

Education for All in Sri Lanka -

ICT4D Hubs for Region-wide Dissemination of Blended Learning

Peter Mozelius

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Education for All in Sri Lanka

ICT4D Hubs for Region-Wide Dissemination of Blended Learning

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*To Chalani, may your children's
life be better than your parents'.*

Abstract

ICT4D, here defined as the use of Information and Communication Technologies (ICT) in developing regions, can be seen as one of the most powerful and cost efficient ways to improve the standard of living in the developing world. Many regions in Asia have shown a rapid but heterogeneous development where information technology had a drastic impact on development but often with the problems related to ICT4D 1.0: lack of sustainability and lack of scalability.

This study analysed the Sri Lankan infrastructure for region-wide dissemination of blended learning in the 21st century based on the exploration of some selected ICT4D hubs and educational initiatives. The overall aim of the research was to observe, describe and analyse how the selected ICT4D initiatives and the creation of ICT4D hubs in Sri Lanka might support region-wide dissemination of blended learning and local development. A longitudinal case study has been the overall approach where a number of embedded thematic units were explored in long-term fieldwork conducted between 2006 and 2012. Data has been collected from a combination of observations, interviews, group discussions, surveys and document analysis.

Findings showed that several of the studied ICT4D hubs have contributed to the general development but the country's internal digital divide has in fact grown, as urban growth has been so much faster than the growth in rural areas, leaving the country with geographic as well as socio-economic gaps. Some of the former war zones have definitely been left behind and there is a need for further support of the Eastern and Northern regions of the island. Sri Lanka has had an outcome that must be classified as better than average compared to other developing regions with increased opportunities for education and with some ICT4D hubs as multipurpose meeting points. Contributing factors to the successful development are the high literacy rate, the chain of ICT4D projects rolled out in the right order and a committed implementation of educational eServices. On the other hand there were other, more negative findings indicating that sustainability, knowledge sharing and inter-project cooperation and coordination have often failed.

The identified strength in the Sri Lankan model, which can be recommended for other parts of the world as well, is the way top-down management of infrastructure sometimes is combined with bottom-up grass-root activities. Other recommendations, that also are global, are to extend existing ICT4D hubs and upgrade them to more intelligent, autonomous and multi-service ICT4D routers that could also handle the future need for eServices in the fields of eHealth, eFarming and eGovernance.

Keywords: ICT4D, ICT4D hubs, Digital divide, Sri Lanka, Blended learning, Education for All

Sammanfattning

ICT4D/ IKT för Utveckling, som i denna avhandling definieras som användandet av information- och kommunikationsteknologi (IKT) som stöd för utveckling, ses av många som ett av de mer effektiva sätten att förbättra levnadsstandarden i utvecklingsregioner. Många regioner i Asien har, precis som Sri Lanka, haft en snabb men heterogen utveckling där användandet av IKT på ett märkbart sätt har påskyndat utveckling och globalisering i storstadsområden men ofta med de problem för skalbarhet och långsiktig hållbarhet som förknippas med ICT4D 1.0.

Denna avhandling har undersökt den Sri Lankesiska ICT4D-designen i det tjugoförsta århundradet genom att utforska några utvalda IKT-baserade ICT4D-nav/ICT4D hubs där den gemensamma nämnaren är blandat lärande/blended learning. Den övergripande forskningsstrategin var en longitudinell fallstudie där ett antal inbäddade tematiska enheter utforskades i fältstudier mellan 2006 och 2012. Studiens målsättning har varit att observera, analysera samt beskriva hur ett antal undervisningsprojekt och ICT4D-nav har bidragit till den regionala spridningen av blandat lärande och lokal utveckling.

Resultaten av studien visade att ett flertal av de undersökta utbildningsinitiativen har bidragit till den allmänna utveckling men att detta främst gäller Sri Lankas storstadsområden i landets sydvästra delar och att landets norra och östra delar har behov av ytterligare stöd. Sri Lankas IKT-stödda utveckling uppvisar resultat som måste klassas som bättre än genomsnittet i jämförelse med andra utvecklingsregioner, med ökade möjligheter till utbildning och med ett flertal IKT-baserade utbildningsnav som multifunktionella mötesplatser. Viktiga bidragande orsaker till utvecklingen var den låga graden av analfabetism, en delvis planerad kedja av biståndsprojekt, samt ett hängivet arbete på gräsrotsnivå med implementationen av e-tjänster. Flera av de studerade initiativen och ICT4D-naven har bidragit till utveckling, men att den interna skillnaden mellan storstad och landsbygd har ökat samt att samordning av utbildningsresurser och projekt inte har lyckats särskilt väl.

Den identifierade styrkan i landets utvecklingsmodell, som också rekommenderas för andra utvecklingsområden, är hur vissa centralstyrda IKT- och utbildningsprojekt har kombinerats med lyckade lokala gräsrotsaktiviteter. Vidare rekommendationer, som även de är avsedda för andra delar av världen än Sri Lanka, är att behålla existerande ICT4D-nav men att upprusta dessa till mer intelligenta, autonoma och serviceorienterade centra som även innefattar e-tjänster inom e-hälsa (eHealth), e-jordbruk (eFarming) samt e-förvaltning (eGovernance).

Nyckelord: ICT4D, ICT4D-nav, Sri Lanka, Blandat lärande, Digitala klyftor, Utbildning för alla

Acknowledgement

Many thanks to all my Sri Lankan friends and collaborators, without whose help this thesis would have been impossible to write. Our discussions have been an important part of the analysis process and without your company I would never have found the way to some of the remote ICT4D hubs that are described in the study. There will probably be no more Swedish initiated aid projects in Sri Lanka in the fields of ICT and eLearning, but what is an interesting future challenge is to keep the sometimes successful collaboration alive without any funding. That would be real sustainability. One idea would be to keep the ICTer conference (ICTer, 2014) as an annual meeting point with discussions between Swedish and Asian researchers. Due to my teaching I will probably not be able to participate in ICTer but as a member of the ICTer review team I will share ideas and discussions.

Furthermore, I want to express my appreciation for the opportunity to participate in the European Union funded AsiaLink eBIT project and the Sida funded NeLC project. Without the relatively successful outcome of the eBIT project I would never have written a thesis on this subject and several of the main ideas in the thesis are the result of discussions with, Swedish, Dutch and Sri Lankan colleagues in these projects. As an example, seven out of nine co-authors in the compiled articles have in some way been active in the eBIT and NeLC projects.

Finally I must thank the supervisor team for your iterative and constructive feedback all through the process. Not all supervisors will, like Henrik Hansson join field trips on the other side of the globe. Not all co-supervisors will read a messy prototype kappa as carefully as Anders G. Nilsson, and with a smile, explain the important structural changes that make a messy prototype a decent thesis. I am also very grateful for the thoroughly and committed pre-doc revision done by Devinder Thapa. Thank you Thapa, it was beyond all expectations! I would also like to thank Thashmee Karunaratne and Ranil Peiris for your proofreading and useful comments on Sri Lankan details.

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Abbreviations

BIT Bachelor of Information Technology

CD Content Developer

DEMP The Distance Education Modernisation Project

eBIT The updated online version of BIT

EFA Education for All

ICT Information and Communication Technologies

ICTA The Sri Lankan Information and Communication Agency

ICT4D Information and Communication Technologies for Development

ICT4D Hub An ICT-based centre for transmission of useful information

ID Instructional Designer

LMS Learning Management System

LOR Learning Object Repository

NeLC The National eLearning Centre created at UCSC

NODE National Online Distance Education

OER Open Educational Resources

OLPC One Laptop Per Child

OUSL Open University of Sri Lanka

SME Subject Matter Expert

UCSC University of Colombo, School of Computing

VLE Virtual Learning Environment

1. Introduction

In 2005 during my first visit to Sri Lanka in the inception phase of the AsiaLink/eBIT project I was invited to a dinner given by the Swedish -Sri Lankan Friendship Association. Just by chance I was seated next to the then chairman of the association, the late Professor Vidya Jyothi V.K. Samaranayake. Eating his wife's homemade string hoppers I presented myself and explained why I wanted to participate in the eBIT project and when we were waiting for the dessert Prof Sam said to me: "*I think you're lucky, there will be a lot of interesting things happening here during the coming decade*".

And as so very often, the father of Sri Lankan IT was right; so many things have happened that it is difficult to sort everything out in a thesis like this. It has been an interesting journey during these years, with so many exciting things happening but also with two very hard blows, the death of Professor Samaranayake in 2007 and the death of my father in 2008 - the two persons that I really would have liked to discuss this thesis with.

1.1 Background

More than ever before the welfare of nations and regions is closely linked to the quality and outreach of their educational systems and institutions. In UNESCO's plan, *Education for All* the goals should be implemented by 2015 (UNESCO, 2010). In Sri Lanka UNESCO goals like free and compulsory primary school for boys and girls, and a generally high literacy rate were already achieved many years ago. However, the country is still not developed and when it comes to issues like inclusion, access to higher education and local language adaptation they could still best be described as work in progress. ICT4D can be defined as the use of Information and Communication Technologies (ICT) to stimulate progress and growth in economic, social and political aspects. The use of ICT is seen as one of the most powerful and least expensive tools for infrastructure changes and dissemination of education in regions with a shortage of teachers. The D in ICT4D is for development and has several different definitions. This research will often

emphasise development defined as: *Positive changes in people's everyday life where the use of ICT facilitates daily life situations*. More than looking at only economic growth and GDP the development analysis has a focus on capacity building and human centred development as Amartya Sen (1999) and Tim Unwin (2009) define development.

Many regions in Asia have had a rapid but heterogeneous development, where information technology has sometimes made drastic changes to urban regions but often had no impact at all on rural areas. In Sri Lanka, the *internal digital divide* is not as obvious as in neighbouring states like India and Bangladesh. The term internal digital divide will in this thesis have two different aspects and both of them have been defined earlier by other ICT4D researchers. The first aspect is *the geographic divide* between the urban and rural areas (Simba, 2004), the second is the *socio-economic divide* between the educated and relatively affluent groups with access to computers and the Internet and the less privileged citizens (James, 2003).

Government-supported initiatives like the Nenasala telecentre project (Nenasala, 2010) have been started with the purpose of bridging the internal gap and act as a support structure in poor rural regions (Gaiani et al., 2009b). In the same manner, the Sri Lankan *One-to-one computing* project for primary schools has an island-wide structure and a strategy for the translation of content into local languages. The Sri Lankan government has the aim to transform to a knowledge society, but access to tertiary education is still constrained by several bottlenecks (Warnapala, 2009).

Over the years, a lot of aid projects have been started in Sri Lanka with funding from several countries and around the millennium shift the country was the world's leading aid recipient per capita (Arunatilake et al., 2001). ICT has often been the main tool in the 21st century's development projects in this region. Aid projects were started and run with partners from all over the world with a variety of aims. In this thesis there is a focus on the Dutch/Swedish/Sri Lankan European Union (EU) funded eBIT project (Wikramanayake et al., 2007) and the Swedish/Sri Lankan NeLC project (NeLC, 2012) with initial funding from the Swedish International Development Cooperation Agency (Sida). The interesting common denominator in these two projects is that they have both had the aim of designing, developing and publishing more efficient, economic and scalable eLearning in the external bachelor degree in information technology (eBIT) at the University of Colombo's School of Computing (UCSC) in Sri Lanka. Since the start of the eBIT programme, several changes have been made both in the use of IT and in pedagogy (Wikramanayake et al., 2007). The digital content of courses in the region-wide eBIT and Foundation of Information Technology (FIT) programmes has been developed rapidly and with cost-efficiency in what could be described as a *Conveyor Belt Model* (Mozelius and Hatakka, 2009). The inception phase in the building of a national eLearning centre at the University of Colombo, School of Computing (UCSC) was successful but also cre-

ated new challenges about classification, storage and quality assurance of digital learning objects (Hettiarachchi et al, 2009).

Research on ICT4D is still a young phenomenon and few studies have been conducted in Sri Lankan contexts. Most initiatives described in this thesis have made an impact on society and people's daily lives. Aid projects are evaluated and initiatives often have their own web portals, but there is seldom any analysis of the relations between the different ICT4D initiatives in the country. This study will have a focus on some selected Sri Lankan ICT4D hubs and their alignment or lack of alignment. ICT4D hubs can briefly be described as hubs for transmission of knowledge and educational content in a developing region. ICT4D hubs should be seen as polymorphic entities that can have actual as well as virtual implementations. Examples of actual ICT4D hubs are schools and telecentres, while examples of virtual ICT4D hubs are online learning object repositories and digital learning environments. A more detailed explanation of the ICT4D hub concept is given in section 2.7.

1.2 Aim and Research Questions

The overall aim of the research is to observe, describe, analyse and discuss how the selected ICT4D initiatives and the creation of ICT4D hubs in Sri Lanka might have supported the region-wide dissemination of blended learning and local development. Important research questions to answer are:

- 1 What are the main obstacles in the region-wide dissemination of blended learning in Sri Lanka?
- 2 How should ICT4D hubs be designed to support the region-wide dissemination of eLearning, content and knowledge sharing?
- 3 In what ways can the access to higher education be increased by technology enhanced online education and the creation of ICT4D hubs?
- 4 How could ICT4D hubs support inclusion, equal rights and access for everyone in Sri Lanka and reach people in rural areas?

1.3 Research Articles

This thesis is a compilation of eight separate articles presented in journals and at research conferences between 2008 and 2012. In the four journal articles and four conference presentations the author is the initiator and the main contributor, except for Article 3, which is a 50–50% collaboration. ICT4D is a complex domain and it has been a privilege to collaborate with people who

have special knowledge in the studied domains. The idea has also been to have Sri Lankan details cross-checked by native Sri Lankans.

All the journal articles are published in open access journals where my colleagues and friends in Sri Lanka should be able to access and read them without any fee. The journal articles were first presented at conferences where ICT4D was a conference topic, and were later rewritten and extended to journal versions. There is no linear precedence order of the articles in the thesis, but in a top-down perspective from a global analysis down to local contexts and methodology level, the articles can be related as shown in Figure 1. How the articles are aligned with core categories and concepts in the study is described in section 1.5, where the conceptual framework is also graphically illustrated in Figure 3.

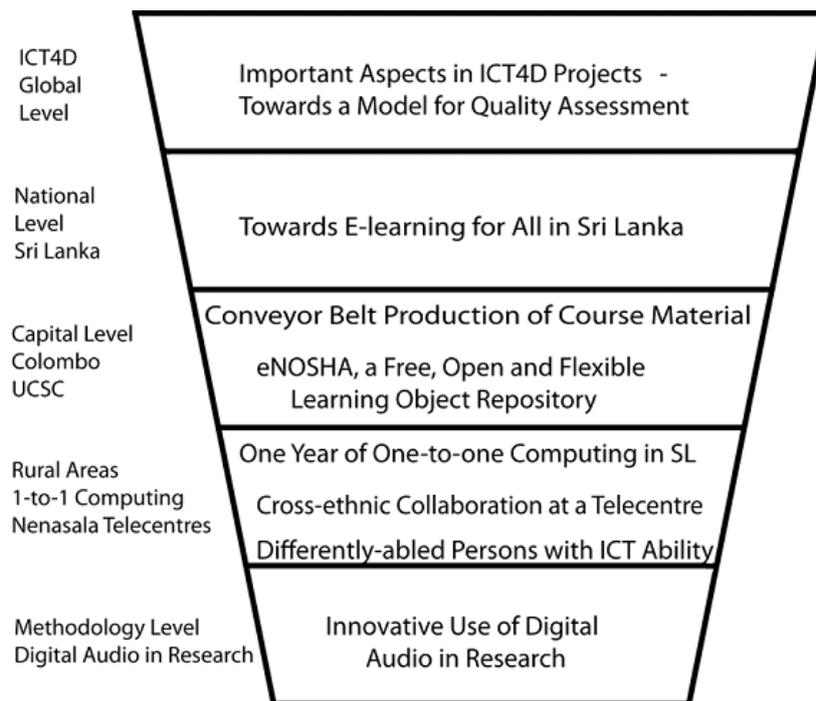


Figure 1: The compiled articles' top-down alignment

Article Details

Article 1: An early journal paper on general ideas in ICT4D projects that I wrote together with colleagues from the Department of Computer and Systems Sciences at the Stockholm University. The aim was to get a global per-

spective of important and general issues in ICT4D. My part of the total amount of work was around **40%**.

Article 2: Conference paper written together with the Head of the National eLearning Centre at UCSC. The aim was to describe the strengths and weaknesses of the studied ICT initiatives that are important parts of this thesis. My part of the analysis and writing was around **65%**.

Article 3: Conference paper for the ICT4D track in the ECEL conference written together with a colleague in the eBit and NeLC projects. The article was a 50–**50%** collaboration where we have assessed the strengths, weaknesses, opportunities and threats of the UCSC model for digital learning content development.

Article 4: A journal article that is a compilation of five earlier articles on various aspects of the learning object repository that was designed in the AsiaLink/eBIT project and was later implemented as part of the NeLC project. My contribution to this article is around **75%**.

Article 5: Journal article on Sri Lankan one-to-one computing, where two of Sri Lanka's leading researchers in the domain have checked the accuracy in detail and helped out with translation from the Tamil and Sinhala languages. Most of the work is my own and my part is around **90%**.

Article 6: Conference article on the study of telecentres and the possibilities for inclusion of people with disabilities in rural regions, written together with a local telecentre grass-roots activist. He checked details and helped out with translation from local languages. My part of the work is around **90%**.

Article 7: A journal paper that is a complement to Article 6 but also has a focus on various ethnic groups in Sri Lanka and their opportunities and obstacles for collaboration through ICT and eLearning. My part of the work is around **90%**.

Article 8: This is a kind of method paper where digital audio recordings of interviews were discussed. My part of the work was around **60%**.

Article Abstracts and Presentation Fora

Article 1: Mozelius, P., Hansson, H., Kahigi, E., Ekenberg, L. (2009). Important aspects in ICT4D projects – towards a model for quality assessment, *UNAD Revista de Investigaciones*, Bogotá, Colombia.
<http://www.unad.edu.co/revistainvestigacion/>

One aim in the first article for the more long-term study was to compare the author's experience in the AsiaLink/eBIT project with lessons learned from other ICT4D projects in other countries. What is global and what is specific in the Sri Lankan context? As illustrated in Figure 1 the longitudinal approach is to get the bigger picture first before zooming in on details in the Sri Lankan context.

Abstract

Information and Communication Technology for Development (ICT4D) is an approach adopted to improve the socio-economic situation in poor countries. It includes e-learning, open and free software, e-democracy, digital media, e-government, capacity building and infrastructure development. Billions of dollars are invested in such programs financed by international aid organizations, state funded aid agencies and multinational private companies. Well known problems are poor infrastructure, crime and poor adaptations to the socio-cultural context. It is a complex multidisciplinary, multi stakeholder and multimedia field with an emerging theoretical framework. This paper identifies and examines important quality aspects of ICT4D projects and provides empirical ICT4D examples illustrating each aspect. The overall research question in this study is: What makes some ICT4D projects more successful than others? Based on the authors own experience of projects in Sri Lanka, Uganda and Vietnam as well as analysis of other projects, the following quality aspects are considered as crucial for successful implementation of ICT in development projects: 1) Authentic local needs, 2) Local ownership, 3) Realistic limitations, 4) Competence network, 5) Communication strategy, 6) Planning horizon, 7) Documentation/measurable results, 8) Resources and sustainability and 9) Fun/Motivation. The relevance of these aspects are discussed and exemplified in the article. The thematic areas identified provide a basis for an emerging model, intended to be useful in the design and planning phase as well as in monitoring and evaluation of ICT4D projects.

Keywords: ICT4D, development projects, success aspects, quality assessment

Article 2 Mozelius, P., Hewagamage, K.P., Hansson, H. (2011). Towards e-learning for all in Sri Lanka - progress and problems in some selected Sri Lankan 21st century initiatives, *14th Cambridge International Conference on Open, Distance and e-Learning*, Cambridge, England.

To approach more Sri Lankan-specific details, the second article was written together with the Head of the UCSC eLearning Centre. K.P. Hewagamage has also been leading the curriculum development for the eBIT program and in addition initiated and designed the FIT bridging programme. How would his view of the projects described differ from the author's? The fruitful discussions that resulted in the first sketch of the conceptual framework might be of greater value for the thesis than the actual article.

Abstract

In the 21st century, Sri Lanka and many other regions in Asia have shown a rapid but heterogeneous development in the field of Information and Communication Technology (ICT). The difference in the impact on urban regions and rural areas has sometimes been described as the internal digital divide. At the same time that the gap has diminished between cities in developing countries and the developed world, the internal development gap has increased in many Asian countries. How can this gap be bridged? In this paper some Sri Lankan initiatives for island-wide dissemination are analysed and discussed. The study is built on observations, recorded interviews and a literature study. In formal tertiary education we have chosen a nationwide online learning programme for a Bachelor of Information Technology (eBIT) and how the content and curriculum was developed and revised by the National e-Learning Centre (NeLC) at the University of Colombo, School of Computing (UCSC). Regarding primary school and informal learning, we have selected the One Laptop Per Child (OLPC) initiative and the Nenasala Telecentre network. We find that these initiatives together have improved life for people in rural areas, but that there still exists an internal digital and social gap that needs further bridging.

Keywords: ICT4D, Education for all, eLearning, Distance education, Telecentres, One-to-one computing, Sri Lanka

Article 3: Mozelius, P., Hatakka, M. (2009). Conveyor Belt Production of Course Material – a Case Study in Sri Lanka, *8th European Conference on e-Learning*, Bari, Italy

Curriculum development must not only consist of revising course plans, but also involve the development of new and more appropriate learning content. This article analyses the strengths, weaknesses, opportunities and threats of the UCSC conveyor belt model for production of digital learning objects. Should the focus be on quality or quantity?

Abstract

In this paper we study the content development process for an external bachelor degree in information technology (eBIT) at the University of Colombo's School of Computing (UCSC) in Sri Lanka. The eBIT degree program was started in 2000 and has since 2004 been funded from both the European Union (EU) and the Swedish International Development Cooperation Agency (Sida). Since the start of the project, one of the main focuses has been on content development. Content development at UCSC is instrumental and hierarchical, with different actors responsible for different parts of the content development process. The different roles are Subject Matter Experts (SME) who decide what material the course should be based on and what knowledge should be transferred to the students; Instructional Designers (ID) who are responsible for organising the course and material, as well as deciding the pedagogy to be used and how the instructions should be structured; and Content Developers (CD) who create the actual content based on the instructions and material provided by the SMEs and IDs. This study is based mainly on observations that have been made since 2005 but also on interviews, both formal and informal, with UCSC staff. Since 2005 12 field trips have been made altogether by the two authors - each lasting between two and three weeks - so an extensive understanding of the development process has been achieved over the years. The study is mainly descriptive, as we explain the development process at UCSC, which can be seen as a conveyor belt production of course material, but we also analyse the benefits and disadvantages of this approach. Findings show that benefits of this approach are a high production of material and the model has also proved to be both time- and cost-effective. To further speed up the production, the development process is highly dependent on templates, e.g., flash templates for learning activities and SCORM templates to design course and lesson structures. The use of templates to speed up the production does, however, pose a disadvantage, as there is a low degree of variety in activities in the material produced. Because of this, the content does not fully support the pedagogy strived for in the eBIT program.

Keywords: e-learning, content development, learning objects, templates, Sri Lanka

How should the plethora of digital learning objects be stored, organised and made searchable? There were no existing repositories that fulfilled the needs for the eLearning Centre at UCSC and, as a prioritised part of the NeLC project, the eNOSHA system was designed and implemented. One design idea with the LOR was to store licensed and free content in the same system with the possibility of ICT4D hubs in rural areas sharing content that was opened up by urban universities.

Article 4: Mozelius P., Hettiarachchi E. (2012). eNOSHA, a Free, Open and Flexible Learning Object Repository – an Iterative Development Process for Global User-friendliness, *European Journal of Open, Distance and E-Learning*, EuroDL <http://www.eurodl.org/?article=466>

Abstract

This paper describes the iterative development process of a Learning Object Repository (LOR), named eNOSHA. Discussions on a project for a LOR started at the e-Learning Centre (eLC) at The University of Colombo, School of Computing (UCSC) in 2007. The eLC has during the last decade been developing learning content for a nationwide e-learning bachelor of information technology degree (eBIT) and a preparatory programme for the eBIT program (The Foundation in Information Technology, FIT). After analysing the specific needs at UCSC a decision was taken to develop a new repository since none of the analysed existing LOR systems could fulfil the UCSC requirements. There was an urgent need for a system that makes it easier for the eLC staff to store and share course material. The system was designed with the main objectives of enhancing the reusability of content and to support the content development process in a user-friendly way to assure user acceptance. We also identified the importance of a flexible LOR design to handle different types of content as well as various user contexts. The development process started with focus groups consisting of staff from UCSC and external project members from Sweden. A requirement analysis was carried out in December 2008, based on which a plan was drafted for the development and implementation of the system. As an overall system development method, we used participatory design, where users were involved in the design, evaluation and implementation of the system. Iterative testing and code revision for amendments and redesign were conducted at universities in Sri Lanka, Finland and Sweden according to the principles of design science. Our aim with the chosen approach was to develop a system that meets the needs and requirements of users at other universities and countries, not just at UCSC in Sri Lanka. Based on the testing of the system, we had a positive response regarding the searchability and reuse of content, but complaints on the uploading of content. Testing conducted in Finland and Sweden revealed earlier unknown security issues, as well as a lack of user-friendliness in the installation process. The integration of eNOSHA 1.6 with the Moodle virtual learning environment has been successful for the Moodle version 1.9 but needs some redesign to work properly with the later Moodle 2.x versions.

Keywords: Learning object repository, content management, Software development, System integration, eNOSHA, Open source, Learning Objects, E-learning

Article 5: Mozellius, P., Wikramanayake, G. and Rahuman, K. (2012). A Sri Lankan one-to-one computing initiative and its impact on formal learning in primary school, *Education and General Studies, Herald International Research Journals*, August Issue: Vol. I (I)

As illustrated in Figure 2 the first half of this longitudinal case study has its focus on Colombo based ICT4D hubs but from 2010 there was a focus shift to entities in semi-rural and rural areas. A study on Education for All must have a wider variety in aspects like age groups, ethnic groups and the geographic spread. In the data collection for the article primary schools in semi-rural and rural areas were visited in regions with Tamil, Singalese and Muslim regions of Sri Lanka. The process of writing this article was important for the creation of details and concepts in the right half of the conceptual framework (Figure 3)

Abstract

One-to-one computing has lately become a frequently used buzzword in the discussions on e-learning in primary education. The main idea in one-to-one computing is to provide every student with a personal computer. This has often been combined with Internet access and the idea to share content but not to share the computers. This study has been focused on the Sri Lankan OLPC initiative and data has been gathered from three selected primary schools in the project. In the Sri Lankan OLPC model there is no focus on Internet connectivity and the emphasis is on content development in local languages. Schools chosen in this first one year pilot project are to be classified as to be “*the poorest of the poor*” and located in rural areas. The research question in this paper is, if and why the introduction of one-to-one computing has had an impact on the formal learning outcomes. All the visited schools have had technical as well as pedagogical problems during the first year, but findings show that there has been an impact on formal learning in subjects like Mathematics and English. We believe that the Sri Lankan emphasis on content development is part of the explanation but also that the strong commitment amongst teachers and parents has contributed. Our recommendation is that this pilot project should be extended but that the focus should be kept on poor schools in non urban areas. We also give some suggestions on how to improve the content development and how to extend the support.

Keywords: One-to-one computing, One Laptop Per Child, OLPC, E-learning, ICT4D, Technology enhanced learning, Sri Lanka

Article 6: Mozelius, P., Megammaana, N. (2011). Differently-Abled Persons with ICT Ability - Inclusion and Empowerment in Sri Lankan Rural Areas via Telecentres, *14th Cambridge International Conference on Open, Distance and e-Learning*, Cambridge, England

For the further refinement of the right half of the conceptual framework (Figure 3) inclusion must be a part of *Education for All*. Which opportunities are enabled for people with disabilities in the Sri Lankan context? The telecentre visited and described is run by disabled persons with a focus on eServices for the disabled.

Abstract

ICT facilities are unevenly spread in many countries and Sri Lanka definitely has its *internal digital divide*. The fast growth of ICT services in urban areas is not matched in the countryside. Telecentres in the Sri Lankan Nenasala network have frequently been used to support poor and isolated regions in an effort to bridge the digital divide. This article is based on observations and interviews with the staff at the Koslanda Nenasala during two visits to the telecentre. The aim of this case study is to examine and discuss if a telecentre managed and operated by disabled persons could serve as a hub for inclusion and empowerment of other disabled people in a rural region. The findings show that disabled persons can organise and run a telecentre in an innovative way with above average results. The Koslanda Nenasala has contributed to empowerment and career opportunities for disabled people in the region. The Koslanda organisation and service model has also been replicated at five other telecentres in the Sri Lankan Hill Country. Other problems identified for a telecentre run and used by disabled persons are the costs of qualified staff and transportation. Telecentres in general depend on Internet access and this dependency is even stronger for a telecentre managed and used by disabled people.

Keywords: ICT4D, Inclusion, Telecentres, Nenasala, Education for all, Sri Lanka

Article 7: Mozelius, P., Megammaana, N. (2012). Cross-ethnic collaboration at a Sri Lankan Telecentre – barriers for effective e-learning in rural regions, *Education and General Studies, Herald International Research Journals*, August Issue: Vol. I (I)

The ending of the Sri Lankan civil war in 2009 opened up new possibilities for cross-ethnic collaboration, but in some areas and ICT4D hubs there was already ongoing collaboration during the civil war. Tea Estate Tamils were never a part of the civil war but they are still a low status group on the Sri

Lankan island. This article was important for a deeper understanding of the lower right corner of the conceptual framework.

Abstract: In post-war Sri Lanka there is still a big social and cultural gap between the different population groups. English has recently been suggested as the new official common language for Singalese, Tamils, Muslims and other Sri Lankan citizens. But in rural areas today the question is more about how to provide content for training in the different mother-tongues. This article is based on observations and interviews with the owner, manager, operators and visitors at the Haldemulla telecentre during two visits in 2008 and 2011. The main research question in this article is to analyse and discuss which factors are important in the management of a telecentre in a non-urban region with a multicultural and multilingual population. The findings show that the cross-ethnic collaboration between the Singalese owner and the Tamil manager is not one of the crucial problems and is something that can be handled. At the Haldemulla Nenasala telecentre the prime problems are more about the current lack of Internet access and how to keep the best employees when the salaries are far below the standard income for staff in the urban ICT industry. However, the Nenasala telecentre in Haldemulla has found a model that seems to be sustainable and, with or without Internet access, they have regular visitors and provide appreciated services to the local community. This telecentre has since its inauguration been one of the best performing in the island-wide Sri Lankan Nenasala network. But the rate of regular visitors has decreased compared with the situation at our first visit in 2008. Since teachers as well as teaching sessions have improved, we find the lack of Internet access to be the factor that has had an impact on the number of monthly visitors. The Internet is today an important source of information in poor rural areas as well as in richer metropolitan regions. Another challenge for a multicultural telecentre is how to provide high quality digital content in the local languages. Sinhala content has been developed and deployed by a Sri Lankan organisation and digital learning objects in Tamil might be shared with Tamil-speaking e-learning organisations in Tamil Nadu in Southern India.

Keywords: ICT4D, Telecentres, Nenasala, Tamil, Singalese, Ethnicity, Sri Lanka

Article 8: Mozelius, P., Hansson, H. (2009). Innovative Use of Digital Audio in Research, *eAsia Conference*, December 2009, Colombo, Sri Lanka

This article is about the use of digital audio in research, including some examples of why and how digital recordings have been used in this study. The initial plan was to mainly use digital recordings in the data collection. But as

seen in the case study timeline, data has been collected in various ways in this study.

Abstract

Studies of how people perceive, understand and interpret information, concepts, issues and life in general are often based on interviews and conversation methods. For many years, in-depth interviews have been one of the most valuable research tools. Interviews have been captured by researchers taking notes during the dialogues. Journalists have, for many years, recorded their interviews; however, in academia the written text has been the standard choice both when collecting data and reporting results. Today digital audio technology opens new opportunities for capture, storage and analysis of voice and dialogue in research. This development expands the researcher's methodological toolbox and enables new research approaches. *The aim* of this paper is to present innovative ideas about the use of digital audio and its implications for research methodology and ethics. In this paper we discuss the following issues:

- a) Advantages of keeping original audio data easily accessible to readers/listeners.
- b) How to enable independent assessments of drawn conclusions.
- c) Further data analysis and the possibility of new conclusions.
- d) Note taking as a barrier and audio recording as a non-intrusive method.
- e) Added value of nuances, prosody and emphasises in the spoken language.
- f) The balance between transparency and personal integrity.
- g) Audio recording, storage and annotations for scientific publications.

We suggest a model for digital audio as a complementary research method, not a substitute for the written approach. With an intelligent use of modern digital audio technology and software, richer interpretations of the original sources are possible. The direct access to audio files in research reports increases the basis for quality assessment in the peer review process.

Keywords: Audio, Research method, Digital recording, Narrative analysis, Audio referencing system

1.4 Methodology

This study has used a qualitative approach with a longitudinal case study as the main strategy. Data has been collected in long-term fieldwork between 2006 and 2013 using a combination of observations, interviews and group

discussions. Data has been analysed iteratively in parallel with the construction and refinement of the conceptual framework that is depicted in Figure 3. The research has not been anthropological in the sense of *going native* and living as a Sri Lankan with other natives for a longer period. Eighteen shorter visits to Sri Lanka during six years with the major part of the time spent in Sweden would be better described with the anthropological term *Yo-yo fieldwork*. The length of the average visit has been two and half weeks but with two longer visits of up to one and a half months. A limitation arising from this is that some phenomena may have been given a too European interpretation where details of local importance have been lost. To get a better understanding of the local context, a rich literature study on Sri Lankan history and population groups was conducted and is presented in section 2.7.

The main themes in the longitudinal case study and their chronological order are illustrated in Figure 2 in the next section. For the embedded cases regarding the Nenasala telecentre network and the Sri Lankan OLPC project, there is also a latitudinal aspect, where data has been gathered with a geographical and ethnic spread during the same time period. The purpose of the longitudinal setup is to be able to study the same variables over time and the purpose of the latitudinal aspect is to be able to compare data from different ethnic groups and different regions in Sri Lanka. The longitudinal aspect has been useful for answering research questions 2 and 3, while the latitudinal aspect facilitated the answering of research questions 1 and 4.

1.5 Case Study Timeline and Conceptual Framework

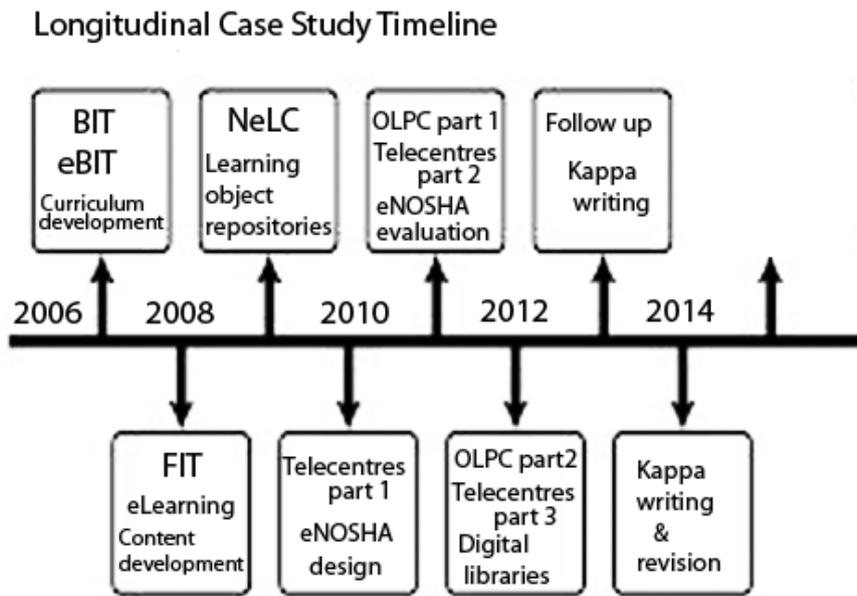


Figure 2: The timeline of the conducted studies

As described also in section 3, the overall approach for the thesis has been a longitudinal case study with a series of embedded units. Data was collected from long-term fieldwork; the chronological order of the studied themes is depicted above in Figure 2.

During the first years, various ICT4D hubs were explored in Colombo at UCSC, where the collected data created the foundation for writing Article 1 and Article 2. To be able to meet the research aim with an understanding of region-wide dissemination, further case studies were later conducted in semi-rural and rural areas. The first ICT4D hubs that were visited outside Sri Lanka's urban areas were telecentres. There are other telecentres than those in the Nenasala network, but in this study the focus was on the Nenasala initiative. There were three reasons for choosing the Nenasala telecentres: 1) it is by far the largest network; 2) it has a long-term plan for nationwide coverage; 3) top-down dissemination is combined with bottom-up activities. Around 20 telecentres were visited between 2009 and 2013, where observations, interviews and group discussions were the main techniques for data collection. Some of the telecentres that generated interesting and rather unusual findings were also revisited until the data collection reached saturation

point. Examples of revisited telecentres are those described in Article 6 and Article 7, two articles that were chosen out of a total of nine research articles on telecentres.

Telecentres were chosen to gather data about the conditions for life-long learning and older age groups in non-urban areas. However, the most frequent age group met in the visits were post-secondary school students with O or A level exams, who were using the telecentres to improve their computer skills. To collect data about younger students at primary school level, six of the thirteen schools in the Sri Lankan OLPC initiative were also visited and revisited during the four field trips that are marked as OLPC part 1 and OLPC part 2 in the case study timeline above (Figure 2).

At the same time that this was a longitudinal study in the sense that some variables in some of the main concepts were observed over a long period, it was also a latitudinal study, where data was gathered and compared from different population groups in a deliberate geographical spread. An example of a latitudinal study is the one on OLPC schools, where one of the two longer field trips had a west to east outline, and the second one had a south to north spread. The results from these field trips are presented in Article 5 and three other articles written on one-to-one computing. Article 4 reports on the virtual ICT4D hub eNOSHA that was planned to be the open learning object repository intended to build a bridge between ICT4D hubs in urban and rural areas. Apart from the main ideas about gathering and analysing data about conditions for various age groups and ethnic groups, the selection of articles was made to cover all the main concepts in the conceptual framework depicted below in Figure 3.

A conceptual framework has been defined by Miles and Huberman (1994) as a visual and/or written product that *"explains, either graphically or in narrative form, the main things to be studied - the key factors, concepts, or variables - and the presumed relationships among them"*. Furthermore, a conceptual framework should be something that is constructed for the actual research study, rather than reusing an existing ready-made framework (Maxwell, 2012). The four main sources for building up a conceptual framework are: 1) the researcher's experiential knowledge, 2) existing research and theory, 3) the researcher's pilot and exploratory research, 4) thought experiments (Maxwell, 2012).

The conceptual framework below in Figure 3 has been iteratively constructed and updated in parallel with the data analysis. The central entity for the understanding of region-wide dissemination of blended learning that was a result of the iterative analysis is the **ICT4D Hub** concept. Figure 3 shows how this central entity is depending on and is related to four main pillars in the study: 1) *ICT4D*, 2) *Education for All*, 3) *Tools for dissemination* and 4) *Ethnic groups*. . Figure 3 also illustrates the entity relationships that the compiled articles are exploring. In the final phase of the study, the conceptual framework has been used as a filter for further analysis and conclusions.

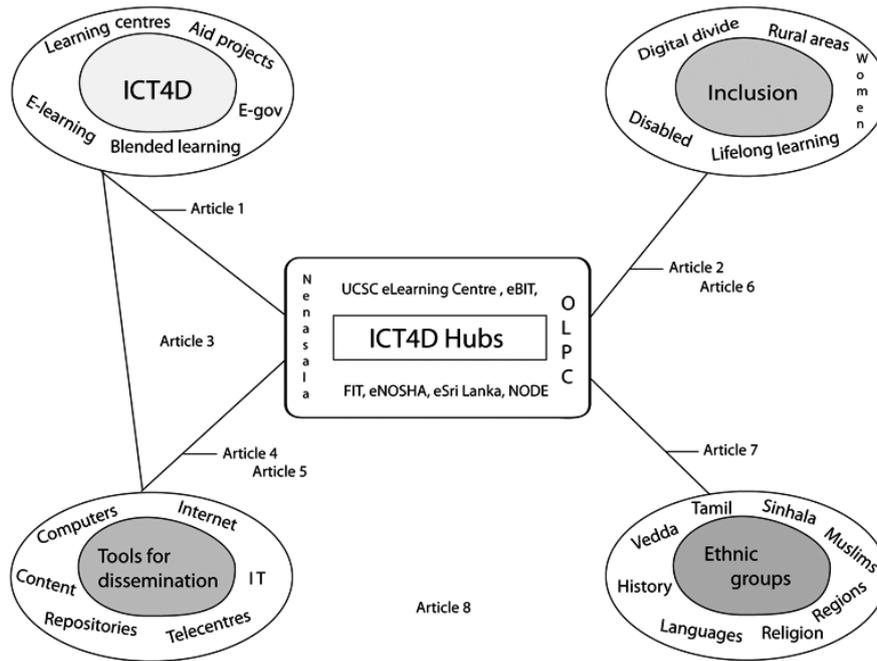


Figure 3: The study's conceptual framework

Successful ICT4D with aid projects and eLearning initiatives depends on the tools for dissemination. Without computers, learning content, content repositories and Internet access, ICT4D will fail. Education for all with informal learning and bridging the urban–rural divide must be aligned with the various ethnic groups if inclusion is to be addressed.

Article 1 is about ICT4D in general, with a global perspective where Sri Lankan concepts are compared with ideas in other emerging regions. In Article 2, the global perspective is omitted, with the idea of analysing ICT4D from a Sri Lankan perspective to build the skeleton for a conceptual framework including urban as well as rural Sri Lankan ICT4D hubs. Articles 3 and 4 discuss how content development and content sharing might be organised and shared between different ICT4D hubs with the hypothesis of virtual online entities to bridge urban and rural areas. Article 5 investigates the idea of giving primary school children personal computers to improve their learning situation and enable them to share their experiences with parents and neighbours. Articles 6 and 7 discuss how different ethnic groups and people with disabilities might be included and empowered. Briefly, the first four articles provide information about the left side of the conceptual framework

on how the concepts of *ICT4D* and *Tools for Dissemination* are interrelated and aligned with the central and polymorphic *ICT4D hub* entity.

In a similar short schematic description, Articles 5, 6 and 7 can be aligned with the right half of the framework, providing information about the relationship between the concepts of *EFA* and *Ethnic groups* with the central *ICT4D hub* pillar. But as can be seen in Figure 3, the interrelationship is more complex and intricate than this, with Article 5 also analysing the tools for dissemination if younger age groups are to be included. Furthermore, Article 2 is associated with both the upper entities in the conceptual framework, *ICT4D* and *EFA*, since it describes both the Sri Lankan *ICT4D* setup and the aim to enable *Education for All*. Finally, Article 8 is about the use of digital audio in research, with examples of why and how digital recordings have been used in this study. Initially, the research plan was to mainly use digital audio and video recordings for data collection, but in the later phases of the case study, timeline data was also collected using various techniques and with a stronger emphasis on field notes, traditional observations and document analysis.

1.6 Constraints

A wide variety of aid projects have been launched on the Sri Lankan island and, for a while, the country was referred to in the international media as “*the new investment center of Asia*” (Arunatilake et al., 2001). This thesis will only analyse some chosen aid projects that have a focus on eLearning initiatives with support for nationwide dissemination. The case studies of OLPC schools and telecentres are just some selected samples of Sri Lankan ICT initiatives that have been chosen because of their focus on technology-enhanced learning in rural areas. More universities and departments than the University of Colombo, School of have, of course, contributed to the creation of *ICT4D hubs* in Sri Lanka, but they are not described in this study.

1.7 Purpose

The purpose is to contribute to our common knowledge in the field of *ICT4D*, and to improve educational practices in eLearning based initiatives in developing regions. Hopefully best practices and the recommendations made in section 6 might be reused and implemented in future aid projects in other parts of the world.

1.8 About the Author

I was born and raised in Sweden, and have lived for shorter periods in other countries, but most of my life has been spent in Stockholm, Sweden. After a rather technical training with a focus on natural sciences at secondary school, I took courses at a wide variety of departments at Stockholm University and the Royal Institute of Technology (KTH). Some of the studied subjects were Software engineering, Computer Science, Astronomy, French, Italian, Cinema Studies, History of Ideas and History of Music. I have a Master's degree in Computer and Systems Sciences and have since 1999 worked as a teacher and researcher in Computer Science and Software engineering at KTH and Stockholm University.

Apart from my knowledge of around various 15 programming languages, I have always been interested in natural languages as well. I have knowledge and skills in Swedish (mother tongue), English (reading, speaking and writing), French (reading, speaking and writing), Spanish (reading and speaking), Portuguese (reading skills), and Italian (reading skills). But for the study described here, I unfortunately understand no more than around 100 words in the Sinhala and Tamil languages. All the work and collaboration in Sri Lanka has been conducted in English, even if the interviews for this thesis were conducted in local languages.

My main interests are music, literature and chess, a poor over-the-board chess player, but better at correspondence chess with computer analysis. I am often described by others as verbose, analytic and stubborn – characteristics that can all be both useful as well as obstacles in a study like this. Other fields of research than ICT4D are Computer science, Programming education, Pedagogy and Games-based learning. A selection of published articles on related themes is listed below:

Gaiani, S., Meegammana, N., Mozelius, P., & Hansson, H. (2009). Knowledge through Cables: is it for Everyone?-A South Asian Case Study, In *Proceedings of eIndia Conference* (Vol. 25, p. 27).

Hansson, H., Mozelius, P., Gaiani, S., & Meegammana, N. (2010). Women empowerment in rural areas through the usage of telecentres-a Sri Lankan case study, In *Advances in ICT for Emerging Regions (ICTer), 2010 International Conference on* (pp. 5-10). IEEE.

Mozelius, P., Balasooriya, I., & Hettiarachchi, E. (2011). eNOSHA and Moodle: The integration of two e-learning systems, In *Proceedings of the 10th European Conference on eLearning-ECEL 2011* (pp. 509-516). Academic Publishing Limited.

Tedre, M., Hansson, H., Mozelius, P., & Lind, S. (2011, May). Crucial considerations in one-to-one computing in developing countries, In *IST-Africa Conference Proceedings, 2011* (pp. 1-11). IEEE.

Hallberg, D., Mozelius, P., & Megammaana, N. (2011). Lifelong Learning: Telecentres in Semi-rural Areas as a Bridge between Formal, Non-formal, and Informal Learning, *eIndia 2011 conference*

Ljungkvist, P., & Mozelius, P. (2012). Educational Games for Self Learning in Introductory Programming Courses-a Straightforward Design Approach with Progression Mechanisms, In *Proceedings of the 6th European Conference on Games Based Learning*. Reading, UK: Academic Publishing International Limited.

Mozelius, P., Rahuman, K., & Wikramanayake, G. (2012). Two Years of One-to-one Computing in Sri Lanka–The Impact on Formal and Informal Learning in Primary School Education, In *World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education*

Mozelius, P. (2012). The Gap between Generation Y and Lifelong Learners in Programming Courses–How to Bridge Between Different Learning Styles?, In *Open Learning Generations: Closing the Gap from "Generation Y" to the Mature Lifelong Learners*. European Distance and E-learning Network.

Mozelius, P., & Roy, A. (2012). Education on Wheels – Mobile Dissemination of E-services and Computer Based Learning in Rural Gujarat, India, In *Proceeding of the 11th European Conference on e-Learning*. Academic Publishing International.

Mozelius, P., Shabalina, O., Malliarakis, C., Tomos, F., Miller, C., & Turner, D. (2013). Let the students construct their own fun and knowledge-learning to program by building computer games, In *Proceedings of the 7th European Conference on Games Based Learning*. Academic Conferences Publishing.

Mozelius, P. (2013). Learning by building – the Lunarstorm generation constructing their own ePortfolios, In *Proceedings of the 12th European Conference on e-Learning*. Academic Conferences Publishing.

Wiklund, M., & Mozelius, P. (2013). Learning Games or Learning Stimulating Games: An Indirect Approach to Learning Stimulating Effects from Off-the-Shelf Games, *International Journal of Digital Information and Wireless Communications (IJDIWC)*, 3(3), 85-95.

2. Extended Background

2.1 Development

Development and social change have traditionally often been measured with the Anglo-Saxon approach which emphasises real estate and economic factors. But in the 21st century, research on new development criteria has emerged and, according to the theory of competitive intelligence, social change should be measured on several levels:

- Economic and business
- Social and cultural
- Environmental and ecological (Arifon, 2010)

With this extended and broader perspective development could set the focus on area-based improvement of human quality and factors including mind, health, environment, culture, job opportunities, relationships, community and happiness (Jongsuksomsaku, 2010). In Thailand, one of the fastest growing economies in Asia, researchers have started to discuss indicators for measuring happiness. As an alternative to the traditional **GNP**, the total sum of a nation's happiness is proposed to be measured as the **GNH**, Gross National Happiness (Supadhiloke, 2010).

Most of Asia's fast expanding boomtowns have in the 21st century been forced to start looking at environmental issues. The air is severely polluted in cities such as Beijing and Bangkok, and not all kinds of development bring a better life to the inhabitants of an urban area. Modern and more environment-friendly alternatives to cars and motorcycles have been introduced in some Asian countries, but in the case of Sri Lanka not much has been done to railways and commuter services since independence. South Asia has in many regions had a *Green Revolution* but in this improvement and updating of the traditional agriculture the focus has been more on efficiency and productivity than on any green ecological aspects. By comparison, the traditional methods seem to be more green, ecological and environmentally friendly than the newer techniques (Kameswari, 2010).

In this thesis the D in ICT4D stands for the positive changes in people's everyday life that are enabled by ICT in the implementations of eLearning, eGovernment, eHealth and eHappiness.

2.2 ICT4D

Information and Communication Technology for Development (ICT4D) is an approach to improve the socio-economic situation in poor developing regions. The term ICT4D mainly refers to the opportunities provided by ICT as an agent of development. Most research in this field is focused on the evaluation of the feasibility of existing technologies and often tools and techniques of Western or Far East Asian origin (Sutinen and Tedre, 2010). Important aspects include eLearning, eDemocracy, eGovernment, eHealth, digital media, free and open software, capacity building and infrastructure development. Billions of dollars have been invested in ICT4D programs, with funding from international aid organisations, state-funded aid agencies and multinational companies. Identified problems to address are poor infrastructure and poor adaptations to the socio-cultural context. It is a complex multidisciplinary and multi-stakeholder field with an emerging theoretical framework (Mozelius et al., 2009). Research on ICT4D is a new phenomenon and, compared to other fields in social science, there are few grand theories. The suggested multidisciplinary approach seldom exists and literature on ICT4D has been compared to a lost sheep. (Raiti, 2006)

However, an idea that is frequently discussed in Asia is Thomas Friedman's concept of a *Flat World* and how computerisation and globalisation will change the conditions and open up career opportunities for a new Asian middle class (Friedman, 2005). A less economy-oriented and more human-centred development theory is the Nobel Prize awarded Amartya Sen's *Development as Freedom*. His definition of development is that it is "...a process of expanding the real freedoms that people enjoy ..." (Sen, 1999, p. 3) and that people's capabilities are as important as their economic situation. According to Sen, development should also be an open ended grass-roots movement process of public deliberation, where people and not only economic growth should be prioritised (Sen, 1999).

The first time a computer was used in a developing country was at the Indian Institute of Statistics in Kolkata in 1956 to improve scientific calculation. From the 1950s until the 1990s, computer-supported development focused on two main fields. Initially, governments in the developing world were the key actors and IT was used for administrative functions of the public sector. Later, in the 1980s, multinational companies started to use IT as a tool for increasing the economic growth in the private sector (Heeks, 2008).

In the 1990s, the rapid growth of the Internet extended IT into ICT and the United Nations' Millennium Development Goals set a new agenda for global development in the fields of health, education and gender equality. A lot of ICT-based aid projects were rapidly initiated, often too rapidly and without appropriate planning, design or evaluation. Two problems identified from what has sometimes been called ICT4D 1.0 are:

- **Lack of scalability:** Small and isolated ICT initiatives were not possible to scale up
- **Lack of sustainability:** Projects were rapidly started but also with a sudden death

(Heeks, 2008)

2.3 Aid Projects and the use of ICT

There are several well-motivated reasons for starting aid projects in developing regions and three of them have been pointed out in a research article by the Professor in Development Informatics Richard Heeks (2008):

The Moral Aspect:

Most software engineers and ICT professionals spend most of their lives serving the needs of wealthy corporations in developed countries instead of addressing global megaproblems.

The Enlightened Self-interest:

If the problems of the poor today can be solved they will in the future buy more of the goods and services that are produced in the developed world with a benefit to all.

The Personal Self-interest:

It is a richer, more satisfying and more colourful experience to design an IT system for an African or Asian community than to do it for companies in the global North.

The 4D part in ICT4D seems to be easier to explain and motivate than the ICT part of the acronym (Heeks, 2008) and it is very doubtful if investment in ICT by itself can lead to any social elevation (Raiti, 2006). The person who initiated the One Laptop Per Child (OLPC) Foundation, Nicolas Negroponte, once proclaimed about the OLPC project that:

“It’s not about training teachers. It’s not about building schools. With all due respect, [to HP’s e-inclusion efforts] it’s not about curriculum or content. It’s about leveraging the children themselves”. (OLPC News, 2007)

However, many experiences around the world contradict this, and the lesson learned is that the acquisition of ICT itself is not enough and that educational projects need pedagogical frameworks (Tedre et al., 2011). The Asian way of developing content in local languages looks more promising and, in general, there is a need for contextual understanding and careful design if ICT4D projects are to be successful (Tongia, 2006; Prakash & De, 2007).

Based on my earlier research (Mozelius et al, 2009) the focus of project analyses in this study has often been on the following nine thematic aspects that all seem important to consider in ICT based aid projects.

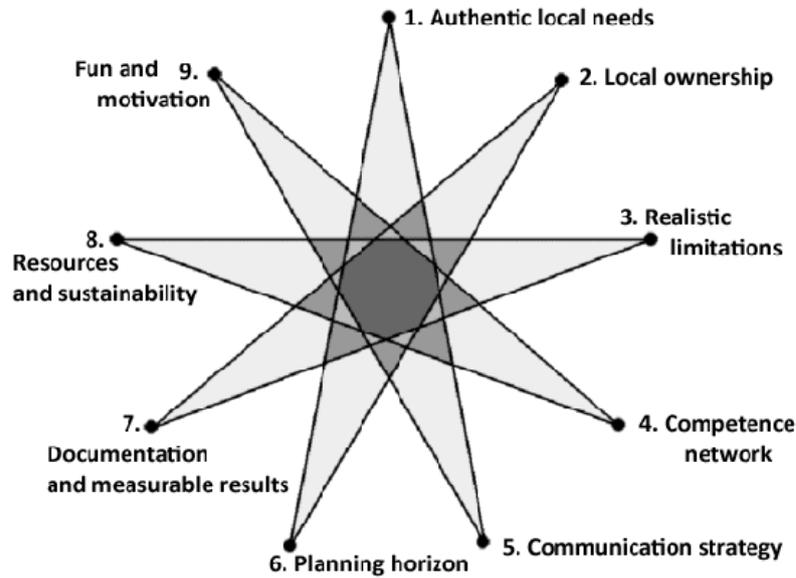


Figure 4: Important aspects of ICT4D projects

Authentic local needs

Without genuine local needs, it will always be hard to motivate involved stakeholders and get a committed collaboration. Projects must be built around the actual situation in the region where the project is to be conducted and a careful needs analysis ought to be the natural first step of any project.

Local ownership

There are several examples where international donations of ICT platforms have not been adapted to the local context. To be successful, tools and systems must be integrated in the daily work and the people using them must have appropriate initial training. Assuring local ownership early in projects will facilitate sustainability later.

Realistic limitations

Sustainable changes and infrastructural improvements take time. If one aid project aims to solve all the problems in a region, there is definitely a risk of failure. Having fewer and more clearly defined objectives is better practice and the main objective in a project should be aligned with the competence networks involved.

Competence networks

To be able to fulfill the objectives in a project, there is a need for a competence network with the necessary skills and knowledge. This is seldom the case when a project starts, and it is a good idea to involve a plan for developing the skills that are lacking, where the training should mainly be for local staff. The establishment of a local competence network during the project is a way to build sustainability.

Communication strategy

A project needs an explicit and agreed upon plan for monitoring communication. How, when and about what should be specified. This aspect is especially important in ICT4D projects when partners are typically located in different parts of the world. Distance meetings are the recommended complement and there are today several affordable or free tools for arranging long-distance meetings.

Planning horizon

Long and medium term planning is often lacking in aid projects. Without clear and explicit planning of visits, activities and deliverables, a project will risk not reaching its potential. On the other hand, this does not mean that adaptations and modifications are excluded. The need for a reasonable planning horizon is a general quality aspect as well, concluded from wider experience of projects and not only important in ICT4D. Responsibilities are on all involved partners, but in particular the project coordinator. Planning and communication of the planning with an appropriate time perspective allows the stakeholders involved to prepare and control their work situation.

Documentation of measurable results

The value of careful and accessible documentation should not be underestimated. If lessons learned and successful work packages are intended to be reused in other contexts, this is facilitated if structured documentation is publicly available. ICT4D projects are often focused on practical details, but poor and neglected documentation of processes and implementations is not consistent with the Paris Agenda agreement of transparency and accountability.

Resources and sustainability

The more the project ownership and involved resources are transferred from the donor side to the receiving country during the project the better. Local capacity building and local ownership are key factors in the creation of sustainability. ICT4D history tells us that many implemented activities and systems encounter a sudden death when a project ends. How resources and systems should survive the project must be integrated in the project.

Fun and motivation

Many project participants lack motivation and see activities and collaboration as boring routines. Social networking among participants should be encouraged as part of the project plan. Without joy, enthusiasm and commitment, projects will be less likely to be efficient and successful.

(Mozelius et al., 2009)

But there are, of course, other crucial aspects to consider when answering the question of why some ICT4D projects are more successful than others.

2.4 Education for All

The Education for All (EFA) movement is a global initiative to support basic education with good quality for all children, youth and adults coordinated by UNESCO. There is an international agreement on six *EFA goals* that should be met by 2015 (UNESCO, 2014). The research in this thesis has a focus on goal 3 and goal 6.

- **Goal 3:** Ensuring that the learning needs of all young people and adults are met through equitable access to appropriate learning and life-skills programmes.
- **Goal 6:** Improving all aspects of the quality of education and ensuring the excellence of all so that recognized and measurable learning outcomes are achieved by all, especially in literacy, numeracy and essential life skills.

Improving quality aspects of education is also the goal that points further to UNESCO's plans for education post-2015, but there are still quantitative goals that will not be met by 2015. In 2012 it was estimated that 114 countries would need at least 1.7 million more teachers by 2015 (UNESCO Post-2015, 2014a). A stronger commitment to good quality education with a focus on lifelong learning and access for all age groups is perhaps the most important goal in the post-2015 education agenda (UNESCO Post-2015, 2014b).

In the United Nations' My World Survey (UN My World Survey, 2014), where respondents chose their six top priorities out of 16 suggested topics for a post-2015 agenda, a clear majority voted for education as a top priority (UNESCO Post-2015, 2014b). Education is a crucial factor that can facilitate multiple dimensions of societal development and the suggestions for the future are to keep the high priority for gender equality and to increase the focus on general equity and access to education for all at all levels (UNESCO Post-2015, 2014a).

In Sri Lanka, as in all other countries, quantitative issues have to be addressed in parallel with qualitative ones. As long as developing regions have an obvious lack of resources, quantitative approaches often have to be prioritised, but in a longer perspective quality aspects must be involved.

2.5 Blended Learning

Like many other phenomena, blended learning can be defined in a broad and simple or more complex and detailed way. In a simple straightforward definition, blended learning can be described as the thoughtful integration of traditional classroom-based face-to-face learning and computer-based online learning (Garrison & Kanuka, 2004). Apart from being a combination of face-to-face instruction and online instruction, blended learning is also seen as a combination of instructional methods and instructional modalities. But on the other hand it is hard to find any learning system that does not blend instructional methods and modalities (Graham, 2006).

In what is sometimes called “*the second wave of eLearning*”, there are also ideas presented on the blend of: asynchronous self-paced learning and synchronous collaborative learning, the blend of structured and unstructured learning and the blend of custom-made and off-the-shelf content (Singh, 2003). As pointed out by Driscoll (2001), blended learning has sometimes been a hyped phenomenon and the term can mean different things to different people. However, most educators would agree on Driscoll’s listing of blending learning as a blend of:

1. Any form of instructional technology (e.g., videotape, CD-ROM, web-based training, film) with face-to-face instructor-led training.
2. Mixed modes of web-based technology (e.g., live virtual classroom, self-paced instruction, collaborative learning, streaming video, audio, and text) to accomplish an educational goal.
3. Various pedagogical approaches (e.g., constructivism, behaviourism, cognitivism) to produce an optimal learning outcome with or without instructional technology.
4. Instructional technology with actual job tasks in order to create a harmonious effect of learning and working.

(Driscoll, 2001)

2.6 A Pedagogy for Liberation and Conscientisation

Paolo Freire is a Brazilian pedagogue who was born in 1921 in Recife, Brazil. His ideas about the pedagogy of liberation spread worldwide in the 1970s and started a discussion not only in the context of alphabetisation

campaigns and adult education in Brazil, which was the initial target. One possible explanation for why Freire's ideas also became popular in developed countries like Sweden might be the fact that they appeared at a time when behaviourism and instructional technology were supposed to be building the base for a new modern school system (Andersson, 2001).

In opposition to behaviourism, Freire's approach was based on a more student-centred pedagogy, suggesting a constant dialogue between teachers and students (Selander, 1984). His concept about liberation by learning dialogues originally stems from Plato and ancient Greece. Teachers should in Freire's pedagogy of liberation act as coordinators of democratic discussions between teachers and learners as a foundation for a mutual learning process (Freire & Rodhe, 1975). Knowledge should be the result of a common exploration, where the teacher must not see the students as ignorant objects (Andersson, 2001). A term that was not coined by Freire but developed since is the concept of *conscientisation*, an English translation of the Portuguese word *conscientização*, with the central meaning of making people conscious about conditions in society and their daily lives (Freire & Rodhe, 1975). Later, in the field of ICT4D, Freire's concept of conscientisation has inspired ideas like *critical consciousness*, *awareness raising* and *empowerment*.

Freire's aim was to find a new form of education that would serve the oppressed and help them to realise their potential as creative beings. One important idea is that learners must feel that the education involves questions that make sense in their actual context (Andersson, 2001). Another fundamental thought in his pedagogical model is that theory and practice must always be united. Theory without practice is as wrong as practice without theory (Freire & Rodhe, 1975). Freire sometimes described his viewpoint as non-dualistic, where a human's thought and language should constitute a whole that refers to the reality of the thinking subject (Freire, 1970). The ideas about encouraging oppressed learners to critically reflect and act upon their own reality (Freire, 2000) qualify Freire's pedagogy as an interesting component in ICT4D projects involving lifelong learning for disadvantaged groups (Hallberg et al., 2014).

2.7 Computer Network Hubs and ICT4D Hubs

Traditionally the word **hub** has two different general meanings:

- A focal point
- The central point of a wheel or a propeller through which the axle passes (Collins Dictionary and Thesaurus, 1987)

Computer Network Hubs, Switches and Routers

In the interconnection of computer networks the simplest and most straightforward way is to use a *hub*. In this context a hub is a simple electronic device that accepts frames with data as input and retransmits the information to the hub's outgoing ports (Kurose & Ross, 2001).

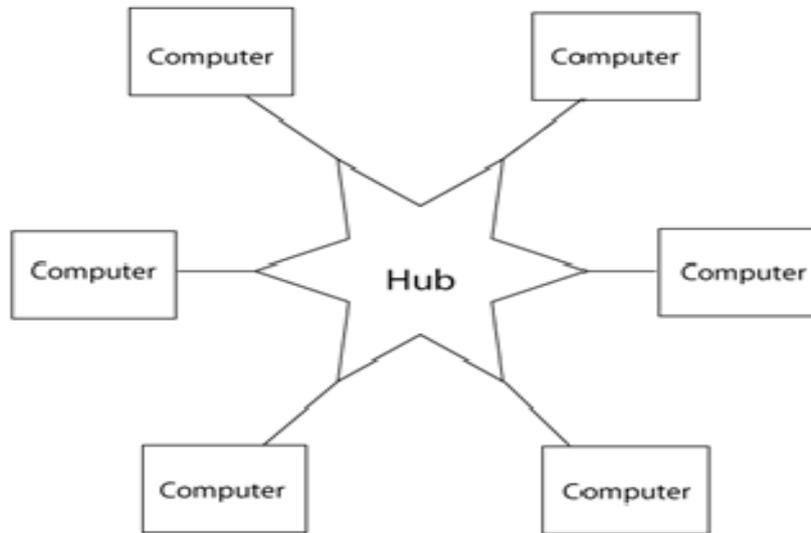


Figure 5: The star topology with computers attached to a hub

The hub itself is ignorant of the transmitted information. Simple hub devices have been an easy and widely used technique to interconnect computers in small networks. A star-shaped computer network resembles a wheel with spokes and the centre of the star network is called the hub (Comer, 2001). A network *switch* does the same work as a hub, but more efficiently by analysing the data traffic that passes through and learning from the analysis. Initially, a switch knows nothing more than a hub and simply retransmits the incoming information to all its ports (Notenboom, 2012). But by using the destination frame of arriving data packages, the switch can learn and register where the information should be passed to (Comer, 2001). Routers, finally, are more complex and smarter than hubs and switches (Notenboom, 2012), and can be seen as programmed computers or intelligent intermediate systems used for connecting networks that may or may not be similar (Stallings, 2000).

eLearning Hubs, ICT Hubs and Sri Lankan ICT4D Hubs

Hubs in the context of eLearning and ICT4D should be seen both in the classical definition as focal points and with the computer network's hub ability to receive and retransmit information. They can also metaphorically represent the central point of the axle that provides region-wide knowledge dissemination. ICT4D, eServices and education must involve more than just mere access to digital content, and hubs ought also to be meeting points for students, teachers, subject matter experts, instructional designers, content developers, technicians, support staff, content development and facilitation.

eLearning Hubs

The term has mostly been used in Asian distance education contexts, where major Chinese cities like Guangzhou and Beijing have been the base for an organised nationwide distribution of mass education (Chen & Zhang, 2003; Quan-rong, 2007). There has been discussion of whether the Chinese large scale distance education hubs should aim at making a profit or not (Kai-sheng, 2003) and how to reach China's rural regions (Changwen, 2008). *eLearning Hub* has also been the name of an educational initiative launched by the Chinese Ministry of Education, aimed at establishing an ICT-supported lifelong education system (Weimin, 2007).

Another Asian hub idea is to establish Singapore as a local eLearning hub (Yue & Lim, 2003) or as a global one for worldwide dissemination of distance education (Anderson, 2003). In both perspectives, the Singapore-based eLearning hub aims to use modern high-end technology and recruit specialists from all over the world (Cordeiro & Al-Hawamdeh, 2001). Globally, the term eLearning hub has also been used in the description of virtual learning platforms in general, and for a WebCT platform in particular (Canessa, Fonda, & Radicella, 2002; Damoense, 2003).

ICT Hubs

With the emphasis more on infrastructure and basic eServices, there has been a discussion on ICT hubs mainly in South Africa (Jacobs & Herselman, 2005; Pade, Mallinson & Sewry, 2009), but later, also in countries like Malaysia (Basaruddin et al., 2011), ICT hubs are being compared to eLearning hubs, being more like community service centres with a more multi-purpose setup aimed at supporting rural development (Jacobs & Herselman, 2005), and resembling what in Asian countries are known as Rural Knowledge Centres, Information Kiosks or Telecentres (Mukerji, 2008; Gaiani et al., 2009a).

In contrast to eLearning hubs, the ICT hubs are located in rural areas to support the local communities and rural development. To be sustainable, they are often designed as multi-purpose service centres providing a wide variety of services and not only eLearning and distance education. ICT hubs

can have Internet connection and commercial services, but they can also be non-commercial hubs for blended learning, like Sri Lankan OLPC schools (Mozelius et al., 2012) and some Sri Lankan off-line telecentres (Mozelius & Megammaana, 2011b).

The Sri Lankan ICT4D Hubs

The concept of ICT4D hubs can be briefly described as a combination of eLearning hubs and ICT hubs as described above. Like eLearning hubs, ICT4D hubs can have various physical as well as virtual shapes and organisational models, but should always facilitate education and development in various ways. Like ICT hubs, ICT4D hubs must also be designed to support rural areas and local development. Sri Lankan ICT4D in this study is represented by entities such as:

- The UCSC NeLC Centre
- The eBIT programme distributed in the Moodle system
- The FIT bridging programme distributed in the Moodle system
- Telecentres in the Nenasala network
- Primary schools in the Sri Lankan OLPC initiative
- National Online Distance Education (NODE) Centres
- The digitisation of the Jaffna Public Library
- Digital online Learning Object Repositories

2.8 Sri Lanka

Sri Lankan society has during its history been multi-ethnic as well as multi-lingual and the island itself has also had numerous names. The very first was probably the Sanskrit name *Lanka* but another early name was *Ratnadeepa* (which means ‘island of gems’). Vijaya and his followers called it *Tambapanni*, referring to the copper-coloured soil they encountered on the island’s west coast. An old Sinhalese name is *Simhaladeepa*, meaning island of the lion race, and early Tamil names are Ilam or Ilankai. Arabs transformed Simhaladeepa to the better known *Serendib*, which is also the origin of the word serendipity. The Portuguese people changed Serendip to *Ceilão*, which during the Dutch era became *Zeilan* and later in the British anglicized interpretation *Ceylon* (Yogasundram, 2008). In 1972 the then President, Mrs. Bandaranaike, reclaimed Lanka with the new name ‘*Republic of Sri Lanka*’ Findings from Prehistory are mainly the same as on the Indian subcontinent and what later distinguishes the island from the rest of the South Asian subcontinent is the relatively late and rapid transition from hunting and collecting to an agrarian and literate civilization. This shift took place somewhere

in the first millennium B.C. and is seen as a historical leap, where several stages of social and technological development found in the Deccan and Ganges regions during the Protohistoric period were by-passed (Siriwera, 2002). Between the 5th and the 3rd century B.C. the Indo-Aryan ancestors of the Sinhalese immigrated and brought Buddhism with them from India. There are no exact dates for when the Tamil-speaking immigrants settled on the island, but in the last centuries B.C. a Tamil population existed in the northern parts of the island (Nationalencyklopedin, 2008). Sri Lanka's aboriginals, who are considered to be the first inhabitants on the island, are the Veddas (Yogasundram, 2008), but today they are only a small minority living in a few separated communities on the island.

The era between the 2nd century B.C. and the 11th century A.D. was a period of greatness, with Anuradhapura as the Sinhalese capital. During this period the settlements increased in the north-central and north-western regions of the island, with the introduction of iron technology and irrigation systems (Siriwera, 2002). In the 13th century there was a decline and at the end of the century formerly prosperous regions around Anuradhapura, Polonnaruwa and Sigiria were abandoned (Siriwera, 2002). A Tamil society flourished in the region around Jaffna in the 14th century, while many Sinhalese moved to the south-western regions. In the 16th century, Portuguese colonists gradually took control of the coastal areas when they started to trade the island's famous cinnamon (Nationalencyklopedin, 2008).

European Colonial Rule

For close to four and a half centuries Sri Lanka was under colonial rule:

- **Portuguese period:** 1505 – 1658
 - The Portuguese invaded Ceylon and ruled the maritime provinces for 153 years. They came to the island for spices but also brought the Catholic Church with them as their ideological apparatus (Wickramasinghe, 2006).
- **Dutch period:** 1656 – 1796
 - The Dutch conquered the areas that were under the Portuguese and continued colonial rule for another 140 years. Amongst many other things the Dutch constructed the forts in Colombo and Galle. They promoted Christianity and built churches but the Dutch power was based on trade (Yogasundram, 2008).
- **British period:** 1796 - 1947
 - The British East India Company took control of the coastal areas in 1796 and in 1802 these provinces became a crown colony under the direct rule of the British government. Some years later in 1815 the English also conquered the Kandyan kingdom and captured the king (Yogasundram, 2008). During the British era the cultivation of

coffee started which later switched to tea after the devastating coffee plague of 1868.

Ceylon became independent in 1948 in a process where the Hindu Tamil population was practically excluded from any political influence by the Buddhist Sinhalese majority (Nationalencyklopedin, 2008). The country's second Prime Minister, Mr. Bandaranaike, originally supported the idea of a dual language policy where both Sinhala and Tamil should be made official languages when the English language began to wane in the 1950s. But later he shifted to the idea of a nation with "*Sinhala Only*", which aggravated the conflict (Bandarage, 2009). Separatist Tamil political parties were created and the most militant formation was the Liberation Tigers of Tamil Eelam (LTTE), which started in 1976.

From the late 1970s until 2009, Sri Lanka was in a state of a civil war with some shorter periods of armistice. The armed struggle between the Sri Lankan government and the secessionist LTTE has been one of the longest running conflicts in modern Asia. A vicious territorial struggle has been going on in the country's northern and eastern regions, but more or less the whole island has been suffering from suicide bombings and other deadly attacks (Bandarage, 2009). There were also incidents outside Sri Lanka, and in May 1991 a young female suicide bomber killed herself and the Indian Prime Minister Rajiv Gandhi in an LTTE-planned assassination in Southern India (Kaarthikeyan & Radhavinod, 2004). Bomb blasts were frequent during the last years of the civil war and the final clashes in the regions around Kilinochi and Mulaitivu were intense and with cruel violations of local civilians. It is hard to calculate the total costs of the Sri Lankan civil war, but at a rough estimate it was many times the Sri Lankan annual GDP (Arunatilake et al., 2001).

Unlike in the neighbouring country of India with its Vision 2020, where India is expected to have the youngest population in the world in the year 2020 (India Vision 2020, 2012; Mozelius & Roy, 2012), Sri Lanka has a population that is predicted to age very fast during the next 50 years. Sri Lanka is one of the fastest ageing countries in the world and in around two decades the population will be as old as Europe's or Japan's today; if the per capita income is lower than in Europe or Japan, this will create problems for Sri Lanka in general (Vodopivec & Arunatilake, 2008).

Computer Science and the use of ICT in Sri Lanka

The history of computers and computer science in Sri Lanka started in 1967 when the first mainframe computer was brought to the island and installed at the University of Colombo. Computer science and programming then became an integrated part of mathematics at university level (MP3-Wikramanayake, 2011). A more general and region-wide acquisition of

computers and communication technologies did not start until the late 1970s, when Sri Lanka opened up the economy and began its globalization process (Mozelius & Meegamma, 2011a).

Computer usage increased towards the end of the 1980s, when many private, and some public institutions started to digitalise their systems. Later, due to the integration of Sri Lanka into the global economy, information and communication technologies have spread and the major private and public sector organisations as well as academic and research institutions have acquired ICT and use it for various purposes (Hansson et al., 2010).

However, computers and ICT facilities are still limited to Colombo and its environs, the Western province and major provincial towns such as Kandy, Galle and Batticaloa. In rural areas, where over 75% of the population lives, the infrastructure is not at all as good as in urban regions and a lot of people do not have computer or Internet facilities (Budde, 2009). Access to ICT is still not for everyone (Gaiani et al., 2009a) and, as in most other countries in Asia, the infrastructural differences between the country's fast-expanding urban regions and the rural areas can be much greater than the difference between the Sri Lankan capital and a European city of the same size (Hansson et al., 2010).

2.8.1 The Sri Lankan Language Situation

The Sinhala Language

Sinhala is the mother tongue of the Sinhalese people, who are the largest ethnic group on the Sri Lankan island. Sinhala is a language with its origins in the Indo-Aryan branch of the Indo-European language group. Sinhala is spoken by about 16 million people in Sri Lanka, with 13 million of them being native Sinhala speakers. Considering Sri Lanka's geographical location between the Arabian Sea and the Bay of Bengal, it is not surprising that Sinhala has been constantly influenced by the languages spoken by visiting merchants and colonisers during the various epochs. The Sinhala of today includes loan words from the many contacts with Tamil, Portuguese, Dutch and English, but also minor loans from Arabic, Malay and the Persian languages (Hussein, 2009).

In its earlier stages, Sinhala had only a few Tamil words, but today this is the language that has contributed the most loan words. The influence of the Tamil language began with the 11th century Colan conquest of the island and had a strong impact until the arrival of the Portuguese in the 16th century (Hussein, 2009).

The Tamil Language

Tamil is the other main constitutionally-recognised official language of Sri Lanka. This is a language that, like other Dravidian languages, is agglutinative and with conjunct consonants and glottal stops that gives the language its special character (Hussein, 2009). Tamil also has a long tradition of a written language on the island from the early 2nd century Buddhist epic *Manimekalai* (Goonatilake, 2010) to the many Tamil newspapers in the 21st century.

Tamil is also the official language in the Indian state of Tamil Nadu with a total of around 72 million Tamil speaking persons in India, Sri Lanka, Malaysia and other small regions in Southeast Asia and the Caribbean islands. Sentences are mainly built in the subject-object-verb order and when it comes to influences the Sanskrit language has periodically had a strong impact. Written Tamil is an independent version of the South Indian writing systems that has its roots in the *Brahmi scripts*. (Nationalencyklopedin, 2008)

The English Language

After the defeat of Napoleon in the early 19th century, the British were the first colonisers to establish direct rule over the entire island (Wickramasinghe, 2006) with the *Proclamation of 1818*. The traditional powers of chiefs and headmen were greatly reduced by the British administration when more or less all important duties were replaced by British civil servants.

The Colebrooke Report of 1831–1832, suggesting administrative, political, economic and educational reforms, can be seen as the commencement of a planned occidentalisation of the island. This was a profound conversion where the English language was to be the main tool in a reformation involving the establishment of local English schools. From the 19th century until today, good English skills have always been a requirement for all kinds of administrative careers (Yogasundram, 2008).

In 1946 it was decided that English should cease to be the governmental language, but because of the English-speaking elite this has been a long and delayed process (Wickramasinghe, 2006). English also had a strong impact on the Sinhala language in the fields of government and administration. Some examples are:

- pārlimentuva – parliament
- komisama – commission
- depārtamentuva – department
- kompāniya – company (Hussein, 2009)

Despite the profound immersion of the English language in Sri Lankan society today, Sri Lankan inhabitants' English skills are stratified and often dependent on parents' choice of primary and secondary schools (MP3-

Gunawardene, 2011). Urban areas have a wide variety of schools where English is introduced early for parents who can afford the fees, while rural areas often have problems recruiting trained English teachers (The Island, 12/02/2011).

The Vedda Language

The aboriginal Vedda people have several Vedda languages rather than one common Vedda language. Phonologically, the easiest way to recognise Vedda languages is by identifying the high frequencies of the C and J sounds (Lakshman, 2011). All Vedda languages are of unknown origin and their roots are unrelated to the Sinhala, Tamil, or other Dravidian or Indo-Aryan languages. Furthermore, the Vedda languages have no literary traditions, and influences and loans come mostly from the surrounding Sinhala-speaking communities (Hussein, 2009).

In the 21st century, the Vedda languages include both modern Sinhala and older Sinhala elements, but it is hard to find exactly when the endogamous Veddas started to pick up and speak Sinhala. Robert Knox (1681), an English sea captain working for the British East India Company, wrote about Veddas that spoke “*the Chingulayes Language*”. Today the Veddas’ language situation is sometimes described as “societal bilingualism”, describing a community where people use a foreign language to get improved access to goods, security or status (Hussein, 2009).

2.8.2 Population Groups and Religion

A factor considered to be one root of the ethnic conflict in modern times between the Sinhalese and the Tamil groups is the link between the Sri Lankan state and Buddhism. In the 20th century post-colonial Sri Lanka’s Sinhalese nationalists promoted a Buddhist prototype of democracy and in 1972 the new *Republican Constitution* declared the religion of the majority to have a special and higher status than other religions (Wickramasinghe, 2006).

The Sinhalese majority

About 72% of Sri Lanka’s population can be included in the Sinhalese and mainly Buddhist majority. Sinhalese people often divide themselves into the subgroups of *Low Country Dwellers* and *Kandyan Hill Country Inhabitants*. This is also the dominant ethnic group in Sri Lankan politics and commerce on the island. The largest groups of Sinhalese people can be found in the central and southwestern parts of the island. In those regions where agriculture is important, the largest caste is the farming caste (Wickramasinghe, 2006).

The history of the Sinhalese began when the Aryan-speaking West Bengalis vanquished the island's aboriginal inhabitants and settled permanently (Hussein, 2009). No exact data can be determined and there were at the same time also Tamil traders and mercenaries on the island about 2000 years ago. In this early stage of Sri Lankan history, these two ethnic groups coexisted in harmony. The main difference between the groups at that time seems to have been that Tamils spoke Tamil and practised Hinduism, while the Sinhalese people spoke Sinhala and professed Buddhism (Siriwera, 2002).

Tamil speaking groups

At least four different Tamil speaking groups can be identified in Sri Lanka:

1. Tea Estate Tamils or Indian Tamils
2. Jaffna Tamils
3. Colombo Tamils
4. Tamil Speaking Muslims

A majority of the *Tea Estate Tamils* are immigrants from Tamil Nadu in India. They came to Sri Lanka with the main purpose of working in the tea estates (MP3-Rahuman and Ramberg, 2011). This group has not been particularly involved in the civil war and has never been in serious conflict with the Singalese, despite their often poor conditions as tea estate workers. The main actors in the civil war and in the LTTE organization have been *Jaffna Tamils* living in the Northern regions around the city of Jaffna. In early 2011, Tamil social activists in Jaffna started to form a new political party. The way in which the former LTTE leader, Kumaran Pathmanathan, might be involved is unclear (Daily Mirror 02/02/2011). Jaffna has its own university, OLPC schools and telecentres, but the infrastructure and ICT facilities are still suffering the effects of the 30 years of civil war.

Colombo Tamils lives in Colombo often in Southern Colombo along the Galle Road and Wellawatta district that for many years also has been known as "*Small Jaffna*". Tamils often group in communities but not necessarily with other Tamil groups. Most of them are Hindus but they sometimes marry people from other religious or ethnic groups. A majority but not all Muslims speak Tamil. *Tamil Speaking Muslims* are mainly found in the Eastern and Northern regions. Most of the Muslims have Tamil as their mother tongue but in the Ampara district and in Colombo many of the Muslims have Sinhala as their mother tongue. (Rahuman, 2011)

Moors or Muslims

About 7% of the Sri Lankan population belongs to the group called Moors or Muslims and they can be further divided into three subgroups:

- Sri Lankan Moors
- Indian Moors
- Malays

Sri Lankan Moors are descendants of Arabs who married with local women, and the earliest Muslim settlements seem to have arisen from peaceful infiltration by Arabian merchants. The core of the Moor community consists of the descendants of settlers from Iraq and the Arabian Peninsula (Hussein, 2009) living in the Eastern Province and in bigger cities on the coast (Wickramasinghe, 2006). There are also reasons to believe that Muslims in the Puttalam and Chillaw districts are partly descended from Egyptian traders, but today the Sri Lankan Moors are a largely mixed community (Hussein, 2009).

The Indian Moors are more recent Muslim migrants from India (Wickramasinghe, 2006) but there is one theory that Muslims fled to the island from Kerala when the Portuguese arrived in India in the 16th century (Hussein, 2009). Another theory claims that Indian Hindus who were converted to Islam in the 14th century when the Dehli Sultanate invaded South India later fled to the Sri Lankan island when the region was re-conquered by Hindus (Yogasundram, 2008). Malays are the second largest Muslim community in Sri Lanka, with about 50,000 persons or 4% of the country's total Moor population (Hussein, 2009). The Malays are Muslims descended from the East Indies troops brought to Ceylon by the Dutch (Wickramasinghe, 2006).

Tamil was the language spoken by Muslim merchants along the Coromandel Coast in India and, since the Sri Lankan Moors' livelihood depended strongly on maritime trade, Tamil became the lingua franca of commerce (Hussein, 2009). Most of the Muslims still have Tamil as their mother tongue, but in the Ampara district in eastern Sri Lanka and in the Colombo area a lot of the Muslims have Sinhala as their mother tongue (MP3-Rahuman, 2011).

Christians and Christianity

The Sri Lankan Christians believe that the apostle Thomas actively preached the bible on the island as early as in the 1st century, but Sri Lankan Christianity in reality did not start until the 1500s, when Portuguese missionaries were brought to the island's coastal regions. As Vasco da Gama declared when he reached Calicut in India in 1498, the Portuguese came to Asia in search of Christians and spices. If there were no Christians around, the mission was to create new ones by any possible means (Rubiés, 2000). The so-called *Goa Inquisition* was not only for the Indian region of Goa but also for the rest of the Portuguese Empire in Asia. Prime targets were persons belonging to other religions, and Asian temples were burnt or turned into Christian churches (Goonatilake, 2010). There were never any official inquisitions in Sri Lanka, but many actions were performed in the same spirit and the discrimination against other religions was obvious (Wickramasinghe, 2006). In the 1540s the Portuguese King told the Friar Joao that "*When you*

see the King of Ceylon, remember to tell him that, if he wishes to be a Lord, he must not turn to Pagodas but follow Christ” (De Queyroz, 1930).

Especially in the *karava* fisher caste, there were many people who converted to Christianity (Travelsrilanka, 2007). In Sri Lanka it is difficult to shake off your caste origin, but one way to change your life conditions is by converting to another religion (MP3-GirtyGamage, 2012). A conversion to Christianity can in various respects give a higher status for someone from the fisher caste, and it was also possible for them to be relieved of various taxes. Many people who converted to Catholicism changed their Sinhalese or Tamil surnames to the Portuguese names of their baptismal sponsors. For people from a lower caste, the change of name could also hide their origins and backgrounds (Wickramasinghe, 2006).

During the Dutch era, the new colonists tried to replace Roman Catholicism and other religions with Protestantism by rewarding converts with promises of upward mobility. Protestant chapels were constructed and Catholics were harassed. In the Dutch judicial system the evidence of non-Christians has no legal value against Christians (Wickramasinghe, 2006). A large number of natives converted to Protestantism and in 1718 the total in the Colombo, Galle and Matara regions was given as 93,165 (Goonewardena, 1958). The creation of the Dutch Burgher community began when low-ranking Dutch military recruits responded to the incentive of free land and married local women (Wickramasinghe, 2006).

Still the coastal fishing regions like Negombo are the areas with the most Christians and the majority of these are Catholics. Of the total population, around 8% are Christians. Roman Catholicism is organised on the island with one archbishop and 10 bishops. In Sri Lankan Christian churches the services are held in all three of the main languages. The local Catholicism is mostly similar to the practice in other countries, with churches, statues of Jesus and Sunday meetings for worshippers, but in a Sri Lankan adaptation the Virgin Mary is said to have extra miraculous powers, like the ability to stop snake poison (Travelsrilanka, 2007).

Burghers

The word *Burgher* is of Dutch origin and does not have any connotations related to hamburgers even if its original Dutch spelling was *burger* without any h (Hussein, 2009). A Burgher was originally a Sri Lankan citizen of European or colonial Ceylonese descent. Most of the early Burgers had Portuguese or Dutch ancestors but the Burghers have frequently intermarried with the Tamil and Sinhalese communities. A great deal of people have also migrated to Australia, Europe and other parts of the world and the word Burgher nowadays refers loosely to any Sri Lankan citizen of mixed descent.

Unlike the Dutch and the British, the Portuguese colonisers freely intermarried with the local populations as *Casados* (Portuguese for ‘married’), a habit that was also encouraged by the Portuguese crown (Hussein, 2009).

The descendants from these marriages were often called *Portuguese Burghers* and they are today mainly located towards the eastern littoral around the city of Batticaloa (Hussein, 2009). A Dutch Burgher community was established when Dutch military recruits were given land by the Dutch crown and married local women (Wickramasinghe, 2006). At the end of the Dutch rule, there existed a substantial Burgher community where Dutchmen had sometimes married local women but more often women of Portuguese descent (Hussein, 2009). Burghers also had a strong influence in proportion to their relatively small population during the British era. They were well educated with good English skills and were often employed in the British administration (Yogasundram, 2008).

The Vedda People

Both Sinhala and Tamil people call themselves indigenous Sri Lankans, but it is the Veddhas or Vanniya-laetos who are Sri Lanka's aboriginal inhabitants. Sri Lanka's aboriginal and indigenous inhabitants are known both as Veddhas or Veddhas. In the thesis I will mainly use the more common spelling Veddhas. Wanniya-laeto, which is what they prefer to call themselves, can be translated as *forest-dwellers* (Vedda.org, 2011a), or according to the Swedish anthropologist Wiveca Stegeborn: *forest beings* (Stegeborn, 2004). Veddhas were originally hunter-gatherers using bows and arrows to hunt, while at the same time having a long tradition of gathering wild plants and honey. Today in the 21st century, they still produce and sell honey, but the bow and arrows are mainly used to attract the attention of potential customers from outside the Vedda community.



Figure 6: Vedda salesmen in the Dambana village Photo: Peter Mozelius

Many Veddas later settled down as farmers, practising a slash and burn cultivation. More than any other indigenous group in Sri Lanka the Veddas have preserved a traditional life style where modern technology including computers and mobile phones has been classified as a treat to the community's cultural values.

Veddas have a direct line of descent from Sri Lanka's original Neolithic community dating from at least 16,000 B.C. and there are several sources with even older dates (The Sunday Island, 1993). The American anthropologist James Brow claims that the Vedda history is based more on myths than on verified historical facts. According to Brow, most authors that have written about Veddas and their history have never actually met them or visited the Vedda communities (Brow, 1978). Brow also has a theory on how the descriptions of Veddas have changed, from the earliest reports in the 17th century to what is written later by more professional researchers. Veddas and their culture are mentioned in the 17th century writings of Robert Knox on his captivity by the King of Kandy. Knox describes the Veddas as divided between "*wild men*" and a "*tamer sort*". The latter had more contact with surrounding society and served in the king's army (Knox, 1681). During the early British period in the 19th century, most reports were written by colonial administrators, soldiers, missionaries and adventurers in an era where the opinion was established that there were very few interactions between the Veddas and the surrounding population (Brow, 1978).

When Brow conducted his Vedda research he was often reminded of the common Sinhalese opinion that real Veddas had ceased to exist. However, his findings in the central Anuradhapura district show that there were at least 6000 persons in the region who could be classified as Veddas or Wanniyalaetos (Brow, 1978). Later, in the 21st century, the Sri Lankan electrical engineer and anthropologist Susantha Goonatilake posited that there are no more than about one hundred Veddas remaining and that the rest have been assimilated by the surrounding Sinhala culture (Goonatilake, 2001). Goonatilake, who visited Wiveca Stegeborn when she lived with the Veddas in the Dambana region, claims that the population there is divided into two groups. The majority want to settle down as farmers, cultivating the land that they have been given by the Sri Lankan government, but they are living in parallel with a minority that still uses the Vedda languages and practises traditional rituals. Goonatilake's theory is that the latter, smaller, group consists of Veddas who have a genuine wish to continue a traditional way of life, but that there are at the same time people practising the traditional rituals as a way to get money from curious visitors (Goonatilake, 2001).

2.8.3 Caste Systems

Sri Lanka, and other Asian countries like India, Sri Lanka, Bangladesh, Nepal, and Japan have a long tradition of caste systems and they are all on the UNICEF list for discrimination based on caste. Even in developed countries like Japan, caste-specific values still define gender roles. Importance is given to the eldest sons and women are supposed to support the smooth running of families and society (Zhou & Teasdale, 2004).

In Sri Lanka the caste system is less repressive than in India (Goonatilake, 2010), but at the beginning of the 20th century there was still a caste system that was cross-ethnic and rigid. It was caste and not ethnicity that divided society, with the Pannas, Hinnas and Demalagattaras at the very bottom. At the top of the social ladder, above the caste groups, were Englishmen and Burghers. As late as in the 1960s, a political career was seen as impossible for people from low castes. Later, the election of Ranasinghe Premadasa as Sri Lanka's president in 1988 has been compared to the election of Barack Obama 2008 in the United States (The Island, 25/02/2011; Coray, 2008).

Currently, in the 21st century, ethnicity has become more decisive than caste and amongst the Singalese majority in urban areas caste issues are something that mostly belongs to the private sphere. For Tamil groups, the caste division still has significance and, during the civil war, attacks on Singalese targets were often planned by high-caste LTTE leaders and later executed by low-caste persons (Kaarthikeyan & Radhavinod, 2004). Tea Estate Tamils or Indian Tamils who were brought over from South India by the British are mainly of low-caste origin and neither group has been able to improve its social status in the Sri Lankan Hill Country.

A basic principle in Buddhism is that humans should be judged by their deeds and not by birth, an idea that goes against the grain in caste systems. This is also a reason why Buddhism has had problems gaining acceptance in India, a country where caste is still of importance. Nevertheless, Sri Lankan Buddhists also have their own caste system, which can be a sensitive matter to discuss, not least with Buddhist priests (MP3-Gamage, 2012).

3. Methodology and Methods for Data Collection

The overall approach used in this study was a long-term fieldwork where a number of embedded cases have been combined as a longitudinal case study on Education for All in Sri Lanka. Ingoing cases were deliberately chosen with a geographical spread with an aim of region-wide coverage, but always with a focus on Sri Lanka and contexts that could be seen as parts of the *Education for All* concept. Data has been collected in a mix of qualitative methods where interviews, observations and group discussions have been the main sources. Interviews and group discussions were often recorded for further analysis and observations have been complemented by photographs, surveys and document analyses.

Qualitative research is a way to explore how individuals, groups and organisations relate to human or social problems, where data analysis can be inductively built up from particulars to themes. In qualitative research, the researcher sometimes has to interpret the meaning of the collected data (Creswell, 2009). With the ambition of getting a holistic understanding of the complex overall situation, I have created my own mixed approach, but the common denominator for the compiled articles is definitely the case study approach:

- **Article 1:** Comparison of three case studies from three different developing countries where one is conducted in Sri Lanka. The article is important for the exploration of what is global and what is specific to the Sri Lankan context. Data is mainly collected by interviews and observations.
- **Article 2:** A case study of the Sri Lankan ICT4D hubs that can be seen as the main pillars in the thesis. Seven embedded hub cases where data has been collected by interviews, observations and the study of local mass media as described in section 3.7.
- **Article 3:** A case study of the content development process at the UCSC eLearning Centre where the process has been identified and later evaluated by a SWOT analysis. Data has been collected by interviews, observations and document analysis.
- **Article 4:** A study of Learning Object Repositories and the idea of storing and reusing learning content. The contribution to this thesis comes from the evaluation phase of the eNOSHA system, where data was collected from user tests and interviews with staff at the UCSC National eLearning Centre.

- **Article 5:** A study of primary schools involved in the Sri Lankan OLPC project where the three embedded cases were selected in a west to east geographical spread to cover different socio-economic and ethnic groups of the Sri Lankan population. Data was collected by interviews, group discussions and observations.
- **Article 6:** A case study of a telecentre in the Nenasala network with a focus on inclusion and support of people with disabilities. Data was mainly collected by interviews, group discussions and observations.
- **Article 7:** A case study of another telecentre in the Nenasala network with a focus on cross-ethnic collaboration. Data was collected through interviews, observations and email correspondence.
- **Article 8:** A positional paper on the use and potential of digital audio recordings in research illustrated with two Sri Lankan case studies. The described concept was later partly used in the data collection for this thesis.

When and in what order the ongoing case studies have been conducted is illustrated with the Case study timeline that is presented and described in section 1.5. The articles relationship to the main concepts in the study is depicted in the conceptual framework, which can also be found in 1.5. The framework has been iteratively built during the study in parallel with the data analysis.

During my work in the AsiaLink eBIT and NeLC projects (eBIT and NeLC projects, 2007) and my 18 visits to Sri Lanka from 2005 to 2012, I was involved in several activities for practical problem solving. Most of these activities were carried out at the University of Colombo, but there were also shorter collaborative sessions during my visits to universities, telecentres and primary schools in other parts of the island. At the UCSC I developed and assessed digital learning objects that were later used in the eBIT and FIT programmes, and I was also a member of the team that developed the eNOSHA learning object repository.

Working in the Swedish–Sri Lankan aid projects, I was also participating in board meetings at the UCSC and development workshops outside the university where eLearning strategies were discussed. In 2007 I joined the workshop for curriculum development in Negombo, where I contributed to the construction of the syllabus for a new programming course in the eBIT programme. Together with some Swedish colleagues, I attended the Kandalama evaluation workshop in 2008, considering semester 3 and semester 4 of the eBIT bachelor programme. In 2010 I was invited to participate in the planning of the content development for the FIT programme where I was later one of the evaluation team when the courses were assessed, optimised and further developed.

As a researcher should, I tried to respect people's integrity and sometimes maintained informant anonymity. But as concerns persons in more official positions, I usually used their names, since they had chosen to work in public and their names could be easily found anyway. There has been some criticism of some of my research papers on the Sri Lankan OLPC initiative because I explicitly used the names of the visited schools; my opinion is that schools are public institutions and, in a pilot including 13 schools, they were easily identifiable even if their names were omitted. In my research articles on OLPC, I sometimes used the names of the school principals but never the names of teachers, students or technical staff.

3.1 The Case Study Approach

Case studies are a strategy where researchers can study activities, groups of individuals, phenomena or processes in greater depth by collecting detailed data in time-boxed cases (Creswell, 2009). Several of the ICT4D hubs described have been revisited in this longitudinal case study with the aim of collecting additional data and discussing findings. Sometimes the iterative data collection has been spread out geographically to get a better understanding of the region-wide dissemination that is a central theme of the thesis.

A case study can be defined as an empirical enquiry investigating real world contemporary phenomena (Yin, 1989). Furthermore, case studies are a strategy where researchers can explore and evaluate programmes, processes or activities in depth, combining various methods of data collection (Creswell, 2009) in a setup where the different data sources should collectively generate a deeper understanding of the investigated phenomena (Remenyi, 2012). Case study research, more than any other kind of research, relies on a combination of primary and secondary data and may also be a combination of several embedded units (Remenyi, 2012).

In this longitudinal case study, the ICT4D hubs described are the embedded units that should together provide an understanding of the mechanisms and relationships in the region-wide dissemination of blended learning. The order of the case study has been to start from the global perspective, moving further to a Sri Lankan national perspective, before finally focusing on more local phenomena in various rural areas. A chronological order for the embedded case studies is depicted in the *Case Study Timeline* that can be found in section 1.5.

3.2 Observations

What people say or write is often seen as the major source of qualitative data, but there are always limitations to how much can be analysed and learned from what people say and write down. For a more complete understanding of the complexity of some situations, participation and observation of phenomena might be the most relevant and comprehensive research strategies (Patton, 2001). In my observations, I have been participating in the development of the eBIT and FIT programmes as well as in the construction of the National eLearning Centre (NeLC) at the University of Colombo, School of Computing.

As a researcher, it is important to be a skilled interviewer, but it is also of value if the researcher is, at the same time, a good observer. To be able to read non-verbal messages and people's body language is a useful technique to get a deeper understanding (Patton, 2001). In the observations of UCSC-based activities, the author has definitely been part of the process and on a friendly and collaborative basis with most of the informants. But in the research part, there has been an attempt to be as neutral as possible and to apply the approach of being "*outside observers*" (Walsham 1995).

Types of Observations

Observations are seen as the most archetypical research technique when the aim is to explore, explain or predict existing phenomena. Two main categories of observations are controlled and non-controlled observations, where the choice depends to a large extent on the research problem and the research design. Controlled observations are mostly used in experimental studies with a quantitative approach and more rarely in qualitative research (Frankfort-Nachmias & Nachmias, 1996).

Controlled Observations

This is a method that can be used in both laboratory settings and field studies, but with the common denominator that the researcher wants to infer causality by controlling intrinsic as well as extrinsic variables during the observations. The most controlled forms of observations in both natural and social sciences are conducted as laboratory experiments, where the research design involves the creation of the conditions in the laboratory environment. In field experimentation, controlled observations are staged in a natural situation, where the researcher manipulates one or several variables in a setting that is as controlled as the actual circumstances admit (Frankfort-Nachmias & Nachmias, 1996).

Non-controlled Observations

In the qualitative research setting, observations are a central strategy where fieldworkers enter the worlds of others in existing environments. Sociolo-

gists often share and observe the daily lives of various communities, while anthropologists even settle down and live with remote groups in almost non-controlled observations (Frankfort-Nachmias & Nachmias, 1996). Non-controlled observations are also a common method in contemporary digital anthropology (Uimonen, 2012). When the researcher is meant to be participating, observing may be seen as a contradiction (Boellstorff et al., 2012) and this duality goes for actual contexts as well as for online virtual worlds (Boellstorff, 2008).

In practical fieldwork, the proportions of observation and participation shift in long-term studies (Boellstorff et al., 2012). In my observations of Sri Lankan eLearning hubs, I have often deliberately increased or decreased my level of participation, depending on the character of the various eLearning hubs. In virtual online worlds and non-English speaking ICT4D hubs, I have reduced my level of participation, while in English-speaking urban contexts I have increased my activity.

3.3 Interviews

The main reason for interviewing people is to find out things that we cannot observe directly, like thoughts, feelings and intentions. Neither can we observe behaviours that took place at previous points in time. We have to ask questions to get a better understanding of other persons' perspectives and the meanings that they attach to what is going on in their daily lives. Qualitative interviewing assumes that the perspective of another person is meaningful and can be made explicit (Patton, 2001).

An interview can be defined as a purposeful discussion between two or more people (Kahn & Cannell, 1957). Different kinds of interviews can help you to collect relevant and reliable data which is useful for your research questions and objectives. Interviews can be anything from highly formalized interviews using standardised questions tailor-made for each respondent to informal and unstructured conversations. The level of formality can be categorised as:

1. Unstructured and informal interviews
2. Semi-structured interviews
3. Structured and strongly formalised interviews

Informal and unstructured interviews can be a useful tool for exploring central areas in greater depth. Producing unstructured data by a combination of conducting in-depth interviews and taking images is seen as a good practice in research strategies like case studies and grounded theory (Denscombe, 2010).

In this thesis, everything from structured and formal Type 3 interviews to long informal in-depth conversation-like Type 1 interviews has been used, with the major part being something that could be classified as Type 2 interviews. In the standard technique used at telecentres and primary schools, a collection of questions has been constructed for each study and the same questions have been asked at all the institutions visited but with minor changes for various stakeholders. But when something unexpected or new appears in an answer there has always been time and freedom to dig deeper and to follow interesting side-tracks. When informants have been brought up in a different way from the researcher, it is important that the researcher tries to formulate the questions in a way that the informants feel comfortable with (Wengraf, 2001). At university level and ministry level, the interviews were conducted in English, but interviews at grass-roots level in rural areas were translated to and from Tamil and Sinhala. There are many reasons for using open-ended standardised interviews (Patton, 2001), but my main reasons for preparing questions are:

- To get focused interviews where the sometimes limited time is used efficiently
- To facilitate the analysis when answers are easy to find and compare.

The quality of data gathered during an interview depends largely on the interviewer's technique and attitude (Patton, 2001). To get data of good quality from interviews, the researcher has to constantly search for communicative and interpretive errors. A good way of iterative improvement is to analyse the interviews as soon as they happen, in the same way that a "*re-searcher of interviews*" would research it to make amendments for the next interview session (Wengraf, 2001). My technique here has been to record most interviews (where the interviewee has agreed to recording) and then to listen to the recordings while travelling back home from field trips. In several research teams, we had the habit of discussing and making the first common analysis during lunches and dinners when travelling. Sometimes I took notes instead of recording, but often with the feeling that this disturbs the focus and observations.

Programme evaluation interviews have the overall objective of collecting the perspectives of staff, participants and other persons associated with a programme. What is often interesting is the thoughts and expectations that people have about programme processes and outcomes (Patton, 2001). To get a deeper understanding of more complex phenomena, I tried to interview as many stakeholders as possible and to use the *flip-flop technique* (Gibbs, 2010) to get opinions from different levels in a programme or organisation. The flip-flop technique is described below in section 3.6.

3.4 Recorded Interviews and their Analysis

Academic researchers have a tradition of conducting in-depth interviews as a way of gathering data on people's opinions of complex phenomena. Another tradition in academia is to capture the answers by taking notes during a conversation. In various forms of journalism, interviews have been recorded for many years and are seen as a more efficient alternative to written text or shorthand. Digital audio technology has also opened up new possibilities for capturing, storing and reusing recorded data. As with new technology in general, there are pros and cons, and some issues to consider are:

- Keeping original audio data easily accessible to readers and listeners.
- The possibility of independent assessments of the conclusions drawn.
- Further data analysis and the possibility of new conclusions.
- Note-taking as a barrier and audio recording as a non-intrusive method.
- Added value of nuances, prosody and irony in the spoken language.
- The balance between transparency and personal integrity.
- Audio recording, storage and annotations for scientific publications.

(Mozelius & Hansson, 2009)

Digital audio recordings should be seen as a complement to the written approach and not a substitute, and it is recommended that the researcher takes some written notes as a backup if the recording equipment fails (Creswell, 2009). Modern audio recorders have not only decreased in size, but have also been a lot more reliable during the last decade. In the 100 or so interviews that I recorded during my visits to Sri Lanka, only once did the recording actually fail.

The balance between transparency and integrity will always be a double-edged sword, but I find it a good idea to keep some informants anonymous. Two aspects where replayable audio files definitely can add some value are:

- In the translation and retranslation of interviews conducted in local languages since there is never any option of taking notes in languages that you do not understand.
- In the further iterative data analysis, the different files in the same research category can be wound, rewound and compared.

One important task for the researcher is to become thoroughly familiar with the data by reading and re-reading the material and, when some time has elapsed since the data was collected, there is also a need to refresh the researcher's memory (Denscombe, 2010). For these purposes the recorded MP3 files have been frequently used in this study. Close listening to audio files in combination with rereading the field notes was useful in the early

analysis phase when chunks of raw data were used to create categories. All digitally recorded interviews that are used in this thesis are stored at: <http://people.dsv.su.se/~mozelius/thesis/>.

File names are the same as those given in the separate section for “Recorded interviews in MP3 format” at the end of the thesis. The MP3 format was chosen because it is an open standard that can be played on most existing computer platforms without any additional software.

3.5 Participatory Action Research

The overall research approach has been a longitudinal case study but some of the embedded cases have been involving participation in the actual daily work in a role that could be described as Participatory Action Research. *Participatory* should here also include the aspect of looking at situations through the eyes of various participants and stakeholders and with *Action Research* defined as:

- Practical problem solving as well as expanding scientific knowledge
 - A cyclical method of planning, taking action, observing, evaluating and reflection
 - A seek to analyse and understand the changes in social situations and structures
 - A strive for improving the quality in human actions and focus on real problems
 - Rendering research results that could be reused and shared amongst participants
 - Respecting peoples integrity within an agreed framework of ethics
- (Cohen et al, 2007)

During my work in the AsiaLink eBIT and the NeLC projects (eBIT and NeLC projects, 2007) and my 18 visits to Sri Lanka from 2005 to 2012 I have been involved in several activities for practical problem solving. Most of these activities have been carried out at the University of Colombo but there have also been shorter collaborative session during my visits to universities, telecentres and primary schools in others parts of the island.

At the UCSC I have developed and assessed digital learning objects that later have been used in the eBIT and FIT programmes. An example of cyclical planning, taking action, observing, evaluating and reflection in the solving of a real needs based problem is the development of the eNOSHA online repository system. The work was conducted as a Design Science project carried out iteratively in a Scrum team collaborating sometimes face to face in Colombo, sometimes on a distance with online meetings.

Working in the Swedish – Sri Lankan aid projects I have also been participating in board meetings at the UCSC and development workshops outside the university where e-learning strategies have been discussed. In 2007 I joined the workshop for curriculum development in Negombo where I contributed to the construction of the syllabus for a new programming course in the eBIT programme. Together with some Swedish colleagues I attended the Kandalama evaluation workshop in 2008 where semester 3 and semester 4 of the eBIT bachelor programme. In 2010 I got invited to participate in the planning of the content development for the FIT programme where I later was part of the evaluation team when the courses were assessed and optimised.

3.6 General Data Analysis

In the early analyses, chunks of collected data were sorted and labelled depending on the actual content, resembling what is referred to as open coding in grounded theory (Denscombe, 2010). Later, the results of this initial coding were aligned and gathered in broader categories in a more selective coding, where key components are building up relevant concepts with interrelations. In this iterative analysis process, the constant comparative method has been used (Denscombe, 2010). This has been a suitable and useful method for the creation of the conceptual framework that is depicted and described in section 1.5, where entities and their relationship have been iteratively elaborated and refined.

Another frequently used technique was to take field notes and to write memos (Bryman, 2011). Field notes in combination with close listening to the recorded MP3 interviews were used for the first data analyses, the results of which were documented in memos. The writing of memos was to serve later as a documentation of the categories and concepts found. Memos also acted as a results collection for further reflection and refinement, and in the work with this thesis the memos were often expanded later into research articles presented at conferences for feedback.

The general idea was to record as much as possible of the interviews conducted (with the consent of the informants) and to always take field notes for the more important or unexpected findings. One principle was to listen and relisten to recordings as soon as possible after collecting the data. Close listening to recordings, with winding and rewinding back and forth, was often done while travelling to and from remote ICT4D hubs and during flights back home to Sweden. The underlying idea here was always to analyse the data when the interviews, dialogues and impressions were still fresh in the mind, and before returning to Sweden. Important main findings from the analysis were then aligned and compared in the process of writing memos.

The interpersonal comparison between my prime analyses in the memos and those conducted by other Swedish and Sri Lankan research colleagues was done in the process of writing common research papers. Starting in 2008, all visits to Sri Lanka resulted in at least one research article and the eight articles compiled in the thesis are a selection from more than 20 articles written together with other ICT4D researchers. Most of these articles were deliberately presented at conferences in South Asia where ICT4D and eLearning have been major conference themes, to get feedback on conclusions and concepts from other researchers familiar with the research field and the cultural contexts. To write articles together with Sri Lankan researchers can also be seen as informant triangulation, where collaborating authors give their views on the concepts found and validate or reject the outcomes of my analyses.

3.7 The Flip-flop Technique and Triangulation

To strive for a reduction of subjective personal opinions in interviews and questionnaires, the concept of flip-flop originating from grounded theory (Gibbs, 2010) has been used. Flip-flopping in this context means that in most of the research areas, interviews were conducted with several stakeholders at different levels in the projects involved, and sometimes on the same level but geographically and/or socially spread. As an example, I have in the OLPC initiative discussed the same issues with:

- Teachers at various OLPC schools
- Pupils with a different mother tongue at different OLPC schools
- The pupils parents
- Support staff
- Content developers
- The Director of ICT at the Ministry of Education

Another aspect of the Flip-flop technique is to compare the opinions at universities and grass-root level with the government's public presentations in local media. The Flip-flop techniques used could also be seen as triangulation by *data triangulation* and the use of *informant triangulation* (Remenyi, 2012). Triangulation in general is the attempt to look at the situation through a number of different lenses to confirm similarities and discover contradictions (Denscombe, 2010).

Originally, triangulation was a technique used mostly in quantitative research, but later the technique has also been used in qualitative research in ethnography and other fields of social science (Bryman, 2011). Data triangulation has in this study been implemented by the use of multiple data collection techniques, where interviews have been combined with observations,

photography and document studies. When the findings from complementary data sources have concurred, this has given a fuller picture of the studied case and also contributed to improving the accuracy by data validation. Informant triangulation is also a way of strengthening the internal validity (Remenyi, 2012), or, as it is called in a qualitative study like this, *the credibility* (Bryman, 2011).

3.8 Local Media Studies

ICT4D is a new field of research with a lot of shortcomings and relatively few grand theories. Compared to other areas in social science, there is a scarcity of literature and the proposed multidisciplinary approach has not really been implemented (Raiti, 2006). To get useful and updated information, I have during my 18 visits to Sri Lanka always tried to follow the ongoing discussions on ICT, education and development in the local media. Ideas in articles and TV programs could then be followed up and elaborated by questions in interviews and discussions with university staff.

Even if the Sri Lankan media are to a certain degree filtered by the government, there have always been journalists who have very openly presented and analysed interesting concepts. It has also been of value for interviews and observations to get familiar with the Sri Lankan terminology in the fields of IT and education. The terms used are sometimes not exactly the same as in Europe and the English is not always consistent. ICT and eLearning are young phenomena in Sri Lanka and I have found mass media to be an interesting complement to the relatively few research articles on technology enhanced learning in the country.

3.9 Research Ethics

When you are conducting research in a foreign country with different cultural references it is not always easy to understand which borders should not be crossed. I have always tried to respect people's integrity and never to force someone into conflicts in the organisation where they are employed. But in interviews I have seldom avoided the so-called "*dangerous-to-the-later-relationship*" questions (Wengraf, 2001) when I have felt that there were no obvious risks. People in public positions are mostly mentioned by name while teachers and grass-roots activists have been kept anonymous. The schools in the Sri Lankan OLPC project have also been mentioned by their real names, which has been criticised by reviewers in the research journal where the articles are published. My opinion is that the schools would have been easily identified anyway in a pilot project with only 13 schools, and

during my visits to the schools I have met more pride than shyness from the principals, teachers, technical staff, students and parents involved.

Corruption is a fact in Sri Lanka as in most other South Asian countries, at micro as well as at macro level (Daily Mirror Business, 24/12/2011). In private companies and the public state bureaucracy, bribes are common (Transparency International, 2011). On the other hand, Sri Lanka has a long tradition of hospitality and politeness in social life. In my research I have sometimes paid for lunch and dinners for informants and collaborating researchers but never in situations where I have felt that I have "*bought*" information or anything similar.

4. Some Selected ICT4D Hubs and eLearning Concepts

In Sri Lanka the *Free Education Scheme* was introduced as early as in 1945. This reform has contributed to the fact that the country has one of the highest literacy rates in Asia and a very high percentage of the population attends the secondary school programmes. But the university model has remained highly elitist and far from all secondary school students pass the O- and A-level exams. The actual intake for 2009 was 19,650 and the number of students that were left out of the system that year was more than 100,000 (Warnapala, 2009).

Therefore the challenge is to find alternative paths to get a qualification for university studies and this can be done only through the use of distance education and eLearning. Sri Lanka has to ensure a more efficient use of public resources to open up more opportunities for higher education (Gaiani et al, 2009b).

4.1 Colombo Centred Distance Education

at the same time can be seen as the strength and the weakness of the early distance education initiatives described below is that they have all been designed, started and more or less conducted from the University of Colombo. Infrastructure and Internet access were, and still are, better in the capital of Sri Lanka than is the case in the island's rural areas. Learning activities that can be smoothly executed from a computer in Colombo might not run at all in the Sri Lankan countryside.

The two most important Sri Lankan universities in the field of IT and computer science have been, and still are, the University of Colombo and the University of Moratuwa. For many years, the University of Moratuwa has had a focus on hardware, while the University of Colombo, School of Computing (UCSC) has specialised in software engineering and system development (MP3-Jayaweera, 2011). In this thesis some of the main pillars are digital content development and the dissemination of e-learning. For that reason there will be a clear focus on UCSC and UCSC based initiatives.

The BIT Programme

In the last years of the 20th century there was an increasing demand for IT graduates in Sri Lankan industry. At that time the traditional university system could not increase the intake for their IT programmes. To address this problem, the Bachelor of Information Technology (BIT) degree course started at the University of Colombo in 2000. BIT was designed as an external programme without any actual teaching at the university in Colombo (Wikramanayake et al., 2007). They constructed the syllabi and were responsible for the curriculum, but for lectures and teaching sessions the students had to attend facilitating places and teaching institutes (MP3-Nishakumari, 2011).

The intake enrolment was high from the beginning with more than 5000 students in the yearly BIT batches, but the pass rate was, for some years, below 2%. Even if pass rates in general are lower on in distance programmes, this was not an Neither was there much e-learning in the BIT program and the Internet-based resources were mainly a static web page from which the students could download a digital study guide (MP3-Gamage, 2011).

In 2002, when the University of Colombo's School of Computing (UCSC) was founded by Professor V. K. Samaranayake, the BIT program started to move in the direction of eLearning. UCSC was started as a merger between the Institute of Computer Technology and the Department of Computer Science at the University of Colombo (Mozelius & Hatakka, 2009). In the inception phase, UCSC had a staff with a lot of knowledge about computer science and traditional technology, but less experience and skill in eLearning techniques.

The eBIT Program

The next important step towards an e-learning based IT Bachelor degree was not to rename the programme but to introduce a Learning Management System (LMS) and provide the courses with learning objectives (MP3-Gamage, 2011). The first LMS was the Swedish-developed *The Education* platform, a system that might be classified as more of an e-learning content management system for individual student access to learning material than an LMS, with a computer-supported collaborative learning environment. *The Education* was also a licensed system with fees that were affordable in Sweden and Europe but expensive in a developing country like Sri Lanka (MP3-Weerasinge & Hewagamage, 2011).

As a continuation of a series of earlier Swedish-initiated ICT4D projects, the *Asialink eBIT* project started in late 2005. This project was to focus on activities that concern both education and technology in the field of e-learning with an overall objective:

“To satisfy some of the demand for work force created in Sri Lanka by the expansion of ICT-related economic sectors.”
(AsiaLink/eBIT project 2005)

This was to be addressed by stimulating curriculum changes to increase the eBIT pass rate from 2% to 5% (Mozelius et al., 2009). During 4 years of Dutch-Swedish-Sri Lankan collaboration, a more complete e-learning platform was constructed with support functions aiming to facilitate the study situation. One of the first changes in the AsiaLink programme was to replace the LMS with the Open Source Virtual Learning Environment (VLE) Moodle (Moodle.org, 2012). To support the shift from teaching to learning, there was a need for a new e-learning platform to enable inter-student communication and support collaborative learning (MP3-Hewagamage, 2011).

The first phase of the project had a focus on curriculum development, where new more detailed syllabi in combination with a more activity-based course design certainly improved the quality of the eBIT programme. The pass rate started to rise but there still remained problems in the areas of student support, flexibility, teaching and learning activities, access, students' academic confidence, localization of content and attitudes to e-learning (Andersson, 2008). Considering the main problem with the low pass rate, people who worked in the eBIT project and at the eLearning Centre found that an important bottleneck was the students' lack of skills in:

- English
- Mathematics for Computing
- Fundamental Computer Science
- Self-learning in virtual online environments

The Foundations of Information Technology (FIT) Programme

In a three-year IT Bachelor degree the initial phase can be very hard for a student who lacks basic knowledge of the computer's architecture, given its daily use for word processing and spreadsheet software. Deep knowledge of mathematics is not a criterion for successful studies, but skills in the fields of the mathematics used in programming and database management are certainly valuable. The FIT programme was not particularly widespread during the first years after its launch, but, according to the communication between facilitators and the students who have enrolled on these bridging courses, has been useful and appreciated (MP3- Rahuman & Ramberg, 2011).

The FIT programme was designed as a bridging programme for students who had problems passing the ordinary A-level exam. These courses where students can learn basic computer science, mathematics and English for IT are also of interest for a broader target group than the potential eBIT students. But the FIT programme has not been promoted, since it would probably attract a lot of students and there are for the moment no resources for staff to handle the examination (MP3-Wikramanayake, 2011).

English in an online environment was a new concept and when the FIT courses were developed the instructional designers did not really know how to handle sections with exercises on pronunciation and conversation. Later, *Voice Forums* were introduced, where students could submit and store audio files with recorded exercises. These files could be accessed and assessed by teachers and facilitators and also posted to other forums and shared with course mates. This was an interesting construction, but so far no sound files have been uploaded in the FIT English course. As in many other online and distance education contexts, there seems to be a shyness barrier that has to be broken (MP3-Gunawardene, 2011).

4.2 The National eLearning Centre

Technology enhanced learning and distance education has rapidly grown in many developing regions and open universities can now reach a far larger population than in the 20th century (Dhanarajan, 2001). But the development of high quality e-learning content is now more time-consuming and costly (Boyle, 2003; Pagram & Pagram, 2006). Universities and other educational organisations in developing countries need to deal with these issues if they are to be able to deliver education of a high quality.

To address these challenges, a UCSC-based e-learning centre was started, at the same time as the department was founded in 2002, to support the transformation of BIT material into interactive e-learning content to support the curriculum development and to make eBIT an improved alternative for external studies (Mozelius & Hatakka, 2009). At the same time that there was ongoing collaboration with Swedish experts, the eLearning Centre also received Japanese support, and was in dialogue with Australian universities (MP3-Wikramanayake, 2011). Important tasks for the early eLearning Centre were to implement the curriculum changes and to develop aligned activities and learning objects. After the migration to the Moodle virtual learning environment, all the learning objects, on more complex aggregation levels, were to be stored in *SCORM format*. At the eLearning Centre, a model for rapid and efficient content development was established. A priority at the eLearning Centre has been to always deliver and keep deadlines, and sometimes quality has not been the primary objective (Mozelius & Hatakka, 2009).

The eLearning Centre's rapid development model can be seen as a conveyor belt where the involved actors have strict and defined roles in the content development process. Syllabi based on chosen course books are designed by Subject Matter Experts (SMEs) and later passed on to Instructional Designers (IDs) as the blueprint for the aligned course content. Each syllabi-

bus is later broken down into smaller chunks of activities by IDs. Interactive learning activities are then designed as story boards by the IDs and passed on to the Content Developers (CDs) for the actual implementation. To be efficient and be able to deliver quickly, CDs often use templates in Flash, HTML and JavaScript or redesign material retrieved from the Internet.

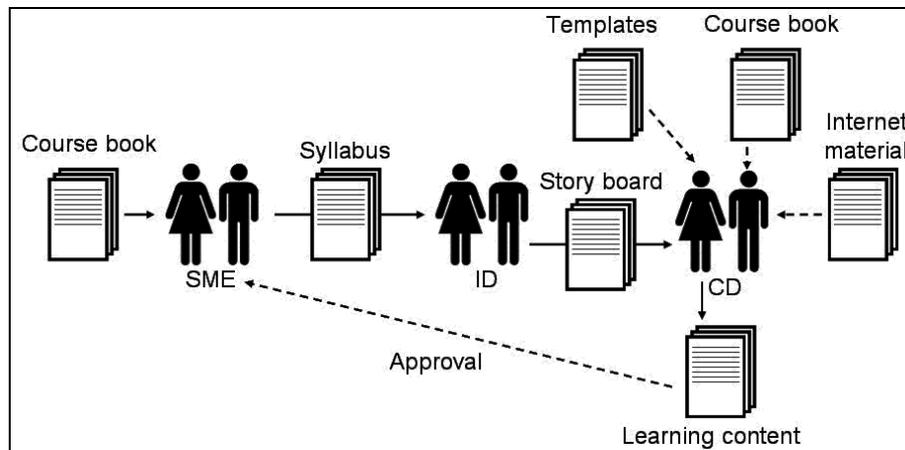


Figure 7: The Conveyor Belt Model for Digital Content Development
Graphics by Mattias Hatakka

The conveyor belt model can be criticized as concerns quality aspects (Mozelius & Hatakka, 2009), but when it comes to fast content development it has proved to be an efficient way of working. In the more than 50 new courses that have been designed and developed since the inauguration of the eLearning Centre, most of the learning objects have been created and stored in the Moodle platform or on local hard drives.

In a longer perspective, it is not a rational solution just to store developed content in a virtual learning environment without any structure, metadata or search mechanisms. Discussions held in the European–Sri Lankan eBIT project in 2006 and 2007 on how to store digital learning objects more efficiently later resulted in a Learning Object Repository (LOR) group. Based on these discussions, a needs analysis was conducted by a focus group in the Swedish–Sri Lankan NeLC project founded in December 2008 and February 2009. The focus group was a mix of Sri Lankan subject matter experts, content developers, instructional designers, software engineers, administration staff, students and Swedish eLearning experts. The main objective of the focus group was to specify which needs and goals UCSC has for the future storage of digital learning objects

4.3 Open Content and Learning Object Repositories

Today when distance education is changing and online courses can reach larger audiences (Dhanarajan, 2001) the idea of sharing OpenCourseWares and Open Educational Resources (OER) is interesting (Caswell et al., 2008). In the 21st century when prestigious universities like Massachusetts Institute of Technology and Kyoto University amongst others have opened up course material, it opens new opportunities to fulfil the declaration in United Nations Article 26 of the Universal Declaration of Human Rights. Article 26 says that everyone has the right to education, and that "*technical and professional education shall be made generally available*" (UN General Assembly, 1948). There are also new licences for open content like the GNU Free Documentation License and Creative Commons to support developers of open resources (Caswell et al., 2008).

Universities and educational organisations in developing countries have a number of challenges to address (Andersson, 2008; Rajesh, 2003) and if developing regions are to enhance their distance education there is a need to deal with the cost aspect of content development. At a time when e-learning is expanding fast in many countries, it is important to find models for storing digital learning objects as well (Hatakka & Mozelius, 2009). For the moment, there are no global solutions that fit all e-learning initiatives and there will always be a need for local adaptation of the digital content (Albright, 2005; Hatakka, 2008).

There is today a lot of open content available on the Internet and the problem is mainly how to find the resources and even more how to find appropriate quality resources (Albright, 2005; Unwin, 2005; Larson & Murray, 2008). One of the most important aspects of open content and its searchability is metadata (Hatakka & Mozelius, 2009). Metadata helps users to store, find and access content that is relevant to their teaching and learning and level of education.

The 50 new courses that have been designed and developed at the UCSC eLearning Centre are composed of thousands of learning objects at various *aggregation levels*. When the total number of learning objects grows, the need for a LOR to sift the information also grows. A LOR is a software system where learning objects can be stored with relevant metadata to make the learning objects searchable and reusable. LORs can be categorised into:

1. *Content repositories*: All learning objects are stored on accessible servers

2. *Linking repositories*: Portals with links to content provided by others
3. *Hybrid repositories*: A combination of 1 and 2

(McGreal, 2008)

The definition of a learning object is broad and not very clear; the most common one is “*any reusable digital resource that is encapsulated in a lesson or assemblage of lessons grouped in units, modules, courses, and even programmes*” (McGreal, 2004). With such a common definition there is a need to divide learning objects into various granularity categories. The granularity levels or aggregation levels of learning objects are specified differently at different universities and in different educational contexts (Mozelius & Hettiarachchi, 2012). For the learning objects developed at the UCSC eLearning Centre the levels are:

- **Atom**: The smallest level of aggregation, like images, text files or animations.
- **Collection of atoms**: A combination of atoms, like a HTML document with embedded pictures or an audio recorded lesson with exercises.
- **Course module**: A complete course section including collections of atoms.
- **Full course**: A full course that include all the course modules for a specific course.

4.4 The eNOSHA System

To specify the actual goals and requirements for a LOR system at the eLearning Centre, a needs analysis was conducted. Data was collected through workshops with focus groups on two separate occasions in December 2008 and February 2009. These focus groups mainly consisted of content developers, instructional designers and management staff from the UCSC in collaboration with Swedish consultants working in the NeLC project. The main agenda items for the focus groups were to specify needs and goals for a UCSC-specific LOR and how a metadata set should be designed (Hatakka & Mozelius, 2009).

Metadata is important for describing the various types of resources and to help users to understand in which educational contexts the objects are suitable (Albright, 2005). Describing the content with metadata is not without its own problems if the metadata set is to secure user acceptance (Attwell & Pumilia, 2007). After a workshop test of available learning object repositories, the decision was taken to create a new UCSC-specific metadata set that

should also be flexible and compatible for future use in more global contexts. The main steps to design a new metadata set were as follows:

1. A tentative design was sketched by the Swedish participants based on existing literature on metadata and reuse of learning objects
2. The draft was presented to the focus group at the workshop in December 2008, where each entry in the set was discussed and related to the actual needs
3. As a result of the workshop discussions, changes were made to the draft based on the input from the stakeholders in the focus group
4. The updated metadata set was mapped against digital learning objects developed at the UCSC to check if the new design was able to handle all types of course content
5. Results from the mapping workshop were used for a new redesign sent to the focus group for final approval in February 2009
6. After some fine tuning the metadata set was approved by the focus group

(Hatakka & Mozelius, 2009)

During the workshops in December 2008, some participants in the focus groups also made a comparative test study of existing free and open LORs to investigate which available system might meet the UCSC requirements. Since the linking repositories or hybrid repositories described above are not suitable for UCSC, or any other organisation with a large-scale production, all the analysed LORs were from the category of content repositories. The final analysis showed that none of the examined software systems passed the tests and flexibility was the critical point where most systems failed (Mozelius & Hettiarachchi, 2012).

Licensed software with high fees could not either be considered a good choice for universities in developing regions, and systems where the source code is closed or not available were disapproved as well, so as not to exclude future extensions and adaptations. Some of the tested systems also behaved unstably and unpredictably, which must be avoided if a LOR is to be a supportive base where robustness as well as usability is essential. The final outcome from the conducted workshops was to build a new LOR based on the created metadata set (Hettiarachchi et al., 2010).

Within the framework of action research (Davison et al., 2004; Kock, 2007), a software development collaboration started in 2009 between UCSC, Stockholm University and Örebro Business School in Sweden. The main objective of the project was to build a user-friendly e-learning repository for online storage where learning objects would be easy to find and reuse and as context-neutral as possible. Some of the most important goals can be found

in the acronym **eNOSHA**: **e**Learning **N**eutral **O**nline **S**torage with a **H**olistic **A**pproach. eNOSHA later became the name of the development project as well as the name of the final system. The eNOSHA project was part of the NeLC project, with the overall objective of establishing a new national eLearning Centre in Sri Lanka (Hettiarachchi et al., 2010).

A software development project is an iterative process, where evaluation, redesign and updating should be based on various kinds of testing (Mozelius & Hettiarachchi, 2012). New features and algorithms need unit and integration testing and, to improve usability and user-friendliness, there must also be continuous user testing. The eNOSHA system is also a modularised system, where each and every module is tested and debugged separately before being tested all together as a complete system. Evaluation of the system's usability was conducted by use scenarios created by the project members in combination with interviews with test users. (Mozelius & Hettiarachchi, 2012)

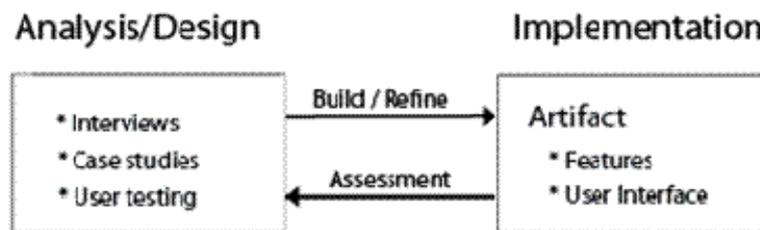


Figure 8: The iterative process of assessment and refinement

In software development the agile method Scrum (Schwaber & Beedle, 2001) was used for an iterative and incremental process in which details can be discussed and redesigned during the project. The Scrum meetings were always daily, as prescribed in the Scrum theory. When the project members were collaborating long-distance, the meetings were held less frequently and online as *Skype conferences*. All the software development and testing was done in 30-day iterations, which in the Scrum terminology are called sprints (Schwaber & Beedle, 2001).

The eNOSHA is designed with the ambition of creating a software system that can be used in various kinds of organisations and not only a university repository. Courses in other educational contexts will certainly not be divided in the same way as they are at UCSC, and the metadata set contains fields where languages, categories and other properties can be modified and ex-

tended. One of the most important design goals was to build a flexible LOR that should not only be tailor-made for the UCSC eLearning Centre. Adaptations and fine-tuning to other contexts should be possible within the system without any changes in the source code, which would make the system useful and reusable in other developing countries. Important issues in the design for flexibility were to have features for:

- Handling various type of content at various aggregation levels
- Open and closed content to be stored in the same LOR
- Different user roles with different needs and permissions
- Enabling internal and external users to share the same installation

(Mozelius & Hettiarachchi, 2012)

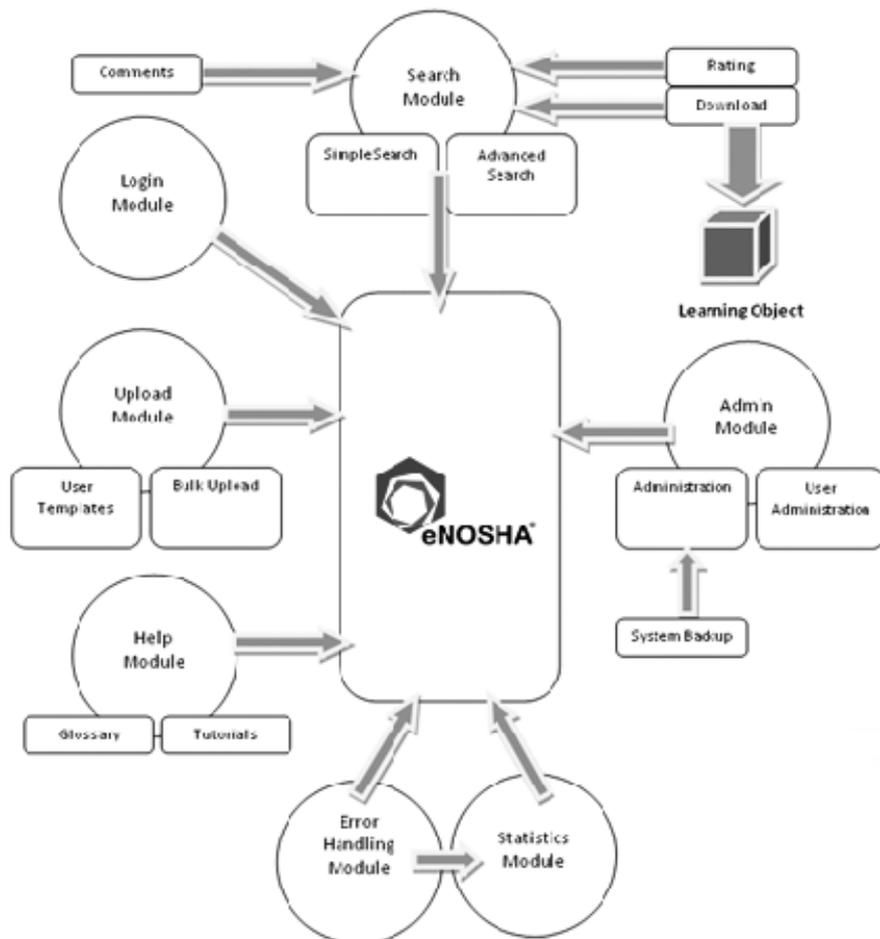


Figure 9: eNOSHA System Core Modules Graphics by: Isuru Balasooriya

The eNOSHA system is designed with the idea of dividing the most important functionality into separate core modules that can be extended with auxiliary units. Different universities and organisations have different needs and not all the additional modules have to be used by everyone. An example of an additional module is the *Moodle module* (Mozelius et al., 2011a), which was designed and developed later to integrate the repository with the Moodle virtual learning environment (Moodle.org, 2012). An online demo version of eNOSHA version 1.8 can be accessed at: <http://enosha.dsv.su.se/enosha/>

4.5 eSri Lanka and the Nenasala Telecentre Network

Various ICT based initiatives started by the Sri Lankan Information and Communication Technology Agency of Sri Lanka (ICTA) were later put together under the umbrella of *eSri Lanka*. The common vision that should be realized through a coordinated six programme strategy that:

“... encompasses ICT Policy, Leadership, and Institutional Development Programme, The Information Infrastructure, Re-engineering Government, ICT Human Resource Development, ICT Investment and Private Sector Development.”

(eSri Lanka, 2011)

The main objectives are that eSri Lanka should contribute to “*develop the economy of Sri Lanka, reduce poverty and improve the quality of life*” (eSri Lanka, 2011). One of the initiatives in eSri Lanka is the Nenasala telecentre network, a project that aims to meet the infrastructure requirements in rural areas and address the information and communication needs region-wide through the establishment of telecentres to provide ICT based eServices (Nenasala, 2010). Technology enhanced learning and eServices are rare phenomena in rural areas (Gamage & Halpin, 2007). The Nenasala network was launched to provide access to ICT for people in rural regions in Sri Lanka and with the main objectives of:

- poverty reduction
- peace building
- social and economic development (Nenasala, 2010)

Nenasala is a Sinhala word that means a centre for knowledge and Nenasala is the brand name for the 600 community-driven telecentres in rural Sri Lanka. The overall aim is to reduce the internal digital divide, develop culture and promote commerce and community integration. Nenasala telecentres are equipped in several ways but normally with 2–4 computers and a printer. Many telecentres, but not all, have satellite broadband Internet access (Meegammana et al., 2010).

There were different telecentre implementations on the island before the launch of the Nenasala network and in the inception phase a lot of different organisation models were tried. Telecentres were often, and still are, started and housed in collaboration with existing local organisations (MP3-Wijayawardhana, 2008). Three currently common models for telecentre organisation in Sri Lanka are:

- The Temple model
- The Family model
- The Entrepreneur model

(Gaiani et al, 2009b)

In the *Temple model* the computer hall is located close to Buddhist temples and even if the monks are not conducting the ICT training they are involved in the daily organisation of the telecentre. Sometimes, as in the Thalakumbura Telecentre located in a Buddhist temple in the Badulla district, the younger priests also attend the IT training (Meegammana et al, 2010).

Nenasalas with a *Family model* for organisation are run at the homes of one or usually several family members. Longer or shorter courses and teaching sessions are given in the families' houses or apartments in the evenings and at weekends.

The *Entrepreneur model* can have many shapes, but one interesting and working solution can be found in the Etampitiya Telecentre in the Sri Lankan Hill Country, where two young innovative software developers are the organisation team. One of the managers is of Tamil origin and the other is Singalese. At the same time as providing IT training for visitors of both Tamil and Singalese origin, they also run a business providing low cost computers in the region. (Gaiani et al, 2009b)

4.6 One-to-one computing and the Sri Lankan OLPC Initiative

One-to-one computing has been popular as well as frequently discussed in the fields of primary school e-learning and ICT4D (Pal et al., 2009). The basic concept of one-to-one computing is to provide students with individual laptop computers. In most implementations this has been combined with Internet access and ideas of sharing content, though not sharing computers. Some examples of low-cost laptop brands tailor-made for one-to-one computing are Intel Classmate, Asus Eee PC and the One Laptop Per Child (OLPC) XO computer. Different versions of the one-to-one computing concept have

been implemented in the developing world as well as in several developing countries (Tedre et al., 2011).

Sometimes the one-to-one computing initiatives are linked to curriculum development and pedagogical ideas like a shift to self-learning or project-based learning. But none of the one-to-one computing initiatives seen so far is holistic in the sense of explicitly looking at major curriculum development or changes in the educational systems involved (Tedre et al., 2011). Most studies on one-to-one computing have been conducted and published in the context of rich and developed countries. In an American study at a school in California, researchers found that the laptops introduced stimulated students and improved their literacy skills (Suhr et al., 2010).

Other analyses of initiatives in developing regions have mostly been more negative, with criticism of the costly investments in hardware and the absence of digital content and pedagogy (Unwin, 2010). In the Peruvian OLPC initiative, even the persons working in the project classify it as a failure (OLPC News, 2011). Recent research on technology-enhanced learning has shown that investment in new technology alone is unable to bring about any radical improvement (Greaves, 2012). In one-to-one computing, factors like teacher training, curriculum development and parental involvement are crucial and have to be considered (Tedre et al., 2011; Lehmann & Livingstone, 2012).

The Sri Lankan OLPC Initiative

As in many other countries, there have been several different concepts of one-to-one computing implemented on the Sri Lankan island. One example is the so-called *eVillage project* where Intel's Classmate computers are used in an initiative where students share computers with Internet access (MP3-eVillage, 2011). Another example is the One Laptop Per Child (OLPC) initiative, which is the project that this thesis will focus on. In Sri Lanka all of the primary schools involved initially provided one laptop per student, but computers later broke down and were not repaired or replaced. What makes the Sri Lankan OLPC model special is that there has been a chosen focus on digital content development in local languages instead of Internet connectivity (MP3-Gunadasa, 2011).

Initially, nine schools in nine different provinces were selected for a one year pilot with funding from the World Bank. The students in the schools are from different ethnic groups in schools located in poor rural areas where computers are not common in schools or in people's homes. In the setup and deployment of the initially 1000 XO computers, the OLPC Lanka Foundation collaborated with the Ministry of Education. Later, private sector funding enabled an increase in the number of XO laptops and an additional 350 units were purchased and distributed to another four schools.

The implementation and the computer-based teaching and learning sessions in these 13 schools were monitored by the Sri Lankan Ministry of Edu-

cation as well as World Bank officials (OLPC Sri Lanka, 2011). Digital content based on the primary school curriculum was developed in English for learning objects in mathematics and English and local languages. Later the developed content was translated into the two main national languages, Tamil and Sinhala, with different versions for different schools.

The XO computers' operating system *Sugar* was also localised to both national languages and all students can now work with laptops and learning material in their mother tongue. Teachers have received basic training in how to use the XO computers and how to lead teaching sessions based on the distributed digital learning objects (Rahuman & Wikramanayake, 2009). The Sri Lankan Ministry of Education has, unlike in many other OLPC implementations, chosen a model where the emphasis is on content development in local languages instead of a focus on Internet access and an online search for learning material (MP3-Gunadasa, 2011).

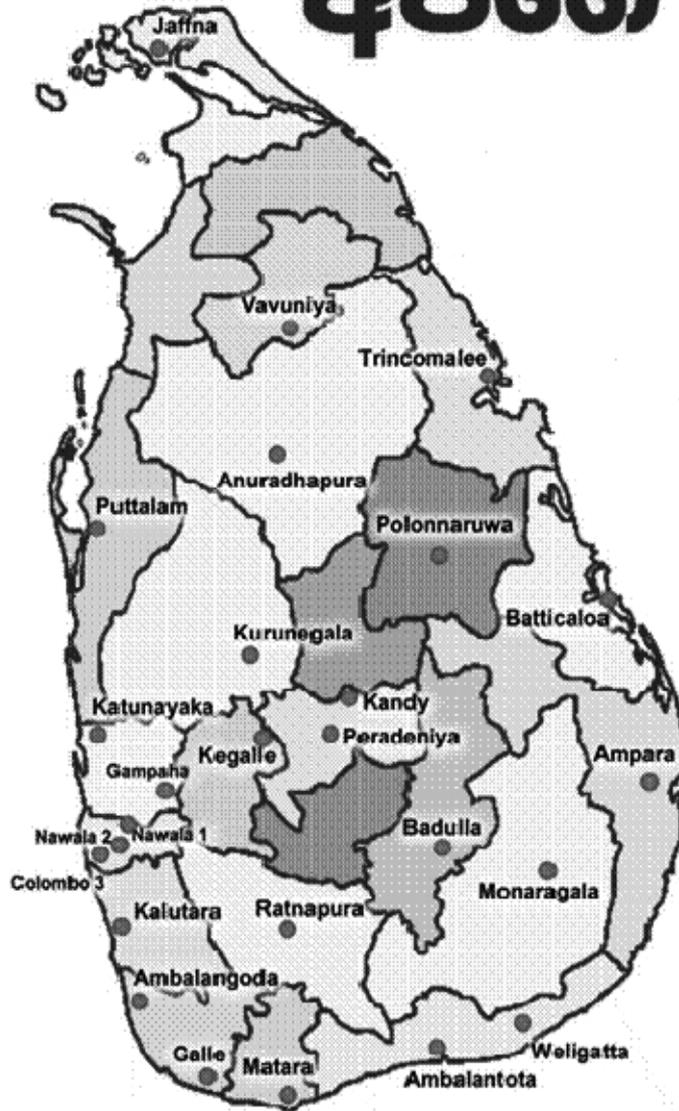
4.7 DEMP and the National Online Distance Education Centres

In 2003 the Open University of Sri Lanka (OUSL) received funding from the Asian Development Bank for modernising and digitising their distance education. OUSL has during the last 30 years experimented with different new forms of distance education (OUSL, 2011) and the Distance Education Modernisation Project (DEMP) is one of several initiatives. In the DEMP project, OUSL collaborated with the Sri Lankan Ministry of Higher Education. Part of the project was to develop infrastructure to support access to post-secondary education in Sri Lanka by the use of National Online Distance Education (NODE) Centres.

Another objective was to address the decreasing percentage of women in higher education in the 21st century. Women's representation in undergraduate enrolment rose from 47.7 % in 1978 to 54.4 % in 2006 and the introduction of online courses at the OUSL seems to match the female need for flexibility (Gunawardena & Karunanayake, 2008).

Every NODE Centre has 25 high-end computers connected to the Internet, with a wide variety of software (MP3-Nandasara, 2011). The DEMP project later became a white elephant, and of the initially planned 100 e-learning NODE centres with Internet access, only 26 were completed (MP3-Nandasara, 2011). There is no funding for setting up any more NODE centres, but the existing ones are used to support the *English for All* course where the distance education will be enhanced with traditional as well as blended learning teaching sessions at NODE Centres. (MP3-Nandasara, 2011)

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Figure 10: NODC Centres in Sri Lanka

4.8 The Jaffna Public Library

The seeds of a public library in Jaffna were sown in 1933 when K. M. Chellappa made some publications public in a room at his house in Jaffna. Next year, in June 1934, the Jaffna Library was formed at a meeting at the Jaffna Central College with the objective of establishing a free central Tamil library in Jaffna. In 1953 the library moved to its current location, where a new building that meets international standards was constructed with American, Indian and local funding (Thurairajah, 2011).

During the Sri Lankan civil war, the library was reduced to ashes twice. This happened for the first time when the building was torched in 1981 and later again in 1985 when the reconstructed library was destroyed by bullets and rockets from the fighting in the Jaffna war zone. In 1997 the then President of Sri Lanka, Chandrika Kumaratunga, decided to restore the library as part of the Sudu Nelum (White Lotus) movement (Thurairajah, 2011). The restoration was completed in 2002 and 10 years later the right side of the rear wing accommodates audio-visual multimedia facilities.



Figure 11: The Jaffna Library Multimedia zone Photo by: Peter Mozelius

4.9 Mobile Phones

The use of mobile phones has not been a major component in any of the Sri Lankan initiatives described above. Mobile technology in the islands e-learning will probably increase in the coming years and a World Bank funded PhD student will analyse the pros and cons of mobile learning at the UCSC as part of her thesis. So far, mobile phones are mostly used for traditional phone calls and text messages (SMS). In the eBIT and FIT programmes, a Moodle module has been developed at the NeLC for handling SMS reminders to students, announcing issues like schedule changes.

One main reason for the absence of mobiles in Sri Lankan eLearning, eHealth, and eGovernance might be the relatively low number of smart phones and the absence of more advanced e-services for cell phones (MP3-Megammaana, 2011a; MP3-Megammaana, 2011b). A cellphone-based system to support local fishermen has been developed at the Ocean University. The main purpose is to help fishermen to sell their catch to the currently appropriate market. This is a relatively young system and the functionality has not yet been fully evaluated (MP3-Jayaweera, 2011).

The breakthrough of smartphones happened relatively late in Sri Lanka in 2012-2013 when the fieldwork for this thesis was completed. In 2013, the number of smartphones has increased rapidly. One area where mobile phones have been used in a creative way is in eFarming. The older generation of farmers normally lacks computer literacy but can improve their work and income by retrieving useful information (De Silva et al., 2013; Walisadeera, Wikramanayake & Ginige, 2013).

5. Findings and Discussions

Findings addressing the four research questions are presented and discussed separately in sections 5.1 to 5.4, followed by more general findings in section 5.5. Finally, three surprising findings are described in section 5.6.

5.1 Which have been the main obstacles in the region-wide dissemination of blended learning in Sri Lanka?

The transformation of traditional education into eLearning and distance education must include more than just providing digital content and a traditional curriculum. In the early version of the BIT programme traditional material was digitised and linked from a simple website (MP3-Gamage, 2011). Lectures, teaching sessions and other course activities were only given by private study centres and facilitating places where students have to pay for activities and tutoring (MP3-Nishakumari, 2011). Facilitating places are common in urban areas but rare in rural regions. Without any online activities and online facilitating the pass rates in the first batches of the BIT programme were as low as around 2% in the large 5000 – 6000 students batches with few teachers or facilitators (Mozelius et al., 2009).

The most obvious bottleneck for region-wide dissemination of ICT supported blended learning is the limited bandwidth and the high fees for Internet access. This has been a crucial issue in formal university education (Mozelius & Hatakka, 2009) as well as in informal lifelong learning (MP3-Haldemulla_Manager, 2011). In 2009 when the BIT programme had been updated to the computer supported eBIT version with a new curriculum based on online activities only 3,6% of the Sri Lankan population had Internet access (CIA, 2009). The Internet infrastructure has improved since then, but the official figures are not always equal to the actual performance (Daily News, 03/03/2011) and there are huge local differences in costs as well as access (Mozelius & Megammaana, 2011a).

Sri Lanka is a former British colony where English has been the official language since the 19th century and is also a condition for career opportuni-

ties (Yogasundram, 2008), but there are large variations in citizens' English skills. The language barrier is a fact when it comes to tertiary education (Mozelius et al., 2011b; MP3-Gunawardena, 2011) and at a lower level there is a need to develop digital content in local languages (Mozelius & Megammaana, 2011b; MP3-BlackwoodOLPCSchool_TeacherTeam, 2010; MP3-KalagahagewelaOLPCSchool_TeacherTeam, 2012).

Further obstacles for university studies in IT that were identified in the course evaluations of the eBIT/AsiaLink project are lack of skills in basic computer science and mathematics. Both these issues and the language barrier were later addressed in the FIT bridging programme. The FIT programme has been successful when it has been given and students acquire valuable preknowledge for further university studies (Mozelius et al., 2011b). But since its introduction, there has been no-one working on the further promotion or examination of the FIT courses (MP3-Wikramanayake, 2011). The FIT and eBIT programmes give a solid knowledge grounding in the field of IT and an interesting idea could be to offer some of the courses in collaboration with telecentres (MP3-TelecentreManagerAvisawella, Dec2013).

At university level, there are skilled experts employed to handle the maintenance for both software and hardware issues, but in ICT4D hubs outside the university domain this is a problem (MP3-Telecenter_Manager, 2010; MP3-TelecentreManagerBoralagoda, 2013). There can be an official plan for maintenance (MP3-Gunadasa, N._SriLankanOLPC, 2011), but in actual situations the process can be slow especially for XO computers in the OLPC initiative (MP3-SeelaratraVidyalayaOLPCSchool_Principal, 2011; Mozelius et al., 2012). A support model for hardware as well as software maintenance is a critical issue for both OLPC schools (Tedre et al., 2011) and telecentres. An example of inefficiency is when a telecentre with only 2 working computers and groups of 20 students have to repeat teaching sessions up to 10 times (MP3-TelecentreManagerBoralagoda, 2013).

Finally, digital content in local languages is another critical point (Tedre et al., 2011) and the teaching material that has been developed in Sinhala and Tamil has been appreciated (MP3-Blackwood_OLPCSchool_TeacherTeam, 2011; Mozelius et al., 2011b), but updating, extending and sharing digital content is not implemented (MP3-Haldemulla_Telecentre_Manager, 2011; MP3-JaffnaOLPCSchool_TeacherTeam, 2012). There is a need for content in Sinhala as well as in Tamil and, to support the idea of "language harmony", multi-lingual content should be distributed to the ICT4D hubs (Mozelius et al., 2011b; MP3-SeelaratraVidyalayaOLPCSchool_TeacherTeam.mp3, 2011).

5.2 How should ICT4D hubs be designed to support a region-wide dissemination of eLearning, content and knowledge sharing?

The importance of content in local languages should not be underestimated and in primary schools and telecentres this is a prime condition. The choice to focus on content development aligned to the national curriculum in the Sri Lankan OLPC initiative seems wise, but the amount of exercises is limited and it is not possible for teachers to update or extend the digital learning objects (MP3- Blackwood_OLPCSchool_TeacherTeam, 2011; MP3-KalagahagewelaOLPCSchool_TeacherTeam, 2012). The teachers and principals in the OLPC schools visited also complain about the absence of Internet access and that the delivered server computers are not used at all (MP3-JaffnaOLPCSchool_Principal, 2012; MP3-Palmunia OLPC_TeacherTeam, 2011). The design of ICT4D hubs must be a combination of technology and pedagogy plus a mix of hardware, software, tailor-made content and appropriate teaching and learning sessions. ICT support has opened up new forms of e-learning and distance education, but a blended learning mode with a mix of learning and teaching activities is preferable.

Software could be stored in repositories and distributed via the Internet and, for the same reasons that universities today depend on Internet access, eLearning in telecentres and primary schools has more or less the same needs. For sharing experiences and best practice, the OLPC staff in Jaffna in the north bought tickets with their own money to visit another Tamil-speaking school in the OLPC initiative on the Sri Lankan east coast (MP3-JaffnaOLPCSchool_TeacherTeam, 2012). With the use of the distributed servers and Internet access, the OLPC schools might also share digital content and Tamil-speaking schools and telecentres should be able to download files and share content with Tamil-speaking institutions in Tamil Nadu in India (MP3-Haldemmulla_Telecentre_Manager, 2011; Mozelius & Megammaana, 2011a).

The collaboration between different ethnic groups communicating in various languages does not seem to be the main problem, and the challenge is rather to provide communication channels and content in local languages (Mozelius & Megammaana, 2011b). In Sinhala-speaking primary schools, staff and pupils are interested to have content in Tamil and English as well (MP3-Seelaratna_VidyalayaOLPCSchool_TeacherTeam.mp3, 2011) and the same goes for Sinhala content in the visited Tamil-speaking schools (MP3-Blackwood_OLPCSchool_TeacherTeam, 2011). The future primary schools should better be multi-lingual to support the idea of language harmony (MP3-SeelaratnaVidyalayaOLPCSchool_TeacherTeam.mp3, 2011).

ICT4D hubs like telecentres must have different organisation models (Gaiani et al., 2009b) building on local conditions and opportunities, where the local community should be involved in design as well as ownership (Gaiani et al., 2009a). Regarding sustainability, a multi-purpose telecentre setup (Gaiani et al., 2009) is preferable to a hub that depends on a limited number of activities (MP3-TelecentreManagerAvissawella, 2013; MP3-TelecentreManagerBoralagoda, 2013). Sometimes there is a clash between the organisation model and the multi-service ambition, as in the Temple model (Gaiani et al., 2009b), when business and commercial services are not allowed in a Buddhist temple (Mozelius & Megammaana, 2011a). From a European and more secular perspective, it seems strange when religion interferes with education, such as when a teaching and learning activity is interrupted by a prayer broadcast over the school's loudspeaker system (MP3-Palmunai_MiddayPrayer, 2011). Another question of religious harmony is why the Ministry of Education only has Buddhist decorations in its main building. Religious independence and ethnic independence would be preferable, but pragmatism is often what makes ICT4D hubs work and collaboration between various ethnic groups can be a fruitful (Mozelius & Megammaana, 2011a).

Channels for knowledge sharing ought to be in the design as well, but the biggest disappointment in the examined ICT4D hubs is in the field of content sharing and the use of repositories. A LOR was designed and developed in the NeLC project with a flexible design but mainly to suit the needs at UCSC (Hettiarachchi et al., 2010; Mozelius & Hettiarachchi, 2012). The system was user tested in several steps and integrated with the local learning platform (Mozelius et al., 2011a), but the software never met any enthusiasm or user acceptance from the UCSC staff. The design of the metadata set for the eNOSHA system was done according to recommendations in previous research (Hatakka & Mozelius, 2009), but there seems to be a contradiction between covering all possible needs and user-friendliness. In the Sri Lankan OLPC project it was intended to use the *Curriki* system to store and share learning objects, but there were problems both with the installation of the system and with the agreement on how to open up the content for students outside the OLPC project (MP3-Heawagamage, 2011). Open educational resources (OER) is an interesting concept worth trying (Caswell et al., 2008) but it has so far not been successfully implemented in the examined Sri Lankan ICT4D hubs.

5.3 In what ways could the access to higher education be increased by technology enhanced online education and the creation of ICT4D hubs?

In the 1990s, when the demand for skilled IT professionals increased in Sri Lanka, the traditional educational system was not able to scale up the intake (Mozelius et al., 2011b). New technology-enhanced alternatives like the BIT, eBIT, and OUSL initiatives have definitely opened up for a broader intake, but the country's early online distance was neither user-friendly nor interactive.

Initially, the BIT program's online part was a simple HTML website where students could download PDFs and Powerpoint presentations. Pass rates were down to 2% and there were no online lectures or tutoring (MP3-Gamage, 2011). There was no student collaboration online and for facilitation students had to visit private *facilitating places* and teaching institutes (MP3-Nishakumari, 2011). Facilitating places are common in urban areas but rare in rural regions and students have to pay fees. In the DEMP project the OUSL got funding to develop 100 study centres around the island, but only 26 were completed (MP3-Nandasara, 2011).

Later in the 21st century, when Sri Lankan politicians promoted the idea of distance education as an alternative path to qualify for tertiary education (Warnapala, 2009), there were updates and changes to the existing online programs. BIT was transformed to eBIT, where the online courses were transformed to a more activity-based learning process (MP3-Weerasinge, T_And_Hewagamage, K.P._eBIT_And_eLearningPlatform, 2011), which also required a major curriculum revision (MP3-Nishakumari, 2011). Pass rates then started to increase (MP3-Gamage, 2011) and students who took the eBIT exam were frequently employed in Sri Lankan industry. When the abovementioned barriers with a lack of skills in English, mathematics and basic computer knowledge were detected in the AsiaLink/eBIT project, the FIT programme was designed to get students "FIT for BIT". With a lot of effort and updating, the pass rates increased from below 2% to around 70% in some of the courses in the eBIT programme.

The national eLearning Centre that was started in 2002 at the UCSC with the objective of facilitating the integration of ICT into the education process (MP3-Wikramanayake, 2011) was scaled up during the NeLC project with up to 25 instructional designers and content developers producing learning objects in a rapidly developing process that could be described as a "conveyor belt production model" (Mozelius & Hatakka, 2009). Interactive content for distance education at university level was developed fast, but sometimes in a stereotypical process with frequent use of templates (Mozelius &

Hatakka, 2009). To improve the process and to support reuse, copyright control, version handling and content sharing, the eNOSHA learning object repository was designed and developed as part of the NeLC project. The LOR was designed to support all listed needs at the eLearning centre and also to support content sharing with other institutions outside the university (Hettiarachchi et al., 2010; Mozelius & Hettiarachchi, 2011), but the external content sharing never happened and the LOR was never much used by USCS staff either. At university level, the commitment and internal collaboration is impressive, but initiatives are weaker when it comes to communication and knowledge sharing. The idea of Open Educational Resources stored and shared in Learning Object Repositories has been widely discussed but poorly implemented.

Beside the failure of content storing and content sharing, the UCSC-based distance education has been successful and there is discussion of how to take the next steps and how to initiate collaborations outside UCSC (MP3-DamithKarunaratne, 2001a). What has been done to increase the intake on IT programmes could be applied to other university programmes as well. One interesting ongoing project is to replicate the eBIT and NeLC success stories in Bhutan (MP3-DamithKarunaratne, 2001b). Well-structured eLearning can be a product to export but, in the same way as European eLearning must be adapted to Sri Lankan conditions, the UCSC model must be transformed to suit the local needs in Bhutan.

Sri Lankan higher education has definitely opened up in the 21st century and through the use of computer-based e-learning some academic fields have reached a new audience in rural regions. But without online alternatives for all university subjects and in the absence of region-wide Internet access, higher education is far from accessible to all. As in developed countries, online distance education is a way to increase the intake, but without resources for facilitation and tutoring, the pass rate will decrease. The eLearning Centre at the UCSC has a plan for national dissemination, but it has insufficient resources for facilitation and only for computer science studies. There are several other technology-enhanced distance education initiatives in Sri Lanka, but they mostly lack the national and international network that can be found in India. A well-known and successful example from India is the Indira Gandhi Open University (IGNOU) with about 45,000 academic counsellors, 445 programmes, 3000 study centres and affiliations in 40 different countries (Mail Today, 2011). IGNOU also uses the Indian network of telecentres or Common Service Centres to provide tailor-made courses in various fields and to support basic eGovernance.

5.4 How might ICT4D hubs support inclusion, equal rights and access for everyone in Sri Lanka and reach people in rural areas?

Inclusion of minorities can be supported by the use of ICT and other complementing technology. The initial costs will often be higher but there will often be a return of investment in the long run. To give people with disabilities access to ICT and help with transportation can have successful outcomes both economically and for personal development (Mozelius & Meegamma, 2011a). The same goes for cultural support to former war zones, but in two of the ICT4D hubs visited the extra support was funded by donors from abroad (MP3-Koslanda_Telecentre_Owner_ManagerAndTeacher, 2011; MP3-JaffnaLibraryStaff, 2012). In rural areas, support for inclusion can open up career opportunities that can otherwise be rather limited. A group that has been able to find employment and careers in rural regions via the telecentre network is women with university education. Women are trusted and seen as more reliable than men in positions as telecentre managers and operators, but their salary is relatively low (Hansson et al., 2010).

Successful ICT-enhanced inclusion must be integrated in the local culture and have support from committed local activists and leaders. The non-connected community on the Sri Lankan island are the aboriginal Veddas, and the Vedda chief's opinion on computers and the Internet is that: "*It is good for education. But it can be bad for the Vedda lifestyle*" (MP3-VeddhaChief, 2012). A similar negative attitude was also expressed by a teacher in the local Vedda school who was afraid that ICT might stop people from thinking and take away the ability to appreciate nature. The teacher also mentioned that it might be a threat to the Veddha community if people could find modern ideas from outside the village on web sites (MP3-VeddhaTeacherAndTelecentreOperator, 2012). What several informants mention is the problem of recruiting teachers for the schools in the Vedda village. Amongst ordinary inhabitants in the Vedda village there is a curiosity about computers and the possibilities of the Internet, but this must be in balance with their traditional lifestyle (MP3-VeddhaVillageGroupInterview, 2012). At the Vedda telecentre, the activity was low, with just a few visitors per week, and the telecentre is mostly used for scanning things for the local museum. The telecentre operator lacks knowledge and training to extend the services and the same goes for the primary school where the 7 computers are rarely used. It is also hard to recruit trained teachers to the school (MP3-VeddhaVillageGroupInterview, 2012).

Other groups and areas that need more support are workers in Tea Estate areas and people in the former war zones. In the very north, the Jaffna region has its own university, telecentres, OLPC schools and a rebuilt library providing eServices. But just a little way to the south in the Kilinochchi and

Mullaitivu regions, the infrastructure and culture are in a miserable condition. Region-wide ICT support for lifelong learning would also be a preventive and peace-keeping project in a country where different population groups need to strive in the same direction to achieve a common prosperous future development.

There is still a long way to go in the process of integrating the different population groups and if more aid projects are planned for Sri Lanka my opinion is that they should have a focus on support for the Eastern and Northern parts of the region. An improvement of the standard of living in these areas would be a valuable contribution to the peace process in a longer perspective. The civil war has ended but, without initiatives for integrating all groups, the long term peace could be at risk.



Figure 12: House in the Mullaitivu region

Photo by: Peter Mozelius

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In remote areas, technology-enhanced learning hubs can have a strong catalytic effect and for some of the OLPC schools the children's computers have also been parents' as well as relatives' first contact with ICT (MP3-KukulkatuwaOLPCTeacherTeam, 2010), and in some regions this is the first time in many years that they have had any educational support at all from outside (MP3-Blackwood_OLPCTeacherTeam, 2011). There is definitely an impact on education, where the implemented eLearning has been a valuable complement to traditional education, but the existing ICT4D hubs must open up and improve in the fields of eGov, eHealth and eFarming. Existing telecentres, eLibraries and NODE centres have the potential to act as hubs for telemedicine and eGovernance services as well. With a broader range of services, ICT4D hubs could be more valuable focal points that would better contribute to local development. The focus on eLearning and education has been a good initial choice, but it has mainly attracted the young middle class, whereas, with a new variety of services in eGov, eHealth and eFarming, it would be possible to reach other age and social groups as well.

What I find to be an interesting sign of change is the formation of a new Jaffna based Tamil political party. Some people are worried about the fact that the former LTTE arm procurer Kumaran Pathmanathan might be involved, but if he will chose a political career instead of further military action it should be encouraged or at least permitted. If the former war zones and their population could be more integrated in the Sri Lankan nation the country would have an excellent possibility for further development.

This mix of various ethnic groups, various age groups and various needs in a developing region makes Paolo Freire's pedagogy interesting for life-long learning initiatives outside university programmes. Ideas on encouraging disadvantaged groups to critically reflect and act upon their daily life situations seems appropriate and so does also Freire's fundamental idea of the constant dialogue between teachers and learners. His Pedagogy for liberation and conscientisation was constructed for adult learners in a developing country and former colony not that different from Sri Lanka. Outside the universities where the English OxBridge model still is dominating there is a need for another pedagogical model that is more adapted to lifelong learning.

5.5 Other Findings

The aligned chain of aid projects in Sri Lanka has, in combination with a lot of other variables, contributed to the Sri Lankan development. Not all of the Swedish and European Union funded aid initiatives have achieved all their objectives and been 100% successful, but that is rarely the case in any

developing region. Despite the fact that the Technology enhanced development in Sri Lanka has had a geographically heterogeneous distribution there are reasons for classifying the outcome as better than average. In the current post-war situation, with a fast economical growth, further Swedish aid initiatives could be started as win-win collaborations with a good outcome for both sides. In a phase when Sri Lanka is approaching the state of a developed region and other European countries invest in projects on the island Sri Lanka is no longer on the Swedish Sida list and the Swedish Embassy in Colombo is closed down.

With such a long and successful record of Swedish funded aid projects in Sri Lanka it is hard to understand why we from the Swedish side not are expanding the bilateral collaborations instead of cutting back. Sweden is for the moment not a poor country and I agree with the persons who don't see any economical reasons for closing the Swedish Embassy in Colombo. However, some of the relations, collaborations and personal contacts that have been initiated through the aid projects will go on and let us all hope for a sustainable, prosperous and long term Sri Lankan - Swedish friendship! Just the fact that there will be no more large scale Swedish – Sri Lankan aid projects in Sri Lanka does not mean that there will not be any more collaboration. During the autumn of 2012 and the beginning of 2013 new common research projects in the field of Computer science and ICT4D have been discussed in meetings between Swedish and Sri Lankan researchers in Kista and at Sri Lanka universities and organisations.

Sri Lanka is after the ending of a three decade civil war in an expanding phase with a fast economic growth. Even compared to other Asian countries the expansion is faster than average and in 2010 the Colombo bourse was Asia's second-best performing market. The growth was 8% in 2010 with the same expected expansion in 2011. Reconstruction projects in the Eastern and Northern parts have become interesting investment opportunities for local as well as foreign companies but the governmental support to the former war zones still lacks concrete implementations except for the fast construction of new roads. The current climate for development and social change is better than in many years but the result will partly be depending on the lack of skilled professionals in Sri Lanka in general and in the former war zones in particular. Education is a key issue where the eLearning and distance education parts of blended learning have to be scaled up and improved.

The impact in urban area from tertiary education initiatives like BIT, eBIT and OUSL is strong where IT graduates working in the industry are part of the new and rich Sri Lankan middle class. In urban areas the social change is not that obvious. However, the different ICT4D hubs I visited have to various extents increased the status of the areas. One example is the OLPC school in Gampaha, where parents with children in other schools are queuing for vacant places in the one-to-one initiative (MP3-SeelaratnaVidyalayaOLPCSchool_TeacherTeam, 2011). Telecentres sup-

ported local business and created new career opportunities (Hansson et al, 2010) (Mozelius & Meegamma, 2011a) and established themselves as meeting points where information could be retrieved and exchanged. Multi-service ICT4D hubs could also act as bridges between formal, non-formal and informal learning (Hallberg et al., 2011).

As in several neighbouring countries the lack of qualified teachers and the access to appropriate education is a problem in the areas where the need for reconstruction is urgent. Technology enhanced distance education and a telecentre network has had a positive effect but the internal gap between the Colombo area and the Eastern and Northern regions are obvious even if my field studies just are a few samples in some areas. If Sri Lanka should be able to shift into a knowledge society the language problem has to be addressed. At the same time as it is necessary to develop elearning content it is important to provide high quality distance education in English. As a former British colony the Sri Lankan society has a lot of British influences and a wide use of the English language. But in non-urban areas the lack of skills in English is a fact. In May 2011 the 26 existing NODE centres were used in the launch of a new online course in English. The English for all course is open for everyone and is given as a three month distance course with an estimated intake of around 20 000 students in the first batch. Lectures are sent from Colombo assisted with facilitation and face to face activities in the NODE centres. (MP3-Nandasara, 2011)

When the current Minister of Higher Education S. B. Dissanayake in February 2011 presented his ideas on developing and conducting a series of new courses in English there were public protests from some political parties. However, the protests were not mainly against the new English courses, and were instead a reaction against that the overall educational reforms that included a commitment to set up new private universities. The most controversial decision considering English is the new rule that all students seeking university entrance must take the General English exam. One of the challenges that the Higher Education Minister wants to address is the government's failure to assign English teachers to schools (especially in rural areas). Another challenge is to meet the growing industry demand for qualified English professionals in Sri Lanka. (The Island, 12/02/2011) One idea strongly promoted by S. B. Dissanayake is the introduction of private universities, but not all lecturers and students agree with the changes introduced. After the suspension of Student Unions at the Peradenia University teachers supported the student's strike and there is no consensus on private universities but in February 2012 the University of Bolton inaugurated its new Sri Lankan Academic Centre in Mount Lavinia. In programmes for Business Management and Information Technology students have access to digital resources like e-Books and e-Journals from the library in Bolton.

Sri Lanka is in a position where extended relations with other nations could open up a variety of business opportunities and knowledge exchange

in the same way that India opened up in 1991. But globalisation is a double-edged sword and mismanaged economic reforms could easily backfire and, as in 21st century India, the flight of capital abroad can be of immense proportions (Minocha, 2011). Corruption is a problem and an integrated part of South Asian daily life. According to a survey released by the Berlin-based organisation, Transparency International, one third of all South Asians bribe officials and claim that they are forced to do so (Transparency International, 2011), while the Asia Bank said in May 2011 that “*corruption and a lack of government accountability were the greatest barriers to Asia becoming the world’s wealthiest region in 2050*” (Daily Mirror Business, 24/12/2011). In the previously conducted surveys, only Sub-Saharan Africa has had a higher rate of bribery and the police and the political parties are named as the most corrupt (Transparency International, 2011). In Pakistan, India, Nepal and Sri Lanka bribes are mainly paid to speed up bureaucracy and what is different in Sri Lanka, compared to other South Asian countries, is that paying bribes to tax authorities is more frequent (Daily Mirror Business, 24/12/2011). The corruption is also present at micro level and as an example a lunch in a restaurant in the city of Puttalam, controlled by the Urban Development Authority, was 300 LKR per person when the research team asked for the menu and 500 LKR for the same lunch when we ordered without checking the prices in the menu. At the same restaurant a *normal bill* is just the total amount written on a plain piece of paper without the 12.5% VAT that will be added to the more specific *formal bill*.

Libraries could and should be used more in the post-war reconstruction and the region-wide dissemination of information. An interesting example is the twice rebuilt library in Jaffna, with a surprisingly high standard of traditional paper books as well as digital services. For the city of Jaffna, the library has long been a symbol and a hub for formal as well as informal learning. In the last renovation, Sri Lankan universities, companies and NGOs donated paper books only, but there are new digital services as well that have been designed and implemented with support from Singapore. With computers, multimedia and internet access, the Jaffna Library has started its transition into an eHub.

Most of the dissemination channels in the Sri Lankan eLearning setup depend on Internet access with a bandwidth that is not too low. Many organisations and private persons still have broadband by satellite as their only alternative. In rural areas the subscriptions are costly and the download speeds, as of 2011, were sometimes very low and at unacceptable levels. Measurements conducted by the Sri Lankan Telecommunication Regulatory Commission (TRCSL) show that Internet transmission values can be as low as 100 Kb/s in rural regions (Daily News, 03/03/2011). Broadband by fibre or telephone lines nationwide with affordable subscription costs would doubtless improve Sri Lankan e-Learning in general. In some rural areas, fibre broadband is already in place (MP3-Koslanda Telecentre Owner, 2011), but

in the same region some kilometres away there still are villages that do not have reasonable Internet alternatives (MP3- HaldemullaTelecentreManager, 2011). Internet access was still in 2012 a heterogeneous phenomenon and not always as you could expect when the free Wi-Fi in a 2-star hotel in Jaffna was faster than the Internet connection at the University of Colombo.

5.5 Three Surprising Findings

5.5.1 Cross-ethnic Collaboration

Given appropriate initial support, different ethnic groups can collaborate with constructive and positive outcomes. One positive, surprising example is the telecentre in Haldemulla, where a Tamil manager and teacher have run a telecentre for many years in a Buddhist temple (Mozelius & Meegamma, 2011b). The telecentre has problems with Internet access and sustainability, but there have rarely been any ethnic issues. Telecentre visitors are a mix of Tamils and Sinhals and classes and learning activities are multi-lingual (MP3-Haldemulla-Manager, 2011). The fact that collaborations like this were initiated during the civil war gives hope for more successful cross-ethnic projects in post-war Sri Lanka.

5.5.2 The Top-down Bottom-up Concept

A key to success in Sri Lanka sometimes seems to be the combination of top-down planning and infrastructure construction together with a bottom-up implementation of eServices in projects and ICT4D hubs. In the identified *Top-down Bottom-up concept*, dissemination should be interpreted as in its etymological Latin origin, where the verb means sowing or scattering seeds. The seeds scattered in a top-down manner must later be cultivated by grass-roots activists and in a bottom-up process if there are to be results worth harvesting.

One example of the concept is the development of telecentres in the Nenasala network, where initial governmental provision of ICT facilities has been successfully combined with grass-roots activities to develop the eServices (Mozelius & Meegamma, 2011a). If this vertical arrangement can be combined with better horizontal collaboration and coordination between the various hubs, this would be an interesting and efficient model worth implementing in more developing regions.

5.5.3 The Urban Rural Collaboration Gap

The most negatively surprising finding is the lack of collaboration between urban academics and grass-roots activists in rural ICT4D hubs. Academics almost never participate in any urban–rural educational collaboration projects and rarely visit educational institutions in rural regions. In most of the ICT4D hubs described, the author has been the first academic visitor in many years. An important improvement would be to provide university support to rural hubs during the inception phase.

As pointed out by Colle (2005), universities and rural telecentres should have parallel missions for creating, storing and disseminating information. Improved collaboration would not only benefit the rural hubs, but also generate possibilities for a university to reach beyond the *ivory tower*. A two-way give and take collaboration might include research and development projects and students' use of ICT4D hubs (Colle, 2005).

5.6 The ICT4D Hub concept

As described earlier under section 1.5 the concept of ICT4D Hubs was a result of the data analysis. After identifying 1) ICT4D, 2) Education for All, 3) Tools for dissemination and 4) Ethnic groups as the four main pillars for a model of region-wide dissemination of blended learning ICT4D Hubs was the new polymorphic concept that could replace earlier entities like: eLearning centra, ICT4D educational initiatives, Online learning environments, Learning object repositories, Telecentres, One-to-one computing schools and eLibraries.

This new ICT4D concept enabled a more clear and focused narration in all parts of the thesis including an improved consistency in the research questions as well. Unlike in the earliest versions of the thesis where the ICT4D Hubs concept was a research finding, the introduction and definition of the term was later moved to section 2.7 in the *Extended background* chapter. However, the ICT4D Hubs is a finding in this study even if the term is used in all parts of the thesis.

5.7 Methodology and pragmatic changes

Like software development, thesis writing and research are activities that today are carried out as an agile and iterative process. There are several changes introduced during the process and some of the initial methodological intentions were never fully realised and to optimise the fieldwork the

initial, more ethnographic approach was abandoned. Originally there was also a plan for a systematic recording and documentation of all interviews and group discussions but in some situations MP3-recorders and cameras were intrusive obstacles that disturbed informants. Especially in rural areas recordings have sometimes been replaced by taking notes with pen and paper and many sessions were not visually documented.

The habit of taking field notes as a base for early discussions with field trip colleagues also turned out to be a fruitful method for analysis of surprising findings. Instead of collecting all recordings and images for a larger general analysis field notes and field trip discussions have often been further elaborated in research articles. This divide and conquer strategy was useful for testing and validating the various ICT4D Hubs separately before final common analyses were conducted.

During the first years when I mainly participated in university and Colombo based initiatives my approach was much more of the Participatory action research strategy that is described in section 3.5. Later when ICT4D Hubs in semi-rural and rural areas were explored the Participatory action research approach had to be abandoned for practical reasons like language and cultural barriers. In the inception phase the ethnographical approach with a thick background was helpful to find informants from various ethnic groups and to create Ethnic groups as one of the four main pillars in the conceptual framework. In the conceptual framework, the ethnical aspect is not more than a fifth of the study and the historical study never became as important as it was planned for. However, the study of the language situation was important, not only for the thesis but also for my work in the AsiaLink and NeLC projects.

6. Concluding Discussion

6.1 Conclusions and Recommendations

The overall aim of the research was to observe, describe, analyse and discuss how the selected ICT4D initiatives and the creation of ICT4D hubs in Sri Lanka might have supported region-wide education and local development. Conclusions and recommendations are first presented for each research question separately and finally more common conclusions are given in 6.1.5.

6.1.1 Which have been the main obstacles in the region-wide dissemination of blended learning in Sri Lanka?

The shortage of trained teachers is a general problem in Sri Lanka and in some rural areas it is hard to recruit any teachers at all. Online ICT-supported distance education in ICT4D hubs is an interesting alternative but infrastructure and Internet access show great variations around the island. The costs of Internet subscriptions and computers have gone down during the time the study has been conducted, but having ICT facilities at home is still not possible for everyone.

There is also a language barrier, where it is often the lack of skills in English that hampers students. High quality digital content is still lacking and interactive learning objects in local languages are rare. The idea of open content and content sharing in learning object repositories has been a failure, even if the basic idea still seems sound. Finally, online virtual learning environments without tutoring can be cold and lonely learning hubs that do not suit all students' learning styles.

Recommendations are to build further on the Sri Lankan model of top-down support for infrastructure and equipment combined with facilitation for local grass-roots activity that is described in section 5.5.2. Region-wide planning for Internet coverage should be a governmental issue but activities in the various ICT4D hubs ought to build on authentic and local needs. The idea of *languages harmony*, where the idea is that all Sri Lankan citizens should be able to speak Sinhala, Tamil and English, seems like a good foundation for a future Sri Lankan knowledge society.

6.1.2 How should ICT4D hubs be designed to support a region-wide dissemination of eLearning, content and knowledge sharing?

Many of the studied educational initiatives have been successful and contributed to development but also have the problems of ICT4D 1.0, lacking scalability and sustainability. ICT4D hubs should be designed to address the obstacles described in section 6.1.1, while at the same time they should address authentic local needs. The top-down–bottom-up concept should be used here as well, in the sense that ICT4D hubs must get initial support for hardware, connectivity and teacher training, while long-term goals like sustainability, coordination and content sharing should be designed by the local blended learning champions.

Internet connection and teacher training are crucial factors and so are commitment, collaboration and the coordination of resources. Instead of isolated ICT4D hubs, the solution is to have a network of coordinated hubs. Development, use and reuse of learning objects in local languages and English are also essential in the next phase of *Education for All*, where the focus should be not only on quantity but on quality as well.

Recommendations are to look at the OLPC initiative where digital content aligned to national curricula has been developed and translated to the various languages by subject matter experts. Findings also show that development of quality content is costly and the idea of content sharing needs a revision. ICT4D hubs must also be designed to support tertiary education and inclusion, which will be described in sections 6.1.3 and 6.1.4. Further recommendations are to extend the current eServices that today mainly involve eLearning, and to use and enhance the existing ICT4D hubs, redesigning them for multi-purpose and multi-service use to provide new eServices in the fields of eHealth, eGov and eFarming.

6.1.3 In what ways could the access to higher education be increased by technology enhanced online education and the creation of ICT4D hubs?

The brief conclusion here is that pure technology-enhanced distance learning will increase the intake but decrease the pass rate. In a period where the demand for a workforce was huge in Sri Lankan industry, the quantitative approach was the one to choose, but in the long-term perspective the quality aspects must be addressed. Pure distance mode without interstudent collaboration and tutoring does not suit all students or learning styles and the rec-

ommendation is blended learning and a mix of learning activities, as well as of pedagogy and instructional design.

In the ICT4D hubs studied there has also been a contradiction between sophisticated interactive learning objects and their performance on connections with low bandwidth. The recommendation is to provide back-up for the present but at the same time to plan for the future. There has been an obvious improvement when it comes to Internet connections during the time of this study. The weak point in the Sri Lankan model is the sometimes apparent absence of collaboration between rural ICT4D hubs and universities. Future updated ICT4D hubs should enable better intercollaboration and coordination between universities and rural learning centres.

6.1.4 How might ICT4D hubs support inclusion, equal rights and access for everyone in Sri Lanka and reach people in rural areas?

Several of the studied ICT4D hubs have definitely supported gender equality and, with knowledge and skills in ICT, women will have new career opportunities in rural areas as well. On the negative side are the facts that job opportunities are rare and salaries are low. All the hubs studied have been open to women, and obvious exclusion mechanisms have not been found. Users of ICT4D hubs are more divided when it comes to class than gender and, as has been discovered in other developing regions as well, it is the new young lower middle class that are the most frequent users.

Cross-ethnic collaboration can be successful if multi-lingual services and teaching sessions are given. To include people with disabilities, as in all other parts of the world, there will be extra initial costs, but with inclusion as an immediate result and return on investment in the long run. Minorities like the Vedda people, with their own cultural values, must be respected and ICT4D should never be pushed, just offered.

Recommendations are to go not only for multi-lingual eServices but also for multi-design and multi-purpose. People with special needs must have those needs met by special service design. Furthermore, the recommendations will be the same as in section 6.1.1; new services in the areas of eHealth, eGov and eFarming would attract groups that are not yet included.

6.1.5 General Conclusions and Recommendations

Use of ICT and the creation of ICT4D hubs can be an efficient way of having an impact on developing regions if aid projects are conducted and linked

in an appropriate order, with infrastructure built before the introduction of eServices. It is also of great importance that the ICT4D hubs and educational initiatives are based on local needs and coordinated. Sri Lanka has in the 21st century started a myriad of projects but coordination and evaluation are seldom there. The reason why the region has been relatively successful in the fields of ICT4D, e-learning and mass education is a combination of several factors, of which the most important are:

- South Asia's highest literacy rate
- The tradition of the *Free Education Scheme*
- A chain of aid projects introducing technology and services in the right order
- The creation of ICT4D hubs with the aim of region-wide dissemination
- Committed, hard-working people in important strategic positions
- A generally positive attitude towards ICT and eLearning.

An internal digital divide is a fact in the 21st century, while at the same time the difference between urban areas and the developed world has diminished. As shown in other studies from other developing regions, the world is dotted rather than flat and the Eastern and Northern regions of Sri Lanka are in need of more support. To bridge the gap between urban and rural areas is, together with corruption and environmental issues, the main challenge to address in the next decade. As in many other countries, the idea of sharing digital content in online repositories has been discussed but not really implemented or widely used and one reason is that the Internet infrastructure is still too poor to support online knowledge sharing in rural areas. To provide national dissemination of blended learning and *Education for All*, the collaboration and coordination between academia and grass-roots organisations needs improvement. Most of the ICT4D hubs analysed act as network hubs, receiving and disseminating information without control mechanisms for efficiency and collaboration.

As a general recommendation for better-organised dissemination of eLearning, the next step should be to develop the ICT4D hubs further and make them ICT4D switches, or even better, ICT4D routers. However, ICT4D has in the Sri Lankan context proved to have more than potential, and the existing ICT4D hubs are important focal points for dissemination of blended learning. Keywords found for successful initiatives and implementations are: commitment, collaboration, connectivity and coordination.

6.2 Critique of the study

This investigation has mainly been carried out by a Swedish guest researcher in a foreign country. At university and ministry level, English is the working

language but the studies in rural areas and primary schools are done in local languages where nuances might be lost in translation. Sri Lanka also has a tradition of seeing affirmative answers as good manners and some informants have not always given their critical opinions. A strategy for trying to reduce the over-positive results has been to revisit some of the ICT4D hubs and try to get more straightforward and frank answers when the *politeness barrier* is broken.

Interpreters and research colleagues have, in some projects, perhaps been too involved, and translated from local languages to English, ameliorating some of the answers. The selection of telecentres in the Nenasala network is also to some degree biased and the telecentres visited have often been the more successful ones. One exception, however, is the Vedda telecentre in Dambana, which was chosen by me and not by local researchers. However, as a foreign guest researcher, you are not always free to choose the hubs and places you want to visit, and in some cases I first had to ask for permission from the Ministry of Education.

There might also be reasons to criticise this study when it comes to credibility, transferability and dependability. The main strategy has been to use informant triangulation and to discuss findings with informants and Sri Lankan colleagues. In the articles written together with Sri Lankan researchers, findings and conclusions have in most cases been discussed with the local collaborators before being submitted to conferences and journals.

6.3 Credibility

In qualitative research, credibility is the counterpart to internal validity in quantitative studies, the term representing the alignment between the researcher's observations and the conclusions drawn. This study has been carried out in a complex, foreign and non-controlled environment where data has been filtered through the author's Swedish and European view. This may in several situations interpret the findings in a different way from how a local researcher might look at the situation.

Recommended techniques for improving the credibility that have been used are respondent validation (Bryman, 2011) and triangulation. Respondent validation or informant feedback is a process that distributes the findings to people who have been involved in the investigation. The aim of respondent validation is to confirm that the descriptions and conclusions presented are appropriate. When this is done with stakeholders on various levels in the cases explored, it can also be seen as informant triangulation (Remenyi, 2012) and if official findings are approved by both grass-roots activists and persons at Ministry level, it is another way of strengthening the credibility.

6.4 Transferability

Qualitative research is often designed to have a focused study of a relatively small group of people who share certain properties or certain conditions. Contextually unique phenomena are chosen when striving for depth instead of the breadth which is usually a main condition in quantitative research. The correspondence to external validity in quantitative studies is a study's transferability (Bryman, 2011) where the findings external validity in other contexts have to be addressed differently. Qualitative researchers are encouraged to provide a *thick description* of the details in the actual culture (Geertz, 1973). In this thesis the attempt to achieve a thick description is given in **2. Extended Background** and in **4. The Sri Lankan Setup**.

6.5 Reliability and Dependability

In quantitative research, the reliability is an important component of the research's external validity (Mason, 1996). Reliability can briefly be defined as a measurement of the probabilities of replicating a study in another context with the same results, or if there are random or biased factors involved (Bryman, 2011). Reliability can, like validity, be divided into internal and external reliability. Internal reliability in qualitative research can be seen as a quality assurance process where the researcher discusses findings, interpretations and conclusions with colleagues in the research team. External reliability, which is about the study's replicability, is not as easy to achieve in qualitative research, since it is impossible to freeze the social conditions even during a long-term study. According to LeCompte & Goetz (1982), a qualitative researcher replicating an ethnographic study needs to enter a social role resembling the role that the first researcher had. Sri Lanka in the first decade of the 21st century is a unique and rapidly changing environment with context-dependent conditions that will never appear again.

Reliability in qualitative research can also be assessed as dependability (Lincoln & Guba, 1985), with a recommendation of an auditing process where research colleagues should review or audit and assess if the conclusions drawn are relevant. In this study the eight articles that aggregate the thesis have all been written together with research colleagues some of whom are scholars and others grass-roots activists. All articles have also been peer-reviewed and published in conference proceedings and research journals.

6.6 Future Work

The NeLC project described might be the last Swedish Sri Lankan aid project in the field of ICT4D and eLearning, but there are several findings that would be interesting to investigate further. Three interesting branches to follow up would be:

1. **The internal digital divide:** In my research on ICT4D that was conducted after the pre-doc seminar there was a focus on Sri Lankan tea estate areas. These rather isolated regions could in several aspects be seen as on the disadvantaged side of the internal digital divide. A first article on the situation in tea estate areas is in progress and the plan is to submit it for the IFIP 2015 Conference in Negombo, Sri Lanka. This first article that was written together with Swedish and Sri Lankan colleagues is based on an analysis of the digital divide in tea estate areas with a specific perspective on gender issues and the conditions for people with disabilities. Together with Sri Lankan and Swedish research colleagues, I have applied for funding from the Stockholm University Asia Forum for a minor pilot project on “Communication challenges and informal learning in Sri Lankan tea estate areas”. With or without funding, we are planning to visit some tea estate areas in central Sri Lanka after attending the IFIP Conference in May 2015. IFIP 2015 is a research conference with a focus on ICT4D and the social implications of computer usage. One of many interesting tracks at the conference will be the one for “ICT4D in Sri Lanka - Challenges, Opportunities and Solutions” (IFIP, 2015).
2. **The National eLearning Centre:** At a rough estimate in the final phase of the thesis writing, the sustainability of the NeLC initiative is around 50%. Half the workforce is still employed one year after the completion, working with half the amount of tasks in hand during the funded project span. It would be interesting to explore further how and to what degree the eLearning Centre at UCSC has found new customers and new ways of developing eLearning content. An interesting way to align this branch with the ideas described under 1. *The internal digital divide* would be to investigate how and to what degree the content development at the centre in the capital has reached rural areas of Sri Lanka.
3. **The Sri Lankan one-to-one computing initiatives:** My analysis of the findings from the Sri Lankan OLPC project is that the initiative ended not with a sudden death, but with a sudden silence. XO computers are still used in the schools but it is hard to get any information on the future plan and learning outcomes in a longer perspec-

tive. The OLPC initiative is not the only one-to-one computing project in Sri Lanka and it might be fruitful to compare the outcomes between different one-to-one setups in the region. From a global perspective, the Sri Lankan OLPC setup is different in its small-scale design, the absence of Internet access and the content development in local languages. With a different design and a relatively successful outcome, it would be interesting to compare the Sri Lankan OLPC project with other OLPC projects in other parts of the world.

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7.1 Recorded interviews in MP3-format:

All listed interviews are stored and available at:

<http://people.dsv.su.se/~mozelius/thesis/interviews/>

Blackwood_OLPCSchool_TeacherTeam.mp3 (2011)
(OLPC involved teacher in the Blackwood primary school in Haputale)

DamithKarunaratne_eLearningCentreAndTheFuture.mp3 (2011a)
(Head of NeLC on future plans)

DamithKarunaratne_UCSCInBhutan.mp3 (2011b)
(Head of NeLC on eLearning in Bhutan)

eVillage, eVillage_Interview.mp3 (2011)
(One-to-one computing initiative based on Intel's Classmate PC)

Gamage, G._Girty_Feb2011_BIT_eBITandPassrates.mp3 (2011)
(Sri Lankan Scholar, feminist and activist)

Gamage, G._GirtyGamage_TheSriLankanCasteSystem.mp3 (2012)
(Sri Lankan Scholar, feminist and activist)

Gunadasa, N._SriLankanOLPC.mp3 (2011)
(OLPC initiative responsible at the Sri Lankan Ministry of Education)

Gunawardene, Sewwandi_Feb2011_EnglishForAllAndVoiceForums.mp3 (2011)
(English teacher at UCSC and content developer for English courses)

Haldemmulla-Manager, Haldemmulla_Telecentre_Manager.mp3 (2011)
(Manager at the Haldemmulla Nenasala telecentre)

Hewagamage, K.P._Jan2011eLearningInSriLanka.mp3 (2011)
(Head of the UCSC e-Learning Centre)

JaffnaLibraryStaff.mp3 (2012)
(Interview with the staff at the Jaffna Library)

JaffnaOLPCSchool_Principal.mp3 (2012)
(Principal's experiences of OLPC at the OLPC School in Jaffna)
JaffnaOLPCSchool_TeacherTeam.mp3 (2012)
(Teachers' experiences of OLPC at the OLPC School in Jaffna)

Jayaweera, P._OnMobileTechnologyAndSriLankanUniversities.mp3 (2011)
(Dr, and researcher at the Sri Jayawardenapura University)

KalagahagewelaOLPCSchool_Gallewella_Dambulla_Principal.mp3 (2012)
(Principal's experiences of OLPC at the KalagahagewelaSchool Dambulla)

KalagahagewelaOLPCSchool_Gallewella_Dambulla_TeacherTeam.mp3 (2012)

(Teachers' experiences of OLPC at the Kalagahagewela School Dambulla)

KukulkatuwaOLPCSchool_Nochehigama_Anuradhapura_Principal.mp3 (2012)
(Principal's experiences of OLPC at the Kukulkatuwa School)

KukulkatuwaOLPCSchool_Nochehigama_Anuradhapura_TeacherTeam.mp3 (2012)
(Teachers' experiences of OLPC at the Kukulkatuwa School)

Koslanda-Owner, Koslanda_Telecentre_Owner_ManagerAndTeacher.mp3 (2011)
(Owner, manager and teacher at the Koslanda Nenasala telecentre)

Megammaana, N._NiranjanMegammaana1_MobileTechnology.mp3 (2011a)
(Sri Lankan telecentre activist and content developer)

Megammaana, N._NiranjanMegammaana2_MobilePhonesAndBrowsers.mp3
(2011b)
(Sri Lankan telecentre activist and content developer)

Megammaana, N._NiranjanMeegammaana3_ShilpaSayura.mp3 (2011c)
(Sri Lankan telecentre activist and content developer)

Megammaana, N._NiranjanMeegammaana4_MobilesAndPolitics.mp3 (2011d)
(Sri Lankan telecentre activist and content developer)

Nandasara, S.T._NODECentresAndEnglishForAll.mp3 (2011)
(Responsible for the NODE project)

Nishakumari, K.M.G.B._eBITandCurriculumDevelopment.mp3 (2011)
(Instructional designer at the UCSC e-Learning Centre)

Palmunai_MiddayPrayer.mp3 (2011)
(Learning activities interrupted by Muslim midday prayer)

PalmuniaOLPC_TeacherTeam.mp3 (2011)
(Teacher team's experiences of OLPC at the school in Palmunia)

Rahuman, K._OnMuslimsAndTheTamilLanguage.mp3 (2011)
(Content developer and researcher at UCSC, native Tamil speaker)

Rahuman, K. and Ramberg R._OnPopulationGroupsAndOLPCSchools.mp3 (2011)
(Content developer at UCSC and Professor from Stockholm University)

SeelaratnaVidyalayaOLPCSchool_LibraryAssistent.mp3 (2011)
(Library assistant at the SeelaratnaVidyalaya School in Gampaha)

SeelaratnaVidyalayaOLPCSchool_MaleTeacher.mp3 (2011)
(Teacher at the SeelaratnaVidyalaya School in Gampaha)

SeelaratnaVidyalayaOLPCSchool_TeacherTeam.mp3 (2011)
(Teacher team's experiences of OLPC at the SeelaratnaVidyalaya School)

Telecenter-manager1, Telecenter_Manager1.mp3 (2010)
(Telecentre manager at a Nenasala telecentre)

Telecenter-manager2, Telecenter_Manager2.mp3 (2010)
(Telecentre manager at a Nenasala telecentre)

Telecenter-operator, Telecenter_Operator.mp3 (2010)
(Telecentre operator at a Nenasala telecentre)

Telecenter-student, Telecenter_Student.mp3 (2010)
(Telecentre student at a Nenasala telecentre)

TelecentreManagerAvisawellaDec2013.mp3 (2013)
(Telecentre manager and teacher in urban area)

TelecentreManagerBoralagodaDec2013.mp3 (2013)
(Telecentre manager and teacher in rural area)

VeddhaChief.mp3 (2012)
(Interview with the Vedda chief in Dambana)

VeddhaTeacherAndTelecentreOperator.mp3 (2012)
(Telecentre operator and teacher's view of ICT and education)

VeddhaVillageGroupInterview.mp3 (2012)
(Interview with persons living in the Dambana Veddha village)

Weerasinge, T_And_Hewagamage, K.P._eBIT_And_eLearningPlatforms.mp3
(2011)
(Main responsible for the early development of the UCSC e-Learning Centre)

Wikramanayake, G.N_TheHistoryAndFutureofUCSCAndeBIT.mp3 (2011)
(UCSC Dean, and Professor in Computer Science)

Wijayawardhana, Harsa_2008_TheTelecentreHistory.mp3 (2008)
(Pioneer in the early Sri Lankan telecentre movement)