balanced way:

- Teambuilding
- Kids
- Finance
- Roll Out processes

1.2.1 Teambuilding

1.2.1.1 'Steering Committee'

An inter-ministerial 'Steering Committee' will have to represent the following stakeholders:

- Ethiopian Ministry of Capacity Building (MoCB), Teferra as chairman
- Italian NGO or ministry
- Ethiopian Ministry of Education (MoE)
- Ethiopian Information Communication Technology Development Agency (EICTDA)
- olpc
- Universities, deans of selected universities
- Donor community & philanthropists
- The private sector, chamber of commerce
- The Ethiopian open-source community

The scope of the task force is both oversight and imagination. The members of the steering committee will have to sign an agreement.

The objective of the 'Steering Committee' is to:

- Insure government consensus and approvals
- Oversee the progress and performance of the execution team
- Handle any policy-related issues or needs
- Secure the required budget
- Facilitate the work of the execution team and provide them access and information when needed in all relevant areas (eg, the UN has a tremendous logistics capacity, Oxfam has outstanding relationships with regional educational administrators etc)

1.2.1.2 'eLearning Program Competence Center' (elpc²)

The eLearning Program Competence Center (elpc²) is the central unit to manage and guide the project. It will plan and carry out the various aspects of the deployment. The elpc² team will also be the coordinating body and will consist out of the following positions:

- project manager
- content & localisation manager
- logistic & distribution manager
- technical support & connectivity manager
- training & education manager
- HR admin
- 11 LTE technicians
- 54 LTE resource persons with 1) educational and 2) ICT background

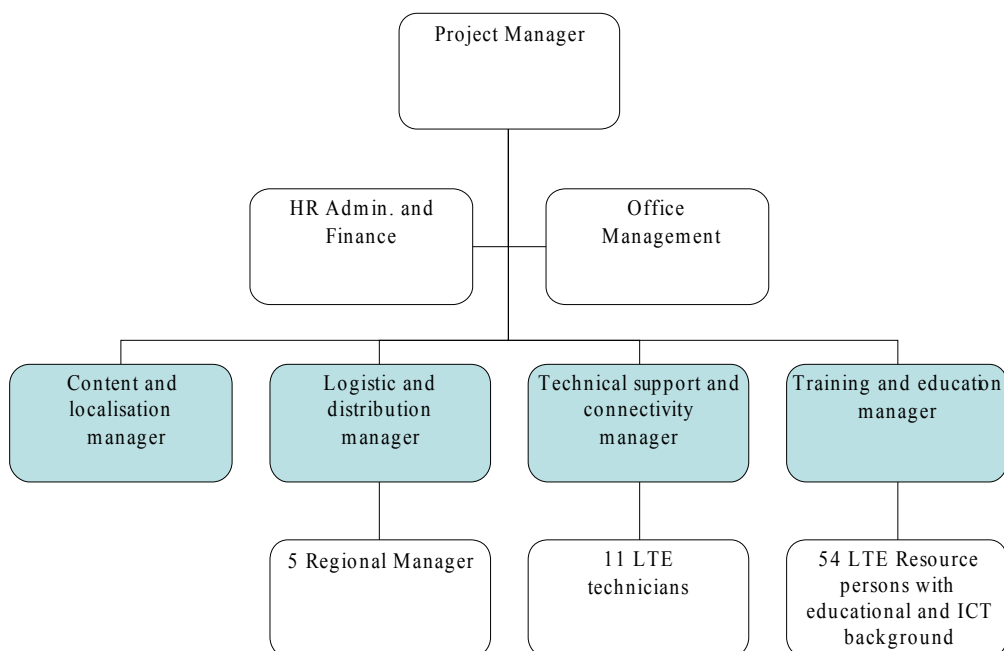
As the olpc initiative is a multi-national effort, each nation does not have to invent everything for itself. They can and should learn from each other. The 'Implementation Team' is responsible for planning, staffing and implementing the initiative. The following is a list of specific roles within the core execution team and the necessary skill sets:

- *project manager*
 - Strong understanding of ICT project management
 - International background
 - Good linkages with the Ethiopian stakeholders
 - Able to communicate in professional English
 - Able to use e-mail almost exclusively
 - Ability to travel internationally
 - Very good communication ability
- *technical support & connectivity manager*
 - Open-source development experience
 - Speaks one or more of the local languages, and has a good understanding of localization challenges
 - Established relationships with existing open source community (active participation is preferred)
 - Working experience with the Linux operating system
 - Strong understanding of IP and wireless communications
 - Experience with and knowledge of the various communication companies/organization operating in the country
 - Working experience with connectivity planning and installation a strong plus
- *training & education manager*
 - Experience with primary education

- Strong understanding, and preferably working experience, with constructivist learning
 - Knowledge of the country's educational system, including curriculum
 - Ability to locate and make available any additional information about the educational system
- *logistic & distribution manager*
 - Knowledge of the country's geography and roads
 - Shipping and customs experience a plus
 - Logistics and Coordination
- [rest to be defined]

The management team will hire the rest of the team (11 LTE technicians + 54 LTE resource persons (with 1) educational and 2) ICT background)) and form 3 sub teams that will focus on specific regions.

The team structure is shown in the graphic below. The final set up will be depending on the final number of regions.



1.2.1.3 'School Team'

In each school the roll out team will identify 2 school teachers per school as point persons.

1.2.2 Implementation of the educational concept

As described in the concept (part I of the implementation handbook), according to the Ethiopian government the implementation of the education concept shall be based on the following eLearning principles.

1.2.2.1 eBooks

The status quo in Ethiopia is that learning materials are schoolbooks, built on static text, graphs and pictures. ebooks will include films, animation and sound, but most importantly they will be interactive. To maximize a computer's potential as an educational tool, Ethiopia needs to see it as a new medium through which children can create and express themselves. Using the laptops, Ethiopian students and teachers can use computer simulations to explore the workings of ecosystems, economic systems, immune systems, and almost any other kind of system in ways that previously were not possible.

eBooks will be used for two purposes:

- as digital textbooks according to the Ethiopian curricular
- as secondary source for additional content

1.2.2.2 eLibrary

eLibraries will make available the full range of digitized content including:

- eBooks
- eLearning material
- educational Software

1.2.2.3 Direct broadcast

The Ministry of Education has implemented the so called „school.net“ project. As indicated also in the chapter „Capacity Building“ in part I of the implementation handbook, it will be considered to use this existing infrastructure to train

- students on different subjects in combination with eLearning tutorials
- teachers on laptop related topics

1.2.2.4 Interactive learning

Interactive learning is a modern learning methodology to make students more active and creative. Advanced ideas, which could not be introduced until a student reached the university level, can now be learned much earlier: when the individual student reaches out for the knowledge. The laptop can be used to either broaden and accelerate access to the existing curriculum, or transform the educational ethos from an emphasis on “things to know” to “strategies for learning the things you don't know.” In a world that changes dramatically almost daily, it is believed it is preferable to become a better learner than to focus on the multiplication of fractions, or to memorize the capitals of the world. The most important skill to master is the skill of learning new skills and concepts. “Learn to learn” is an approach that in itself has a later and powerful application: The nature of work in a globalized working environment requires future Ethiopian employees to perform increasingly complex occupational tasks. To cope with challenges, students or future employees have to be enabled to act in a flexible manner, solve problems, learn and perform independently and co-operate with others. It is becoming increasingly important to acquire action-oriented competence. Students graduating through this concept are expected to have acquired not only skills and knowledge obtained from qualifications, unit standards and curricula. But they also have key competences, such as problem solving techniques, communication skills and the ability to work in teams. One of the most important factors determining the success or failure of the approach “learning learning” is the change in the role of the teacher. It does not mean that the teacher is no longer involved. The teacher has still the important role in planning and structuring the learning process around tasks, problems and questions and he still needs to be expert. But in his new role the teacher guides the student and enables the student to discover things on his own.

1.2.2.5 Innovative learning

Distributing one laptop per child makes students more active and creative learners; and helps them master the new skills and ideas they will need for living and working in a digital society. It will give them access to knowledge that they did not have access to in the past, as well as important ideas and topics that are simply too difficult to address using only paper and pencils, textbooks and blackboards. It also will make learning elements of the traditional curriculum far more effective.

1.2.2.6 The new role of the teachers

Because of the new role of the teachers there is need to spend some time to prepare Ethiopian teachers:

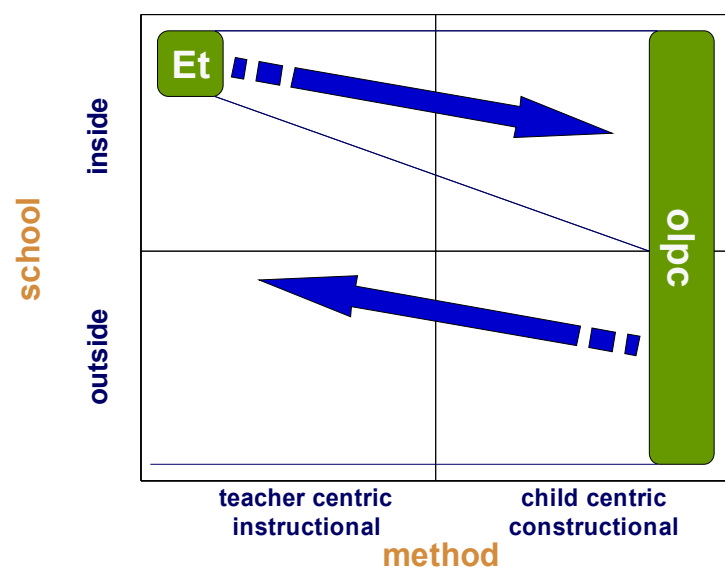
- to get along with the laptop itself and feel secure about how to use it,

- to get to know and get used to methods of teaching and learning which support the "learning learning approach" and especially use ICT in the classroom f.e. how to integrate elearning,
- to use the educational material from traditional textbooks, ebooks, websites and create their own lesson plan.

1.2.2.7 Phased integration of the educational concept

The implementation of the educational concept (as described in part I of the handbook) follows a simple strategy: Both the time children spend inside the school and the time they spend outside the school will be addressed in parallel.

Inside the school the educational concept is focussing on training the teachers on three basic levels (the laptop machine itself, learning methods and the use of content). Once the teachers are trained they will begin to pass on their knowledge to the children. This knowledge will cover the laptop machine as well as skills in media competence. As shown in the graphic this will lead today's instructional and teacher centric to a more constructional and child centric approach.



On the other side activities focussing on the children taking place outside the school will focus on collaboration projects initiated by the children themselves (on the regional level) or with the help of others (UNICEF, google, etc.) on the international level. This purely constructional and child centric approach will make its way into the Ethiopian mindset and will become a part of the school system. Both the "top-down" and the "bottom-up" approach are implemented in parallel.

Together with Ethiopian government (MoE, regional education offices and institutions for teacher training) a phased integration into the school curriculum must be specified. Important will be to have a decision on the ranking of subjects to start and to deal with.

A phased integration should take place within the classroom and outside.

Phase 1:

- Session 1: Get to know the laptop and first introduction to applications
 - Afternoon sessions with the teachers to get to know the laptops
 - Application like eToys are introduced to the teachers
- Session 2: Interactive teaching methods that support “learning to learn” and problem solved learning:
 - Teacher training on interactive teaching methods that support “learning to learn” and problem solved learning
- Session 3: How to teach with the use of ICT in general.
 - How to overcome the barriers to integrate technology
 - What does an integrated lesson plan look like
 - Where to begin

Phase 2

- laptop
 - No more training of the teacher concerning the laptop
 - Within a project day of 6 teaching lessons the students get an introduction and the laptops
 - The teachers integrate notebooks to their classrooms and within the curricula since day 1, by beginning with simple activities f.e with eToys that with time will gradually become more and more constructionist hands-on
 - The facilitators join teachers some days in the beginning in their classes to get to know the students, the dynamics, and to support them but not to take over the class
- Method training
 - When teachers are shown how to better integrate technology into their own classrooms, they become more motivated to use it, and their self-esteem increases. Teachers training on: How to teach with the use of ICT in general. How to overcome the barriers to integrate technology. What does an integrated lesson plan look like. Where to begin.
- content
 - Lesson plans as showcase for specified subjects are discussed. Digitalized textbooks and ebooks are introduced.

Phase 3

- laptop
 - laptops are used in the classroom by students and teachers within the framework of regular lessons. Students help each other in their activities and also do projects on their own, some individually, and some in collaboration with their mates. Students typically experience a paradigm shift by the end of a 4 week period

which takes them from the idea that students need computer in order to integrate technology

- Learning activities can be prepared that include activities like calendar project, “Ethiopia, past and presence”, community photo archive, interactive grammar English or a dictionary English-Amharic
- Ethiopian children must not only own the laptop, but take it home. In so doing the whole family will benefit. Outside the classroom students start to introduce own small projects to other children (in other classes, in the community, at home)
- Method training
 - Afternoon sessions with the teachers on how to integrate the new methodology to the following day's or week's class and to reflect on every day's work. Teachers collaborate with each other by talking about their activities and their results, even by coming to another teacher's classroom and participating in an activity to later adapt it to their own group
- Content
 - Teachers ask the students for homework to be done on laptop to do small projects on things students like, on their own and collaboratively

Appropriate learning activities can be found in the appendix.

Tools and guidance for the preparation and delivery of Ethiopian-specific (and other) materials (in English, Amharic, and other languages) shall be provided, including video, electronic books, PDFs, and web-based materials.

The Ministry of Education (MoE) will identify themes and topics for electronic books and instructional material for children. The enriched curricular for primary schools can only be developed in cooperation with the Ministry of Education.

The curricular has to be differed between:

- the mandatory curricular
- the optional curricular

The MoE will be asked to provide both the mandatory and the optional content to ecbb so that the content can be enriched accordingly.

1.2.2.8 Results and possibilities at the end of the phased integration

At the end of phase 3 there is a possibility for students` projects on a regional or even national level of collaboration (supported by the teachers and facilitators).

At the end of phase 3 there will be workshops on regional and national level with teachers for peer review and best practice of lesson plans. Afterwards presentation to MoE, regional education offices and institutions for teacher training will be given to spread the ideas and experiences.

The teacher-child relationship can and will benefit. With sufficient self-confidence, teachers can learn from children. Maybe there is a way to benefit: a team of one teacher and one student can visit other classes/ other schools/ other regions and share the experience.

1.2.3 Finance

1.2.3.1 Legal body

Before developing a detailed financial plan the question must be clarified which legal body is going to manage the budget. Administering will include:

- salary structure &pay roll management
- fees
- procurement

1.2.3.2 Funding

Basket Fund

The idea of establishing a Basket Fund to meet the key technical assistance and training needs for the Initiative should be discussed with all stakeholders to ensure sufficient funding for the project. The Basket Fund should be designed to be part of an innovative organisational structure to ensure the effective implementation. As part of the negotiations, a Trust Fund Manager must act for a defined period until the current capacity constraints of MoCB are overcome.

The Trust Fund Manager will be able to clarify how to ensure fiscal and administrative responsibility for the implementation with the mandate of managing the fund in an efficient

and transparent manner avoiding mis-allocations. The Trust Fund can be channelled through the Trust Fund Manager's accounts, but will be monitored by the GoE.

The Italian commitment should be channeled through a Basket Fund also.

Private Donors

The idea is to give private donors the possibility to sponsor individual children in Ethiopia. Especially the Ethiopian Diaspora around Washington seems to be willing to join this approach.

Donate one or more laptops to children in Ethiopia

Our vision is to let all 14 Mio. students in Ethiopia participate in olpc's educational concept. Imagine the potential that could be unlocked by giving every child in Ethiopia the tools they need to learn, no matter who they are, no matter where they live, no matter how little they may have. And you can be part of this exciting project.

Here you have the opportunity to donate one or more laptops to children in Ethiopia. Our target is 10.000 laptops by DATE, which will be integrated in the big roll out of 50.000 laptops next year. Donation is possible with all major credit cards.

If you like, you can contact the child which received your laptop. In addition to that your name can be published on this website.

[To donate click here](#)

You can check how many laptops already have been donated by clicking [here](#)

A website is under construction.

1.2.4 Deployment

In the launch phase, Ethiopia needs to distribute ~ fifty thousand laptops to ~ 100 schools.

Upfront the Management Team will gather information. Information gathering involves collecting data that will be used for the deployment. This data might be already available in government databases, such as number of schools, students in each school, location of schools, etc. Other data might not be recorded and will require field surveys, such as school accessibility to transportation, power and connectivity requirements, availability of storage facilities for school servers and communication equipment, etc.

In detail the roll out plan has to be developed including the following aspects:

- content
- deployment/logistic
- training

- support & maintenance
- SW distribution
- location
- connectivity
- localisation

1.2.4.1 Content in an Ethiopian context

Content today

The current textbooks used in Ethiopian schools are available in a digital form from the Ministry of Education. With relatively minor effort in terms of editing and updating the quality of this existing content can be greatly improved. Tools exist today that convert this content to formats appropriate for the olpc notebook (e.g. developed by eduvision).

In addition to this local and specific content, there are myriad of sources of quality extra-curricular content that is freely available – repositories such as Wikipedia, the Project Gutenberg Library and Wikibooks. Even more interestingly, Google, a number national libraries and universities around the world are working to digitize their collections. Volumes that are no longer under copyright protection will be freely available to all.

Content tomorrow

There are some exciting developments in the creation of new content. For example, a publisher in Addis Ababa, Shama Books, is in the process of developing high quality, localized educational content for Ethiopia. This content is developed using proven pedagogical methodologies, and is designed with modularity in mind. This allows for easy localization and curriculum-based adaptation – a noteworthy goal of the publisher.

Localisation will focus on:

- coordinating with regional educational offices
- getting regional textbooks digitized
- considering Ethiopian and / or regional context
- translating into Amharic language
- translating into other Ethiopian languages

Adaptability also allows for the fast incorporation of the latest learning theories and broad-based content. For example, students can be given the skills and knowledge needed to adapt to a constantly changing world as they lead their life.

Beyond such approved and quality-assured content, ICT tools such as the olpc notebook are an excellent catalyst for a surge in the development of Ethiopian (and other developing world countries) – based user generated content. Such content is inherently localized and relevant.

Localization and relevance are vital: ICT promotion in developing countries is generally discussed in terms of bridging the 'digital divide.' The reality, however, is that there are two divides:

- one that is based on connectivity, and access
- and a separate one that is based on content

While there are practically limitless amounts of content available on the Internet, the vast majority of it is tailored to the desires and abilities of users in developed countries. Ethiopian students will be more interested in Amharic information about their country's world-class runners than in tips on improving one's skiing ability, for example.

Distributing content

Content, in and of itself, is of little use – it requires an effective and viable means to be distributed the users that require it. Ethiopia faces a challenge in this regard. On the one hand, Ethiopia lacks the fibre-optic connections to Internet that the rest of the world takes for granted. On another, satellite connectivity is not only expensive, but simply lacking in capacity. Beyond capacity issues Ethiopia has regulatory hurdles that complicate, and at times prevent, the installation of satellite-based Internet connectivity in schools. This, in light of the reality that many rural schools are removed from access to traditional fixed-wire or cellular-telephone access to Internet, requires innovative solutions to distribute the content.

While it is inconceivable that this situation will not be remedied with time (indeed, construction is already underway for a fibre-optic network that will connect Ethiopia to the major international communication trunks), this will not happen immediately. However, there are solutions – available today – that can circumvent these problems.

Low-cost, wide-area content distribution systems exist that cover the entire of Africa and Asia. These solutions use Internet connections where available, but in the majority of cases where they are not defaults to satellite radio – provided by WorldSpace. These solutions allow the direction of content to specific users over a one-way link. Content distributed via this solution can be directed to a location as specific, for example, as a single user, to all grade five students in a given country, to all users on the system or to any combination thereof.

These broadcast systems are particularly well suited to large-scale rollouts (such as the olpc) as they have higher fixed costs than variable costs. The transmission of a textbook over the solution offered by e.g. Eduvision has operational costs of about US \$50, regardless of whether the book is destined for one user or 50 million users.

Using content

Content, and a means to distribute it, still only constitute two-thirds of a larger whole. The final third consists of tools to access and manipulate the content. The fact that a majority of the people in developed countries – despite the high (indeed, almost universal) level of ICT penetration that exists there – will readily print out a PDF document before reading it on screen, is symptomatic of the lack of software tools that can recreate the experience of paper textbook. Beyond this, there is a shortage of tools that make full use of the additional possibilities presented by technology to extend the typical concept of the book.

There are professional solutions that address this. Content viewer for textbooks and other educational content have been developed. Field trials in Ethiopia have shown that both teachers and students will readily adapt to viewing their traditional educational content electronically via appropriate software.

Professional suppliers can help make this entire process effortless:

- the original digitized textbooks are submitted electronically for format conversion
- within five minutes these same books can be available for use by students in schools
- format conversion completed and transmitted to the students in schools via the Internet or satellite radio.

In terms of content, however, this is but the beginning. With a minimal amount of work, newly developed content can be supplemented to take advantage of the full potential of ICT tools. A prototype exists that demonstrates just one such potential use – developed to take advantage of a low-cost microscope attachment developed by MIT graduate students for the olpc laptop camera. In it, a biology textbook is loaded to a section about microscopic water-based organisms that may be found in the rivers and lakes in the student's surroundings. Factual information about the organisms is displayed on the page, along with their images. Alongside that, however, is a window with a direct feed from the camera and microscope – allowing users to view and identify the organisms.

Media pro & con

Type	Form	Interactive	Multi-media	External Links	Self-learning
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Paper Textbooks	Printed material	No	No	No	No
Flexible E-textbooks	e-book	Yes	Yes	Yes	Yes
Static pdf	e-book	No	No	Yes	No
Wikipedia	Electronic Content	No	Yes	Yes	Yes
eLearning SW	Software	Yes	Yes	Yes	Yes
school.net broadcast	video	No	Yes	Yes	Yes

1.2.4.2 Logistic

The deployment philosophy follows the guiding principle of saturated communities. Clustering laptops in large, not small numbers, so the mesh network operates extensively and the initial machines serve as a learning tool.

Fifty thousand machines should reach about ~ 0.3% of Ethiopian school children. Placing those machines is key.

It is recommended to Ethiopia that it picks seven test areas with one school each and three areas with 30 schools to launch the concept. Addis Ababa will be the main place to organize the launch. It will be ideal to launch the project in one rural, one suburban and one urban region with 30 schools each. Likewise, it is also reasonable to consider some extra schools/cities where individual schools/cities have a unique value (like Rema: solar powered). This should be done, however, in a limited fashion, as it compromises the mesh network and the idea of community. Picking places with the full spectrum of socio and geo-political features will help to plan future deployment.

The site selection proposed would cover all 10 regions and and Rema as a city.

Criteria for the school selection are similar to the test school criteria but include the regional educational admin:

- saturation is possible
- school director's willingness
- shared usage of satellite dishes with other schools possible
- School staff

- Social background of pupils
- School size and equipment
- Location

Furthermore the regional teams will spend time in the region to gather data about the schools and important other information such as connectivity.

A corresponding request has been made September 6, 2007

10 containers with 50000 notebooks will be shipped from Taiwan to Addis Ababa. The next steps include the transport of the container into the regions and the site preparation. Site preparation involves:

- ensuring power
- Internet connectivity
- installation of the school server at each deployment school

This preparation must precede the distribution of the laptops. Roughly speaking, it is estimated it takes two days per site for this level of preparation. Additional action are:

- customizing the laptop
- install admin & security measures
- install local content (textbooks etc)

1.2.4.3 Training

The training of of trainers will take place on 3 different levels:

- central: train 6 high level supporters
- hub: train 58 people who wil train students and teachers, who will monitor progress, serve as repository of expertise. Included are a regional project manager, a regional content & distribution manager, a regional technical support & training manager per hub.
- remote: students and teachers are being trained

Resource persons will stay at each school for the first month period of deployment. Experience suggests that children will get more excited and involved in computing than adults. Making use of the students' involvement, Ethiopia will build a group of the most excited and talented children to provide technical and pedagogical support to their peers.

1.2.4.4 Security

The olpc security model provides protection for the children while encouraging them to be expressive with computing—they are uniformed users, with little if any experience with computing and networks. olpc will distribute keys to the school server to unlock the laptops. If a laptop is stolen before it ever gets to a school, it is useless. A “lease” mechanism provides a layer of protection against theft or sale after the laptops have been distributed. Unless a laptop is periodically re-registered with the school, it will be disabled. The details of the lease mechanism need to be discussed; in particular, how and by whom the lease mechanism is managed.

olpc is using a secure BIOS, which protects against irreversible damage to the laptop. A model of strong authentication between users guarantees an appropriate level of robustness within the mesh itself. The approach ensures that signed software will remain virus-free and that unsigned software will be safely contained.

There is an open question of the extent to which the Ministry of Education would like to control the content that the laptops can access, more so for younger than older children. One model is to have all IP access that is external to the mesh route through a portal or proxy that maintains “White Lists” and “Black Lists.” But at some level, the children will have to learn to use their own judgment as to what content is appropriate—this is another aspect of their learning. Thus, the degree to which authority is distributed is a subject for discussion.

1.2.4.5 Support & Maintenance

Support & maintenance will take place on 3 different levels:

- central: 6 high level supporters (same as for training)
- hub: 1 (the regional techn support & training manager) + community
- remote: rest + local GTZ + local organically grown support

The laptop is designed to be robust in light of the conditions in which they will be used. The three most common points of failure for laptop computers have been eliminated: there are no internal connectors to break; there is no hard disk to crash; the backlight is redundant and easily (and inexpensively) replaced. To facilitate software upgrades, they will be done automatically through the school server and will be transparent to teachers and children. The server will also be used for per-child local backup storage. Additional back-up storage will be provided over the Internet by Google (and others) providing free data-storage resources. Also note that children can share the memory on their laptops. So, even though the current laptop has half a gigabyte of flash memory, 20 children in a classroom effectively have 10

gigabytes. There still will be the need for some maintenance: things break; things go wrong. The experience of working with children and computing shows that children themselves will provide much of the maintenance. This represents yet another opportunity for learning within the school community.

On the other side supplemental maintenance will be provided by the same entrepreneurs who run local electronics and TV/PC repair shops, etc. The need for a centralized maintenance program will be minimal but essential. But there is no dependency on international corporations for software and hardware maintenance—it is purely an Ethiopian business. Self sufficiency is the goal.

The leading causes of hardware failure have been addressed in laptop design. The leading causes of hardware failure are hard-disk failure and dropping. laptop has no hard disk, survives 5 foot drop, a backlight that can be replaced for \$2 + 2 screws, 4X the battery lifetime, spill resistant keyboard and touchpad, no fan, has a reduced number of connectors and can be carried in the pouring rain.

The first line repair team is a group of youths or young adults that will be identified by the regional implementation team in each site. These people will be trained by the regional implementation team and will remain in village afterwards. With their debugging skills, and just screwdrivers they can perform the first line of maintenance and change any failed parts.

Most parts that might break are inexpensive and can be easily replaced:

- ~\$1 or Less: buttons, speakers, bunny ears, LED strip in backlight, bumpers, hinge, fuse, connectors/cables
- ~\$5 or less: keyboard, touchpad
- ~\$10 or less: battery
- ~\$50 or less: display, motherboard

While the motherboard and display can be directly replaced in village, these parts can be sent to the regional hub repair facility for refurbishment and reuse.

Neither the Operating System nor the Activities can fail. Both are mounted as read-only. In the operating system, there is an overlay for changed files which can be deleted. What could fail, and the remedy outlined below:

- Kernel attack: gateway mode can be broken, but trusted upgrades can still be used to fix
- Trusted Upgrade system is attacked: This system is hard to break (The Microsoft system has never been broken). Can be restored to a known good system with a USB key

- Bugs in IP table, IPV61: Fix usual way
- Backups: Automatic, but not infallible - These fail in developed world too
- Losing backups through theft of server or disc: Google Gmail 2 Gbyte backup
- Denial of Service attack on a country infrastructure: Stop everything dead, resolve as is currently done in developed world
- BIOS2: A key to determine if the new BIOS can be trusted. With a developer key (a child must apply for this) Everything can break – but one can restore to a known good system

1.2.4.6 SW distribution

Content & SW distribution will be organized within the 3 level concept:

- central: 1 content manager
- hub: 1 regional content & distribution manager
- remote: 2 appointed teacher

The laptop comes preloaded with free and legal software tools for exploring knowledge:

- Web browser
- Electronic-book reader
- Multimedia player
- Games
- Word processing
- Graphics tools
- Software programming environments
- Music composition
- Video capture and editing
- Email
- Chat
- Voice-over-IP
- built-in journal
- etc.

This is not an exhaustive list of the software that can run on the laptop: essentially any Linux program can be run with little or no modification. It is a general purpose laptop, not a limited special purpose machine. However, it is recommended that software, where possible, be tuned to the user interface and the needs of children learning. Engaging the Ethiopian and international open-source communities in this process is an important development opportunity. Please note that Microsoft is also putting Windows on this machine at this time.

The school servers—and the laptops themselves—are intended to provide storage for common reference materials and community generated materials. The community is preparing some artifacts for basic literacy, language skills, mathematics, science, and the arts. However, olpc will not provide curricula or instructional materials; this is the objective of the Ethiopian Ministry of Education.

In general, migrating legacy material to the laptops should require minimal effort and new materials generated for the laptops will port to legacy systems. Ethiopia should be encouraged to participate in an open exchange with other olpc launch countries—Libya, Nigeria, et al.— to share best practices.

1.2.4.7 Location

Office space for elpc² (management team 6 people, 3.level supports 6 people) must be found and rented .

On the regional level it is recommended to cooperate with universities to find sufficient office space.

1.2.4.8 Connectivity

It is planned to identify a pro bono telecom company to connect the school servers to the internet. However, connecting the mesh network (see also annex) to the national Internet backbone is a critical component of the olpc program to provide low-cost connectivity among children, to both their teachers, and to the Internet at large.

Therefore a utilization of the existing Ethiopian network such as woreda.net and school.net must be examined carefully as mentioned before.

The mesh network—802.11s—provides free, robust wireless connectivity between laptops within the community around each school. The typical mesh connection will be between 200 and 1000+ children. (Some meshes may be small, due to the small number of children in a remote village.)

At least one connection node in every mesh is the “\$100 SchoolServer” or alike, which provides a router/gateway for the school's Internet connection and manages the IP address space within the schools. (When desirable, it can be used to segment wireless mesh traffic into multiple channels.) Other functionality of the school server is to provide end-to-end IPv6

connectivity between schools through tunnels over IPv4 clouds and Zeroconf service-discovery support. The School Server also provides low-cost, point-to-point and point-to-multi-point wide-area links between schools. This can be done through terrestrial wireless links, such as WiFi, or WiMax. Regardless of the choice of technology, one step in the deployment process is to make sure that there is a connected School Server up and running before the laptops arrive. This task is much less daunting than imagined. The School Servers themselves also form a mesh network that enables groups of schools to share the cost of Internet connectivity. The School Server is designed for flexible interconnect: to an optional satellite up-link, fiber, DSL, cellular packet, etc.

1.3 Run

One laptop per child in Ethiopia. Ethiopia has roughly 17 Mio children in school. The vision of the project is to be a milestone in providing all children in Ethiopia with notebooks.

1.3.1 Indicators

In order to measure the process, especially the educational impact, success indicators must be developed. These indicators must cover the:

- educational impact: observations should be made taking into account individual students as well as groups of two or more students.
 - acquisition and application of knowledge
 - development of skills
 - learning strategies
 - attitudes
- laptop: once in the hands of the children and teachers, several overlapping factors could be studied, such as
 - software
 - specific content
 - applications
 - user-friendliness
 - manageability
 - stability
 - resistance

- ☐ size
- ☐ weight
- teachers
 - ☐ knowledge of constructionist learning
 - ☐ knowledge of project based collaborative activities
 - ☐ their application during class work
 - ☐ laptop acceptance
 - ☐ appropriation
 - ☐ creativity
 - ☐ exploitation
 - ☐ are learning strategies and attitudes fostered
 - ☐ core concepts involved in the learning experiences of their students
 - curricular
 - extracurricular
- Other
 - ☐ applied learning
 - ☐ community involvement
 - ☐ community development
 - ☐ project collaboration
 - in-country
 - multi-country
 - ☐ awareness
 - ☐ global vision
 - ☐ local vision

Care must be taken so observation, measurement, and the study of indicators does not interfere with, ill-dispose, or negatively affect the teachers and students. Formal, objective, official, and exhaustive evaluation aims, policies, and procedures can be counterproductive to the objectives of many educational or developmental projects. Non-obtrusive sampling, surveying, and other techniques should be utilized.